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Research Article

Formulation And Evaluation of Gutika by Using Arjuna Extract for Antidiabetic Activity

Tanu Engle, Anjali*

Rungta Institute of Pharmaceutical Sciences and Research.

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ABSTRACT

The prevalence of diabetes mellitus, a chronic metabolic condition, is rising globally. It is frequently treated with traditional drugs that can have negative side effects. As a result, there is increasing interest in herbal substitutes that may have therapeutic advantages. A common Ayurvedic medicinal herb, Terminalia arjuna has antidiabetic, cardioprotective, and antioxidant qualities. The creation and assessment of Gutika (herbal tablets) containing Arjuna bark extract for the treatment of diabetes are the main objectives of this study. The presence of flavonoids, alkaloids, phenolics, and terpenoids was confirmed by phytochemical screening after the extract was made using the Soxhlet method with methanol as a solvent. Accurate active compound quantification was confirmed by a UV-visible spectrophotometric analysis at 375 nm. In order to maximize tablet characteristics, binders, fillers, and disintegrants were added to the manufactured tablets along with Arjuna extract. Physicochemical analyses of the tablets' hardness, friability, weight fluctuation, and disintegration time verified that they complied with accepted pharmaceutical standards. The results imply that Arjuna Gutika has potential as a natural substitute for diabetes treatment. To confirm its effectiveness and safety, more clinical and pharmacological research is required. In order to cure diabetes, this study supports the possible combination of contemporary pharmaceutical formulations with traditional herbal medicine.

INTRODUCTION

Globally, diabetes is a serious health issue. The most common medications for diabetes are insulin and oral hypoglycemics, although they have a number of negative effects, including lactic

acidosis, weight gain, hypoglycemia, and significant harm to the kidneys and liver. The medical system still faces the issue of managing diabetes without causing adverse effects. Demand for using natural products with anti-diabetic properties is rising. Herbal medicine has expanded

*Corresponding Author: Anjali

Address: Rungta Institute of Pharmaceutical Sciences and Research.

Email : tanutanuverma7@gmail.com

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dramatically in recent years, and both developed and developing countries are increasingly using these drugs because of their natural origin and few adverse effects. The big tropical woody tree known as Arjuna (*Terminalia arjuna*) is found all over India. This tree, which is between 20 and 25 meters tall, usually has a buttressed trunk, and at the crown, it creates a broad canopy from which branches hang down. The composition the essential drug list of India's ayurvedic formulary includes the Herbo mineral formulation *Terminalia Arjuna gutika/vati*. This age-old Ayurvedic treatment has been used for centuries to treat liver diseases, skin disorders, and jaundice. It is regarded to be effective and safe. Leprosy, fever, oedema, obesity, jaundice, and other liver issues are treated with it. The list of ingredients for Arjuna gutika is as follows. It is known that several ingredients in Arjuna Vati, including *Terminalia Arjuna*, Hari Taki, Stevia leaves, Acacia gum, and Guggul, have hypo-lipidemic qualities. Ayurvedic doctors in various parts of India have long recommended this combination for its antidiabetic properties, however there is no written proof of its impact on lowering blood sugar levels. As a result, it was chosen to assess its antidiabetic properties. The study found that oral administration of T. arjuna at 250 and 500 mg/kg body weight for 30 days significantly reduced blood glucose levels. In comparison with control rats, diabetic rats showed significantly higher aldolase activity and

significantly lower hero kinase and phosphor-glucosyl transferase activity. These levels were markedly restored to normal after 30 days of oral T. arjuna 500 mg/kg body weight. Compared to diabetic control, the administration of T. arjuna bark extract significantly decreased the blood glucose level. The extract at 500 mg/kg body weight demonstrated a larger decrease in glucose levels than at 250 mg/kg body weight. The process could involve stimulating b-cells to secrete more insulin, which would increase the amount of glucose used by different tissues. In South and Central India, as well as in Uttar Pradesh, Madhya Pradesh, and West Bengal, arjunas are typically found growing on riverbanks or next to dry river beds. Tannins, triterpenoid saponins, flavonoids, gallic acids, ellagic acid, and phytosterol are the primary chemical components of arjuna. Arjuna is utilized not only as a heart tonic but also to treat a variety of conditions, including hypertension, liver cirrhosis, pulmonary TB, uterine disorders, venereal illness, epilepsy, chronic fever, nausea, diarrhea, dysentery, urticarial, ulcers, fractured bones, and diuresis. In Ayurveda, T. arjuna bark is used to treat diabetes. Arjuna affects the human body's numerous physiological systems in a variety of ways.

MATERIALS AND METHODS

Plant Materials:

S. no	Plant / Materials	Supplier	Figure
1	Arjuna Bark	Jain Lifesciences (pvt) Ltd. 54/B2 IDA, Kattedan, Hyderabad- 500077. (Telangana). INDIA.	

2	Guggul	AJ AGRI EXPORTS® 41-D, Bunglow No.58, station road, neemuch (458-441) M.P. India.	
3	Acacia gum	Forest found agro products, first floor, plot no 301, puranbag India, kasanagar, Katargam, Surat, 395004, Lice. No.10020021005825.	
4	Haritaki	HNCO organics Pvt. Ltd 56/A, Sumel-5, Asarwa, Ahmedabad, India 380016 mfg. license number GA/713-A.	
5	Stevia leaves	NUTRIZO advancis healthcare PVT. LTD.	
6	Coconut oil	E-Mox manufacturing private limited, Puducherry, 605111.Lic. No.10014045000068	

Extraction Method: The T. arjuna stem barks were carefully water washed after being cut into tiny pieces. The fresh barks were cleaned, allowed to air dry, and then baked at 40°C to finish drying. The dried barks are then grinded to make powder, which were then screened to get fine powder. The process of extracting chemicals that are heat-labile. The Soxhlet apparatus is filled with a thimble composed of filter paper containing the

powdered solid substance, arjuna bark powder. The device is connected to a reflux condenser and a round-bottomed flask filled with the solvent methanol. After the solvent in the Round Bottom flask is gently boiled in 40°C set in 48 hours, the vapor rises via the side tube, condenses in the condenser, and then descends into the thimble holding the arjuna bark material, gradually filling the Soxhlet. The part of the material that has been

extracted is removed when the solvent, methanol, syphons over into the flask when it reaches the top of the connected tube. Until full extraction is accomplished, the process is repeated. After the extract was filtered and distilled on a water bath, a

reddish-brown syrupy mass was produced. It was then dried in a rotary evaporator at a low temperature and with less pressure.



Fig.no: 1 (Extraction of Gutika)

Phytochemical Test:

Table No: 1 Phytochemical Test.

Phytochemical Test	T. Arjuna Methanol Extract
Phenolic	Positive
Terpenoids	Positive
Alkaloids	Positive
Flavonoids	Positive

Pre-Formulation Test:

❖ Solubility:

- **Water soluble:** To ascertain whether arjuna extract is appropriate for aqueous formulations, it is tested for solubility in water.
- **Ethanol soluble:** The More efficient solvents for removing a variety of bioactive substances, such as flavonoids and other ethanol-soluble substances found in arjuna bark may dissolve in ethanol.
- **Methanol soluble:** methanol are organic solvents that can also be utilized to extract different bioactive substances from Arjuna bark may dissolve in methanol.



Fig. no: 2 (Solubility)

- ❖ **PH Test:** The acidity or alkalinity of Terminalia arjuna extract is assessed by measuring its ph. The extract's low acidity, indicated by its pH of about 5.5, is essential for stability and formulation compatibility.



Fig. no: 3 (pH test)

- ❖ **Ash Value:** the Ash Value The amount of inorganic residues, such as minerals and contaminants, is indicated by the total ash content. To find the proportion of ash, the extract is heated to a high temperature (100°C) in a muffle furnace.



Fig. no: 4 (Ash Value)

- **Acid Insoluble Ash:** Indicates non-digestible inorganic materials and is the portion of ash that does not dissolve after being treated with hydrochloric acid.
- **Water Soluble:** Water soluble ash is the percentage of ash that dissolves in water; it is the difference between acid-insoluble ash and total ash.



Fig.no: 5 (Acid insoluble ash and Water soluble of Ash Extract)

- ❖ **Standard calibration curve of Terminalia arjuna extract:** The standard calibration curve of Terminalia arjuna extract is established using UV-Visible Spectrophotometry at a maximum wavelength (λ_{max}) of 375 nm. This approach follows Beer-Lambert's Law, which stipulates that the absorbance of a solution is directly proportional to its concentration. The absorbance readings of a number of standard

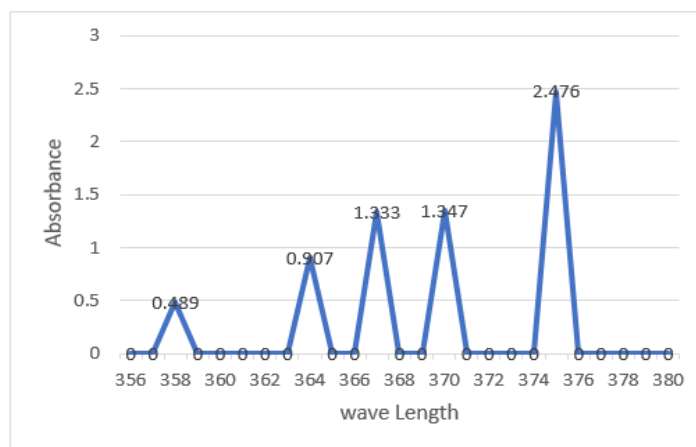
solutions with established concentrations—1, 2, 3, 4, and 5 $\mu\text{g}/\text{mL}$ —are measured. A linear connection is confirmed by the data, which consistently indicates an increase in absorbance with increasing concentration. By comparing absorbance values to the standard curve, this calibration curve can be used as a guide to estimate the concentration of unknown samples. The outcomes ensure that Terminalia arjuna extract is accurately formulated in pharmaceutical and herbal products by aiding in the quantitative estimate of its bioactive components.

Table no: 2 (Standard calibration curve of T. arjuna extract.)

Concentration ($\mu\text{g}/\text{ml}$)	Wave Length	Absorbance
1	358nm	0.489
2	364nm	0.907
3	367nm	1.333
4	370nm	1.347
5	375nm	2.476



Fig. no: 6 (Standard calibration curve of Terminalia arjuna extract)



Graph no. 1: Standard calibration curve of Terminalia arjuna extract.

Formulation of Gutika:

Table no: 3 (Ingredient table of Gutika)

Ingredient	Quantity	Purpose
Arjuna Extract	300mg	Main active Ingredient
Guggul	100mg	Binder and regulate cholesterol
Haritaki	50mg	Filler and Digestive aid
Acacia Gum	25mg	Binding agent
Stevia Leaves	20mg	Natural Sweetner
Coconut Oil	5mg	Lubricant and Bioavailability enhancer

- The normal dosage could be as much as 350 milligrams of extracts each pill. Binders, fillers, and stabilizers are examples of excipients. Binders: Guggul and other substances are frequently used to bind the extract and other excipients. Fillers: Haritaki are used to give the tablet more volume. Acacia gum is one of the disintegrants that aid in the release of its active ingredients. Coconut oil is used as a lubricant.

Procedure of Gutika:



Fig. no: 7 (Weight all Ingredient)

- Combine the powder or extract Arjuna bark if using extract, remove excess moisture to bring it down to a semi-solid consistency. If using powder, mix it in the appropriate amount with the base material or powdered excipients. Add

the excipients and binder: To the powder, add a suitable binder (guggul), such as acacia gum, stevia leaves, haritaki, or coconut oil. To get a uniform dough-like consistency, thoroughly mix.



Fig. no: 8 (Mix the all Ingredient)

- Form into tablet: After the mixture has been well mixed, form it into tiny tablets using a table compression machine. Depending on the

required dosage, each Gutika's weight and size can be adjusted.



Fig. no: 9 (Gutika Compression)



Fig. no: 10 (Arjuna Extract Gutika)

Evaluation test of Gutika:

- ❖ **Hardness Test:** The standard acceptable range for hardness is 3.5 kg a lower

observed value of 0.5 kg indicates that the tablet is softer than required, which may result in breakage during handling. Hardness Test A tablet's mechanical

strength and resistance to breakage during handling, packaging, and transportation are determined by its hardness.



Fig. no: 11 (Hardness of Gutika)

❖ **Weight Uniformity:** Weight Uniformity by ensuring that each tablet has the appropriate quantity of excipients and active components, this test lowers batch variability. There is a little but manageable weight fluctuation

between the observed value of 490 mg $\pm$ 2% and the normal weight of 500 mg $\pm$ 5%.



Fig. No: 12 (Uniformity Weight Of Gutika)

❖ **Time of Disintegration:** The amount of time it takes for a pill to disintegrate into smaller pieces in the digestive tract is known as the disintegration time. The observed time was 12 minutes, although the typical time is 15

minutes. This suggests that the pill disintegrates a little quicker than anticipated, which could affect the release of the medicine.



Fig. no: 13 (Disintegration time of Gutika)

❖ **Loss of Drying (LOD):** The tablet's moisture content is determined by this test. Stability and inhibition of microbiological growth are guaranteed by a specified limit of 1-3%. The observed value of 1.09% indicates that the pill has dried properly because it falls within the

allowed range. Weight Variation Another crucial test for evaluating batch-to-batch consistency is weight variation. The observed result is 490 mg $\pm 2\%$, which shows a slight variance within acceptable ranges, compared to the normal weight of 500 mg $\pm 5\%$.



Fig. no: 14 (Loss of drying of Gutika)

❖ **Weight Variation:** test guarantees that the prescribed dosage of medication is present in every pill in a batch. The weight variation is computed when a predetermined number of

pills are weighed. The weight variation should stay within pharmacopeial bounds if the active component is evenly distributed.



Fig. no:15 (Weight Variation of Gutika)

Result: The study's results indicate that while several quality parameters of the Gutika formulation meet acceptable standards, some aspects require improvement. The phytochemical screening of the Terminalia arjuna methanol extract confirmed the presence of phenolics, terpenoids, alkaloids, and flavonoids, and a standard calibration curve was successfully developed using UV-Visible spectrophotometry at a λ_{max} of 375 nm.

Table no: 4 (Phytochemical test)

Phytochemical Test	T. Arjuna Methanol Extract
Phenolic	Positive
Terpenoids	Positive
Alkaloids	Positive
Flavonoids	Positive

Table no: 5 (Standard calibration curve of T. arjuna extract)

Concentration ($\mu\text{g/ml}$)	Wave Length	Absorbance
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1	358nm	0.489
2	364nm	0.907
3	367nm	1.333
5	375nm	2.476

Table no: 5 (Evaluation test of Gutika)

Test	Standard	Observation
Hardness test of Gutika	3.5 kg	0.5 kg
Uniformity Weight of Gutika	500mg $\pm$ 5%	490mg $\pm$ 2%
Disintegration time of Gutika	30 minutes	14 minutes
Loss of Drying of Gutika	1-3%	1.09%
Weight Variation of Gutika	500 mg $\pm$ 5%	490mg $\pm$ 2%

CONCLUSION: In conclusion, the formulated Gutika satisfied common pharmaceutical assessment standards and demonstrated good physicochemical characteristics. Because of its capacity to enhance glucose metabolism and promote insulin production, the extract demonstrated strong

antidiabetic effects. Future research should concentrate on improving tablet hardness and carrying out clinical trials to verify Gutika's effectiveness and safety in human participants.

DISCUSSION: Gutika's formulation and antidiabetic activity assessment employing *Terminalia arjuna* extract showed encouraging outcomes. The presence of bioactive substances such phenolics, flavonoids, terpenoids, and alkaloids—all of which are known to support the therapeutic effects of medicinal plants—was verified by the phytochemical screening. In terms of hardness, weight uniformity, disintegration time, and moisture content, the examination of Gutika produced positive findings, indicating that the prepared tablets satisfy the necessary pharmaceutical criteria. Prior research showed that *T. arjuna* extract significantly lowered blood glucose levels, demonstrating its antidiabetic potential. The stimulation of the pancreatic β -cells, which results in increased insulin secretion and improved glucose metabolism, may be the cause of this hypoglycemic effect. *T. arjuna* extract provides a natural substitute with fewer adverse effects than traditional synthetic antidiabetic medications. To confirm these results and pinpoint the exact mechanism of action, more in vivo and clinical research is required. Overall, the study backs up *T. arjuna*'s traditional use in diabetes management and emphasizes how it could be included to standardized herbal formulations for safer and more efficient diabetic care.

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