



THERAPEUTIC POTENTIAL OF CARISSA CARANDAS IN DIABETES MANAGEMENT

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Article Received on 24/08/2024

Article Revised on 13/09/2024

Article Accepted on 03/10/2024

ABSTRACT

This study investigates the pharmacognostic characteristics and biochemical profile of *Carissa carandas* fruit extract, focusing on its potential therapeutic implications, particularly in diabetes management. The extract was characterized by its organoleptic properties, including color, fragrance, and taste, which are critical for its identification and quality assessment. Extractive values in alcohol and aqueous solutions indicated varying levels of soluble constituents. Assessment of moisture content, foreign matter, and ash values provided insights into purity and composition. Phytochemical screening identified steroids, triterpenoids, saponins, alkaloids, glycosides, tannins, phenolic compounds, and carbohydrates, highlighting its rich chemical diversity. Evaluation of glucose, HbA1c levels, and body weight changes in different groups suggests potential effects on glucose regulation and body weight management. These findings underscore the extract's biochemical complexity and therapeutic potential, emphasizing its relevance in traditional medicine and pharmaceutical research.

KEYWORDS: *Carissa carandas*, fruit extract, organoleptic properties, diabetes management.

INTRODUCTION

Carissa carandas, commonly known as Karonda, is a versatile medicinal plant recognized for its diverse therapeutic properties, including its potential efficacy in the treatment of diabetes mellitus. Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels due to defects in insulin secretion, insulin action, or both. This condition necessitates ongoing management to prevent complications such as cardiovascular diseases, nephropathy, and neuropathy, thereby improving the quality of life for affected individuals (American Diabetes Association, 2023). The search for alternative and complementary therapies has led to increased interest in herbal remedies, with *Carissa carandas* emerging as a promising candidate due to its bioactive compounds and traditional use in managing various ailments (Singh et al., 2017).

The antidiabetic potential of *Carissa carandas* can be attributed to its rich phytochemical composition, which includes alkaloids, flavonoids, saponins, and tannins. These bioactive constituents are known to exert various pharmacological effects, such as enhancing insulin secretion, improving insulin sensitivity, and exhibiting antioxidant properties that mitigate oxidative stress

associated with diabetes. For instance, studies have demonstrated that extracts of *Carissa carandas* can significantly lower blood glucose levels in diabetic animal models, suggesting its potential role in glycemic control (Bhandari et al., 2012). Furthermore, the antioxidant activity of *Carissa carandas* has been shown to protect pancreatic β -cells from oxidative damage, thereby preserving their function and viability (Khan et al., 2015).

The phytochemical profile of *Carissa carandas* includes alkaloids, flavonoids, saponins, and tannins, which are known for their various pharmacological effects. These compounds have been shown to exhibit significant antidiabetic activities, such as enhancing insulin secretion, improving insulin sensitivity, and providing antioxidant effects. For instance, the flavonoids present in *Carissa carandas* are potent antioxidants that help in scavenging free radicals, thereby reducing oxidative stress, which is a major factor in the pathogenesis of diabetes (Goyal et al., 2012).

Several studies have demonstrated the antidiabetic potential of *Carissa carandas*. In a study conducted by Kumar et al. (2012), the methanolic extract of *Carissa*

carandas leaves showed significant hypoglycemic activity in streptozotocin-induced diabetic rats. The study revealed that the extract could lower blood glucose levels by enhancing insulin secretion from pancreatic β -cells. Another study by Rahman *et al.* (2014) reported that the fruit extract of *Carissa carandas* significantly reduced blood glucose levels in alloxan-induced diabetic rats, indicating its potential in managing diabetes.

Additionally, the antioxidant properties of *Carissa carandas* contribute to its antidiabetic effects. Oxidative stress plays a crucial role in the progression of diabetes and its complications. The antioxidant compounds in *Carissa carandas* help protect pancreatic β -cells from oxidative damage, preserving their function and viability (Patel *et al.*, 2011). This protective effect is essential in preventing the decline in insulin production and secretion that characterizes diabetes.

Moreover, *Carissa carandas* has been traditionally used to manage various ailments, including digestive disorders, fever, and skin infections, highlighting its broad therapeutic potential (Nadkarni, 2002). Its role in diabetes management is supported by its ability to modulate multiple biological pathways, offering a holistic approach to treatment. The synergistic effect of its phytochemicals not only aids in glycemic control but also offers protection against diabetes-related complications.

In conclusion, *Carissa carandas* is a promising natural remedy for diabetes, with its multifaceted mechanisms of action, including glycemic regulation and antioxidant defense. As scientific research continues to elucidate its therapeutic potential, *Carissa carandas* could become an integral part of diabetes management strategies, providing a natural and holistic approach to combating this pervasive health condition.

MATERIAL AND METHOD

The *Carissa carandas* Fruits were collected from nearby botanical garden. For the extraction, the plant Fruits were totally washed in distilled water, dried in the shade at room temperature for ten days, coarsely ground, and afterward went through strainer No.60.

Evaluation of Organoleptic evaluation

The organoleptic evaluation of a polyherbal formulation includes assessing its color, odor, taste, and texture. To determine the odor, a sample is placed in a beaker and inhaled; if no odor is detected, the sample is crushed or exposed to boiling water. The odor strength is categorized as none, weak, distinct, or strong, and the type as aromatic, fruity, musty, moldy, rancid, etc. The taste is classified as aromatic, pungent, sweet, sour, astringent, mucilaginous, or bitter.

Soxhlet Extraction

Soxhlet extraction is a widely used method for extracting organic compounds from solid or semi-solid samples.

For extracting compounds from *Carissa carandas* (Karonda berry), begin by cleaning and crushing the berries to increase surface area. Select an appropriate solvent, such as ethanol or methanol, based on the desired compounds. Set up the Soxhlet apparatus with the sample in the extractor, connected to a round-bottom flask containing the solvent. Heat the flask to boil the solvent, which then cycles through the sample, facilitating efficient extraction. The process typically takes several hours to overnight. Once complete, the solvent is evaporated from the collected extract in the flask to obtain the concentrated extract.^[10]

The % Yield in different solvents plant extracts were calculated by using the following formula:

$$\% \text{ Yield} = (\text{Net weight of powder in gram after extraction} / \text{Total weight of powder in gram taken for extraction}) \times 100$$

Determination of Physical Parameters

Each plant material has its own particular physical specifications like moisture content and foreign organic materials.

Moisture content

To determine the moisture content of *Carissa carandas*, first weigh an empty, clean, and dry dish (W1). Then, weigh a representative sample of *Carissa carandas* (W2) and place it in the dish, spreading it evenly. Dry the sample in an oven at 105°C until a constant weight is achieved. After drying, cool the sample in a desiccator and weigh the dish with the dried sample (W3). Calculate the moisture content using the formula:^[11]

$$\text{Moisture content (\%)} = [(W2 - W3) / (W2 - W1)] \times 100.$$

Total Ash value

To determine the total ash content of *Carissa carandas*, start by weighing a clean, pre-weighed crucible (W1). Add a known weight of the *Carissa carandas* sample to the crucible (W2) and heat it gradually in a muffle furnace until the sample is completely charred and turns to ash. After cooling the crucible in a desiccator, weigh it again (W3). Calculate the total ash value using the formula:^[12]

$$\text{Total ash (\%)} = [(W3 - W1) / (W2 - W1)] \times 100.$$

Acid insoluble ash value

To determine the acid-insoluble ash value of *Carissa carandas*, take the crucible containing the total ash from the previous step and add dilute hydrochloric acid (HCl) to dissolve soluble salts. Heat the crucible until the acid evaporates and the residue is dry. Place the crucible in a muffle furnace and heat it at a high temperature (e.g., 550-600°C) to burn off organic matter completely. After cooling and weighing the crucible in a desiccators, calculate the acid-insoluble ash value using the formula:^[13]

$$\text{Acid insoluble ash (\%)} = [(W4 - W1) / (W2 - W1)] \times 100.$$

Water soluble extractive value

To determine the water-soluble extractive value of *Carissa carandas*, a known weight of the sample is placed in a container with distilled water for a specified time to extract water-soluble components. After filtration, the filtrate is evaporated to dryness, and the dried extract in the container is weighed (W3). The water-soluble extractive value is then calculated using the formula:

$$\text{Water-soluble extractive value (\%)} = [(W3 - W1) / W2] \times 100.$$

Alcohol soluble extractive value

To determine the alcohol-soluble extractive value of *Carissa carandas*, follow a procedure similar to water-soluble extraction but using a suitable alcohol solvent like ethanol or methanol. After allowing the sample to extract in the solvent for a specified period, filter the extract and evaporate it to dryness. Weigh the container with the dried alcohol extract (W4), and calculate the alcohol-soluble extractive value using the formula:

$$\text{Alcohol-soluble extractive value (\%)} = [(W4 - W1) / W2] \times 100$$

Determination of foreign matter

To assess the foreign matter content in *Carissa carandas*, visually inspect a representative sample for any visible contaminants like dirt or stones. Separate and weigh the collected foreign matter (W5). Calculate the foreign matter content using the formula:

$$\text{Foreign matter (\%)} = (W5 / W2) \times 100$$

Phytochemical Screening

Phytochemical screening is a preliminary qualitative analysis performed to identify and detect various groups of bioactive compounds present in plant extracts. It helps in assessing the chemical composition and potential medicinal properties of plants. While the specific methods and reagents used may vary, here is a general overview of the common tests conducted during phytochemical screening.^[13]

Animal

The animal care procedures ensured a conducive environment for the rats: cages and the animal room were regularly cleaned and well-ventilated. Daily removal of excess food and excreta maintained hygiene. The room temperature was carefully controlled at $26 \pm 2^\circ\text{C}$. Rats received daily food pellets and clean water, and were handled gently to minimize stress and ensure their well-being throughout the study.

The animals were divided into 4 groups each consisting of six animals.

- Group I - Received only vehicle (Normal saline)
- Group II - (Normal saline) + Metformin (Used as a positive drug)
- Group III - (Normal saline) + with Formulation with low dose
- Group IV - (Normal saline) + with Formulation with high dose

In streptozotocin induced diabetic model**Induction of Diabetes**

Administer a single or multiple low-dose injections of streptozotocin to the animals, typically intravenously or intraperitoneally. Use an appropriate dosage of STZ based on the animal species, weight, and desired level of diabetes induction.

Collection of Blood

At the end of the experiment (stipulated days), the animals were anaesthetized, using diethyl ether and sacrificed by cervical dislocation on 31st day and the treated groups were sacrificed. Fasting blood samples were drawn from rats in separate tubes with preservatives for haematological and biochemical analysis.

Anti-diabetic activity evaluation**Measurement of biochemical parameters**

The severity of diabetes was assessed based on impaired growth and blood glucose levels. Plasma glucose levels were determined post-mortem using the Trinder method, employing glucose oxidase (GOD) and peroxidase (POD) enzymes along with chromogen 4-aminoantipyrine and phenol. Insulin levels were measured using an insulin RIA Kit, with rat insulin as a standard. Glycosylated hemoglobin (HbA1c) was measured via ion exchange resin method. Triglycerides were assessed using an enzyme-colorimetric method. LDL cholesterol was calculated using the Friedwald formula, and total cholesterol and HDL cholesterol were measured enzymatically. Blood urea levels were estimated using the urea's-glutamate dehydrogenase (GLDH) method. Detection of glucose in routine urinalysis can signal the need for further diabetes screening.

RESULT AND DISCUSSION**5.1 Physical Test of Crude Drugs**

The plant material were evaluated for their physio-chemical parameters and compared with the reported literature. The powder of the plant were evaluated for their physio-chemical parameters and compared with the reported literature. The results compiled with the limits reported in the ayurvedic pharmacopoeia of india:

Table 5.1: The Organoleptic properties of the plant extract.

Crude drugs	Physical Test			
	Nature	Colour	Odour	Taste
<i>Carissa carandas fruit Extract</i>	Coarse powder	Dark maroon color	Sweet and slightly floral fragrance	Tart, sour, and slightly acidic

5.2 Extractive Values

The Extractive Values of the plant extract were evaluated for alcoholic and aqueous solutions.

Crude drugs	Alcohol % w/w	Aqueous % w/w
<i>Carissa carandas fruit Extract</i>	14 %	10.50 %

5.3 Loss on Drying And Foreign Organic Matter.

Crude drugs	Loss on drying (% w/w)*	Foreign matter (% w/w)*
<i>Carissa carandas fruit Extract</i>	12.68	2.28

5.4 Total Ash, Acid Insoluble Ash And Water Soluble Ash Values (Table 5.4)

Crude drugs	Total ash value* % w/w	Water soluble ash* % w/w	Acid insoluble ash value* % w/w
<i>Carissa carandas fruit Extract</i>	18.50	2.52	15.25

5.5 Phytochemical Screening

The *Carissa carandas fruit Extract* have revealed the presence of saponins, tannins, glycosides and carbohydrates. Proteins were found to be absent in all the

extracts. From this analysis, found to have more constituents in extract. The results of preliminary phytochemical screening tests of each extract presented in Table below:

Phytochemical screening for extract of *Carissa carandas fruit Extract*

S. No	Chemical Tests	<i>Carissa carandas fruit Extract</i>
1.	Tests for Steroids and Triterpenoids:	
	• Liebermann's Burchard Test	+
2.	• Salkowski Test	+
	Test for Saponins	
3.	• Foam Test	+
	Tests for Alkaloids:	
4.	• Hager's Test	+
	• Mayer's Test	+
5.	Tests for Glycosides:	
	• Borntrager's Test	+
6.	• Keller Killiani Test	+
	Tests for Tannins and Phenolic compounds:	
7.	• Gelatin Test	+
	• Ferric Chloride Test	+
	• Lead Acetate Test	+
	• Dilute Nitric acid Test	-
8.	Tests for Flavonoids:	
	• Ferric chloride Test	+
9.	• Alkaline reagent Test	+
	• Lead acetate Test	-
10.	7. Tests for Proteins:	
	• Biuret Test	-
11.	• Xanthoproteic Test	-

Collection of Blood and separation of Serum

Blood samples were collected by cardiac puncture and retro-orbital plexus method into sprinkled tubes and centrifuged at 3000 rpm for 20 min. Serum were separated as supernatant and stored at -20°C until analysis performed.

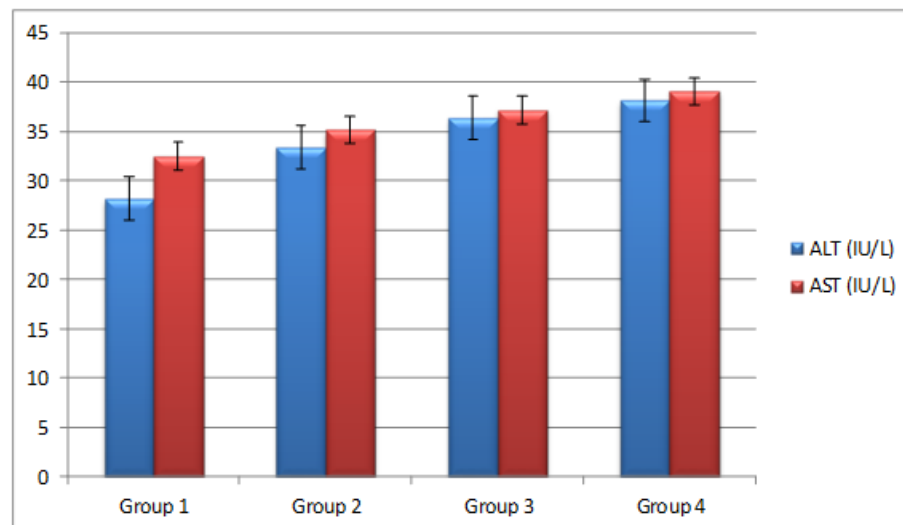
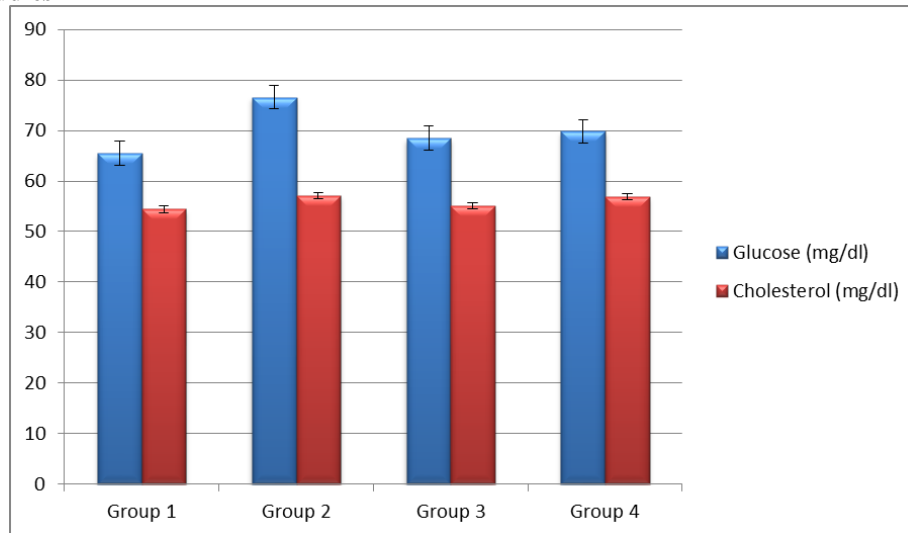
In-Vivo study: Measurement of biochemical parameters

Biochemical Studies

Biochemical studies involve the analysis and investigation of various biochemical components and processes within living organisms. These studies aim to

understand the chemical and molecular basis of biological functions, pathways, and interactions.

Biochemical Studies



Estimation of Glycosylated Haemoglobin

Glycosylated hemoglobin, also known as hemoglobin A1c (HbA1c), is a form of hemoglobin that is used to measure average blood sugar levels over a prolonged period. It is commonly used in the diagnosis and management of diabetes mellitus. The HbA1c level is expressed as a percentage of total hemoglobin. The American Diabetes Association (ADA) has established

recommended guidelines for HbA1c levels for diagnosing and managing diabetes. Here are the general categories:

Diabetes:

- Good control: Below 7%
- Fair control: 7% to 8%
- Poor control: Above 8%

Glycosylated haemoglobin

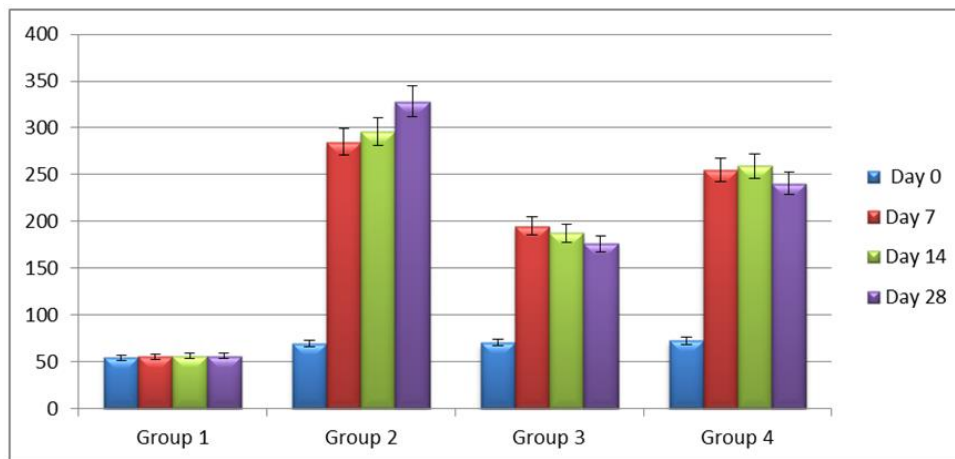
Groups	Time(days)				
	Before study	7 TH day	14 TH day	21 st day	28 th day
Group 1	5.41	5.62	5.53	5.61	5.70
Group 2	5.71	6.54	6.35	6.45	6.55
Group 3	5.14	5.13	5.12	5.11	5.09
Group 4	5.60	5.75	5.85	5.80	5.81

Estimation of Blood Glucose

The blood glucose level of the normal control group remained almost constant. The blood glucose level of diabetic control group kept increasing significantly till last day compared with normal group. The group treated

with extract showed significantly decrease in the blood glucose levels at all time intervals. During the study period of 28 days, Animals were treated at 0, 7, 14, 21 and 28 day and effect of vehicle, standard drug and all solvent fractions on blood glucose were determined.

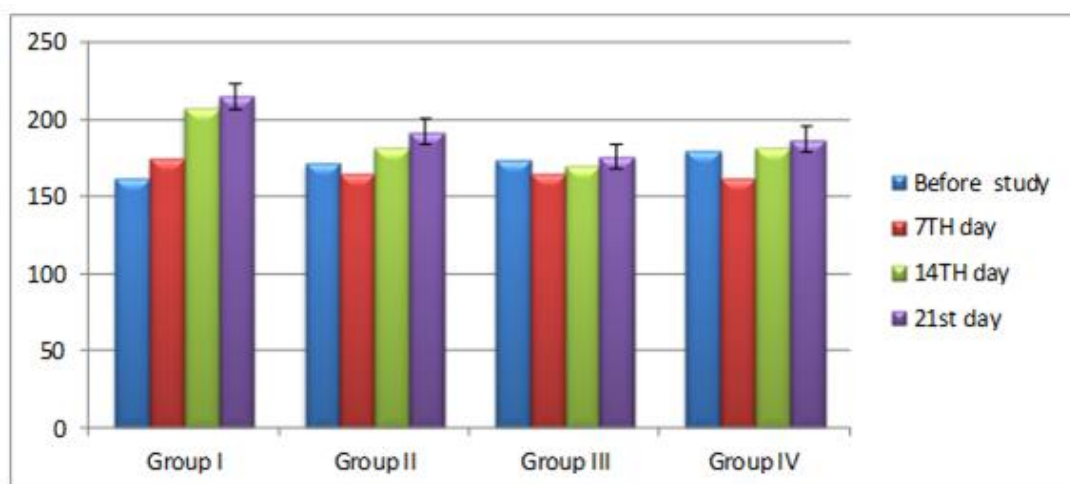
Estimation of Blood Glucose



Determination of Body Weight of Animals

Body weight in our study, the body weight of untreated diabetic group was reduced significantly. This reduction of body weight was also seen in Group III rats as compared to the normal rats in control groups. This data

indicated that treatment of diabetic rats by Formulation 1 had no inhibitory effect on body weight reduction in diabetic rats. Our results were in accordance with the results of similar previous studies.



CONCLUSION

In conclusion, the study on Carissa carandas fruit extract reveals its distinctive organoleptic properties, including color, fragrance, and taste, which are crucial for identifying and assessing its quality. The extract showed varying extractive values in alcohol and aqueous solutions, indicating different soluble constituent contents. Evaluation of moisture content, foreign matter, and ash values further highlighted aspects of purity and composition. Phytochemical analysis identified various compounds present, contributing to its medicinal potential. Blood glucose, HbA1c levels, and body weight changes across different groups provide insights into the extract's potential effects on glucose regulation and body

weight management. These findings underscore the extract's diverse biochemical profile and its implications for therapeutic applications in diabetes management and beyond.

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