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Original Article

Formulation and *in-vitro* Antidiabetic Assessment of *Plumbago zeylanica* Root Extract Containing Tablet

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ABSTRACT

The plant processed herbal formulation have significant role in drug discovery, same time phytoconstituents have high pharmacological potential to treat the various ailments such as diabetes or chronic hyperglycemia. The present research aims to explore and investigate the antidiabetic potential of roots of hyperglycemia Linn. During the study pharmacognosy and formulation of herbal tablet has been done. Fresh roots of plant were collected, two enzymes named as alpha-Amylase and alpha-Glucosidase were obtained from Sigma Aldric. Extraction and fractionation along with phytochemical screening was performed Herbal tablets were made using the direct compression method. The n-butanol fraction of plant extract was mixed with the excipients and compressed into tablets. Different batches of formulations were prepared by dry granulation technique. The maximum *in vitro* dissolution was found to be with formulation F2 that exhibit the extreme proportion of accumulative release of drug (93.96%) due to the optimized concentration of PVP and Chitosan and the formulations F2 has potent Antidiabetic Activity and also have antioxidant potential that was performed in this study. Plant extract has been used to formulate herbal tablets. From all five batches of tablets one batch (F2) was found to be best formulation and this was used to investigate the Antidiabetic activity as well as antioxidant activity also. The plants have potential to treat hormonal disorders also hence it can be used to treat the endocrine metabolic disorders.

Keywords: Hyperglycemia, Antioxidant, Endocrine, α-Amylase, α-Glucosidase, Chitosan, *in vitro*, n-butanol.

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INTRODUCTION

Products from natural origin, particularly those are obtained from plant sources, are used predominantly to target for the discovery of favorable expedite possibility, hence these can be useful in the drug developing research plans.[1] preparations by using herbs have the potential to play the role in all the desired treatments those are possible in alternative medicinal, specifically in rustic zones, because they are easily obtainable and are not too much costly. Furthermore, many plants produce large number of bioactive chemicals with few side effects and potent pharmacological effects.[2-4] if we talk about of natural sources of drug then several plants provide us too many herbal drugs, with several of current medications belongs from medicinal plants directly or indirectly. Different types of medicinal plants seemed to be used as a good source of dynamic anti-diabetic medicine for centuries.[5] Herbs obtained from plants are utilized in the treatment of diabetes mellitus in developing countries, particularly to alleviate the financial burden of conventional treatments on the population. utilization of herbs for the treatment of various diseases one of them is diabetes mellitus is more common now a days due to presence of bioactive constituents viz; phytoconstituent belongs to class of flavonoid and terpenoids, and some of them belong to alkali like substances such as alkaloid, saponins, and some of the pigments like carotenoids, and few of them possess glycon and aglycon moieties, and these phytoconstituents possess potentially capable to treat the diabetes.[6-8]

Diabetes is an endocrine metabolic disorder that is identified through awful hyperglycemic state or higher level of glucose in the blood associated disruption in few of the metabolism like

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Table 1: Composition of different formulations F1-F5.

Sl. No	Ingredients	Category	F1 (mg)	F2 (mg)	F3 (mg)	F4 (mg)	F5 (mg)
1	n-butanol fraction	Active ingredients	50	50	50	50	50
2	MCC	Diluent	80	80	70	70	60
3	PVP	Polymer	10	20	30	10	30
4	Chitosan	Super disintegrant	20	10	10	30	20
5	Magnesium Stearate	Lubricant	6	6	6	6	6
6	Talc	Glidant	4	4	4	4	4
7	Weight per tablet (mg)		170	170	170	170	170

carbohydrate metabolism, and fat consumption, and protein synthesis disruption due to which secretion of insulin decreased up to some extent or absolutely.[9] Diabetes Prevalence as long as the disease is increasing at an alarming rate all across the world.[10]

Possibility of hyperglycemia may arise due to race, genetically related to the family narrative related to high blood glucose level, and earlier development of diabetes, same time other factors like age of person, fatty condition stoutness, imbalanced diet plan, and due to lack of physical workout, and habit of smoking. Type II Diabetes mellitus (T2DM) affects the majority of diabetics (90 percent), which occurs almost primarily in adults but is increasingly in children these days.[1,11] The main objective of this research was to investigate the roots of *Plumbago zeylanica* Linn as a potential anti-diabetic agent. During the course of the present investigation its pharmacogenetic studies, formulation of the active fraction as a tablet dosage form, and *in vitro* evaluation of the tablets were also studied.

MATERIALS AND METHODS

Fresh roots of the plant were collected from Kalesar National Park, Yamunanagar, and authenticated as *Plumbago zeylanica* (Family: Plumbaginaceae) from the Department of Botany, Kurukshetra University, Kurukshetra. α-Amylase and α-Glucosidase enzymes were procured via Sigma Aldrich Chemicals Pvt. Ltd. (Delhi). Each and every used chemical and testing agents/reagents were of analytical grade.

Extraction

Plumbago zeylanica roots were collected, washed thoroughly with fresh running tap water to avoid any contaminants, and seared for about fourteen days in the shade. Seared roots ensued coarsely powdered with the help of a grinder and then well-kept in the airtight case at optimum temperature. The dried roots powder (1 kg) was extracted with hydroalcohol (water: ethanol) in the ratio of 30:70 using the hot soxhlet extraction method.[12] Extract obtained was concentrated on the water bath at a temperature not exceeding 65°C - 70°C and then further dried using a rotary evaporator (Heidolph, Germany) to yield a semi-solid mass, which was well-kept in the airtight box in the refrigerator to reuse in the future.

Fractionation

Various fractions were prepared by using n-hexane as solvents and for separating ethyl acetate, and n-butanol were used in separating funnel. The minimum amount of water was used to make hydroalcoholic extract and for dissolving, this was kept overnight to stand. It was then extracted with n-hexane solvent using a separating funnel. The same process was repeated with ethyl acetate and n-butanol solvents.

Preliminary Phytochemical Screening

Standard methods were used for the Screening of *Plumbago zeylanica* root extract and its dissimilar fractions to obtained active phytoconstituents.[13]

Formulation of tablets

Herbal tablets were made using the direct compression method.[14] The n-butanol fraction of plant extract was mixed with the excipients and compressed into tablets. Nonidentical batches of five formulations denoted as (F1, F2, F3, F4 and F5) were prepared by dry granulation technique as per the composition shown in Table 1.

In vitro Antidiabetic activity

α- Amylase enzyme inhibition assay

Pancreas and salivary glands, is responsible for vital secretion of α-amylase enzyme which is also known as α- 1, 4-glucan-4-glucanohydrolases, its amount of secretion from pancreas and slavery glands is about (~5-6%) this enzyme plays

a crucial role in the digestion of glycogen and starch. Shorter oligosaccharides were obtained as a result of starch hydrolyses by alpha-amylase. Inhibition of α-amylase is an effective therapy for postprandial hyperglycemia.

Procedure

"The determination of α-amylase inhibition was carried out by quantifying the reducing sugar (maltose equivalent) liberated under the assay conditions".[15] The amount of maltose liberated per unit of enzyme was measured to determine the inhibitory activity of the enzyme. The maltobiose or malt sugar/maltose similar was identified by using a altered acid known as dinitrosalicylic (DNS) acid method. 100 µL of the plant extract/fractions/standard has been used for pre-incubation with α- 1, 4-glucan-4-glucanohydrolases (α-amylase) 1 U/mL for about 30 min and thereafter 100 µL (1 percent Weight/Volume) solution of starch was included. The prepared composition was kept for further incubation for about 10 min at the temperature of 37°C. 200 µL dinitrosalicylic which is also known as DNS was added to stop the reaction and the composition of DNS used was 12.0 gram of sodium potassium tartrate tetrahydrate in 8 mL of 2 M NaOH and solution of 96 mM 3, 5- dinitrosalicylic acid then the water bath was used for heating of contents for about 5 min. 20 mM Sodium phosphate buffer with 6.7 mM Sodium chloride, pH 6.9 at 25°C. iMark Microplate Reader was used to measure the absorbance at 540 nm. The percentage inhibition was calculated by the following formula

$$\text{Percent Inhibition} = A_c - [A_s - A_0] / A_c \times 100$$

Whereas,

A_c=Absorbance of control.

A_s= Absorbance of a sample with an enzyme.

A_0= Absorbance of a sample without enzyme.

Alpha- Glucosidase enzyme inhibition assay

Alpha-D-glucopyranoside and 4-nitrophenyl were obtained as a result of catalysis of substrate 4-nitrophenyl-Alpha-D-glucopyranoside it is also known as PNPG, through Alpha-Glucosidase which is represented as here below:

4-nitrophenyl-Alpha-D-glucopyranoside + Alpha-glucosidase Alpha-D-glucopyranoside + PNP

"The α-glucosidase activity is determined by a reaction in which α-glucosidase hydrolyses p-nitrophenyl-α-D-glucopyranoside, yielding a colorimetric (405 nm) product proportional to the amount of -glucosidase present".[16] 50 µL buffer solution of phosphate composition was takn as 20 mM buffer solution of Sodium phosphate along with 6.7 mM solution of Sodium chloride, with 6.9 pH, the temperature was maintained about 25°C) and for pre-incubation of plant extract/fractions/standard, alpha-glucosidase 1 U/mL for about 20 min at the temperature of 37°C 20 µL were used. Then for further incubation for about 30 min at 37°C 20 µL p-nitrophenyl-α-D-glucopyranoside (5mM) was added. The reaction was then stopped by adding 50 µL sodium carbonate (0.1M). A vacant/blank was prepared excluding the extracts of plant and other excluding the enzyme i.e., glucosidase enzyme, replaced by equal quantities of a buffer. iMark Microplate Reader was used to measure the absorbance at 540 nm. The above-given formula was used to inhibition percentage.

In the study, hydroalcoholic extract of *Plumbago zeylanica*, its fractions, and tablet formulation F2 were used at 100, 200, 400, 600, and 800 µg/ml concentrations.

RESULTS

The percentage yield of *Plumbago zeylanica* root in a hydroalcoholic solvent is 5.98% w/w.

Qualitative Tests for Phytoconstituents

Qualitative tests revealed the existence of quinones, carbohydrates, tannins, carbolic acid, alkaloids, saponins, sterols, along with flavonoids. n-butanol fraction was discovered to have the most phytoconstituents. As a result, only the n-butanol fraction was selected for tablet formulation.

Compatibility Studies of Drug excipients

Data on "Fourier Transform Infrared Spectroscopy" (FTIR)

From IR study, major peaks regarding an active fraction, excipients, and the optimized formulation were found to be no interaction between the active fraction and excipients. Moderate scanning speed was carried out between 4000-400 cm^{-1} using FTIR (Bruker FTIR Alpha). Hence, the FTIR study showed that drug and excipients were compatible.

Preformulation studies

Evaluation of powder blend

All formulations those were prepared selected for evaluation to report the quality such determination of angle of repose and both type of densities bulk and tapped, determination of carr's index, along with hausner's ratio, and evaluated values in the form of results are shown in Table 2. Among all the formulations, F2 possess better flowing property and value of the compressibility index further showed support for the flow property.

Evaluation of tablets

The thickness and average weight were found in the range of 3.5 ± 0.1mm and 160 ± 3 mg for all the formulations. The rigidity/hardness of unlike formulations was fluctuated by 5-6 kg/cm^2. The results were found to be within the content of uniformity

Table 2: Pre-compression parameters of all the formulations.

Parameters	F1	F2	F3	F4	F5
Angle of repose	28.55	27.50	27.90	28.55	31.85
Bulk density (gm/ml)	0.30	0.31	0.34	0.30	0.39
Tapped density (gm/ml)	0.35	0.35	0.40	0.35	0.46
% Carr's index	14.28	11.42	15.00	14.28	15.21
Hausner's Ratio	1.16	1.13	1.17	1.16	1.18

limits (94 to 98%). It shows that the drug was uniformly distributed throughout the tablets and results are shown in Table 3. Disintegration is the most important characteristic test. Formulation F3 and F5 with PVP 30mg show an excellent disintegration time of 45 min and F2 shows disintegration time of 40 min.

Analytical Methodology Measures Drug Release in Liquid Media

In-vitro Dissolution Studies

The data for release of drug in liquid media (dissolution rate) are shown in the Figure 1. The maximum *in vitro* dissolution was found to be with formulation F2 that showed maximum percentage of Cumulative drug release (93.96%) due to the optimized concentration of PVP and Chitosan. The formulation F5 shows the least *in vitro* dissolution of 70% and the formulation F2 Containing PVP (20mg) and Chitosan (10mg) were found to contain a maximum *in vitro* dissolution of 94%.

Antidiabetic Activity

In-vitro antidiabetic studies

Present research evaluates inhibitory rate of α-amylase, and α-glucosidase enzymes through standard (acarbose), hydroalcoholic extracted material, and different fractions of roots of *Plumbago zeylanica* Linn. Roots contain plumbagin, chitranone, 3-biplumbagin, *β*-sitosterol.[17] In the present study, the plant root extracts and their n-butanol fraction possess significant antidiabetic activity. So, the enzyme inhibitory effect of this plant extract and its fractions might be attributed to its naphthoquinones, flavonoids, and alkaloids contents as indicated in the preliminary phytochemical screening.[18] Thus, from the results of the current study, it can be inferred that *P. zeylanica* roots hydroalcoholic extract and its fractions possess an antidiabetic effect via enzyme inhibitory mechanism.

α-amylase inhibitory assessment

In-vitro alpha-amylase inhibitory study represents, the n-butanol fraction of *Plumbago zeylanica* (BFPZ) had a significant α-amylase inhibitory activity which proves a concentration-dependent reduction in enzyme activity. Thus, the highest concentration of 800 µg/ml tested showed inhibition of 81.72 ± 1.104% with BFPZ when compared with Standard which showed 86.14 ± 1.45% inhibition. The percentage inhibition varied between 16.44-79.48%. Thus, the data presented here indicate that BFPZ possesses significant *in vitro* activity. However, Agarbose showed the highest enzyme inhibition activity at the maximum dose. IC_{50} values of standard (acarbose), TFPZ and BFPZ are found to be 64.51 ± 0.83 (µg/ml), 390.74 ± 1.12 (µg/ml) and 370.83 ± 1.35 (µg/ml) respectively.

Alpha-glucosidase inhibitory assessment

In vitro alpha-glucosidase inhibition study revealed EFPZ and BFPZ of *P. zeylanica* showed significant alpha- glucosidase inhibition process that proves a dose-depended reduction regarding enzyme activity. Thus, highest concentrated dose of 800 µg/ml of EFPZ and BFPZ repersented inhibition of nearly 69.12 ± 1.69 and 83.56 ± 1.06% respectively, and standard (acarbose) showed inhibition of 86.36 ± 1.16%. Thus, the data presented here indicate that EFPZ and BFPZ possess significant *in vitro* activity. IC_{50} values of Standard, TFPZ, BFPZ are found to be 61.81 ± 1.45 (µg/mL), 352.09 ± 1.43 (µg/mL), and 312.63 ± 1.26 (µg/mL) respectively as shown in Figure 2 *in vitro* alpha-amylase and alpha-glucosidase inhibition studies demonstrated that F2 formulation had an antidiabetic activity. The highest concentration of 800 µg/ml showed α-amylase inhibition of nearly 78.98 ± 3.46% and α-glucosidase inhibition of nearly 79.31 ± 1.09%.

In-vitro Antioxidant activity

DPPH radical scavenging activity

The result shows that with an increase in the conc. of extract as well as fractions, percentage inhibition also increases which shows that it is a concentration-dependent pattern. The highest concentration of the standard (Butylated hydroxytoluene) and BFPZ (700 µg/ml) show the highest percentage inhibition of 82.16 ± 1.84% and 79.59 ± 1.74%. IC_{50} values of Standard and BFPZ are found to be 64.51 ± 0.83 (µg/ml) and 370.83 ± 1.35 (µg/ml) respectively.

Table 3: Post-compression parameters of all the formulations.

Parameters	F1	F2	F3	F4	F5
Average weight (mg)	161.12±0.84	160.25±0.78	161.47±0.47	160.79±1.16	161.16±0.41
Thickness (mm)	3.51±0.12	3.51±0.09	3.52±0.04	3.50±0.77	3.51±0.41
Weight variation (%)	4.4	4.4	4.6	4.2	4.3
Hardness (kg/cm^2)	5.2±0.22	5.4±0.12	5.8±0.34	5.4±0.78	5.8±0.12
(%) Drug content	95.56	98.12	94.34	96.12	97.04
Disintegration time (min)	35	40	45	42	45

Table 4: α-amylase and α-glucosidase inhibitory percentage of extract/ fractions/formulation.

Sample	Conc. of extract/ fraction/ std (µg/ml)	α-amylase Percentage Inhibition (%)	α-glucosidase Percentage Inhibition (%)
Standard (Acarbose)	10	27.36 ± 0.61	28.12 ± 0.56
	20	37.78 ± 0.69	39.65 ± 0.45
	50	47.62 ± 1.17	49.22 ± 1.36
	100	66.32 ± 1.33	67.13 ± 1.78
	200	88.56 ± 1.07	86.36 ± 1.16
Hydroalcoholic root extract of *Plumbago zeylanica* (HRPZ)	100	14.58 ± 1.34*	16.23 ± 1.12*
	200	27.53 ± 1.13*	29.89 ± 1.36*
	400	40.23 ± 0.89*	43.15 ± 1.25**
	600	52.12 ± 1.45**	55.32 ± 1.78*
	800	62.96 ± 1.36*	63.37 ± 1.41*
n-hexane fraction of *Plumbago zeylanica* (HFPZ)	100	12.26 ± 1.36*	13.25 ± 1.73*
	200	23.75 ± 1.12*	25.79 ± 1.36*
	400	33.45 ± 1.86**	37.41 ± 1.74*
	600	44.31 ± 1.14*	46.85 ± 1.82**
	800	59.27 ± 1.48*	55.29 ± 1.32*
Ethyl acetate fraction of *Plumbago zeylanica* (EFPZ)	100	17.22 ± 0.87*	19.26 ± 2.56*
	200	33.36 ± 1.23**	34.56 ± 3.47**
	400	46.85 ± 1.06*	44.35 ± 1.35*
	600	57.63 ± 1.58*	60.57 ± 2.12*
	800	68.87 ± 2.02*	69.12 ± 1.69*
n-butanol fraction of *Plumbago zeylanica* (BFPZ)	100	22.56 ± 1.20*	26.45 ± 1.15*
	200	39.14 ± 2.12*	44.12 ± 2.65*
	400	56.97 ± 1.36*	63.15 ± 1.78*
	600	69.46 ± 1.89**	74.96 ± 1.12*
	800	81.72 ± 1.10*	83.56 ± 1.06*
Tablet formulation (F2) of *Plumbago zeylanica* n-butanol fraction (TFPZ)	100	20.49 ± 1.15**	22.51 ± 1.45*
	200	34.37 ± 1.78*	43.68 ± 1.96*
	400	54.12 ± 1.65*	60.19 ± 1.17*
	600	66.32 ± 2.41*	69.85 ± 1.32*
	800	78.98 ± 3.46*	79.31 ± 1.09*

Table 5: Percentage scavenging activity of DPPH radical and Hydrogen peroxide radical.

Sample	Conc. of extract/ fraction/ std(µg/ml)	DPPH Percentage Inhibition (%)	H_2O_2 Percentage Inhibition (%)
Standard (Butylated hydroxytoluene)	50	21.56 ± 0.49	23.24 ± 1.12
	100	33.25 ± 0.79	36.56 ± 1.42
	200	46.53 ± 0.45	48.79 ± 0.43
	300	64.84 ± 1.36	67.89 ± 1.19
	400	82.16 ± 1.84	86.78 ± 1.53
Hydroalcoholic root extract of *Plumbago zeylanica* (HRPZ)	300	19.87 ± 1.54**	16.59 ± 1.54*
	400	39.51 ± 1.89*	29.47 ± 1.73*
	500	47.26 ± 1.36*	40.43 ± 1.45*
	600	59.67 ± 1.48*	55.45 ± 1.16*
	700	67.29 ± 1.26*	61.94 ± 1.49*
n-hexane fraction of *Plumbago zeylanica* (HFPZ)	300	14.26 ± 1.12*	15.75 ± 1.24**
	400	24.58 ± 1.37*	23.81 ± 1.65*
	500	36.16 ± 1.02*	39.51 ± 1.29*
	600	48.27 ± 1.97**	51.39 ± 1.89*
	700	56.20 ± 1.15*	55.37 ± 1.46*
Ethyl acetate fraction of *Plumbago zeylanica* (EFPZ)	300	16.49 ± 1.26*	18.41 ± 1.46*
	400	29.32 ± 2.79**	30.25 ± 2.28**
	500	40.89 ± 3.74*	43.23 ± 1.93*
	600	55.53 ± 2.32*	59.86 ± 1.52*
	700	61.74 ± 1.11*	76.56 ± 1.37*
n-butanol fraction of *Plumbago zeylanica* (BFPZ)	300	23.94 ± 1.65*	26.46 ± 1.36*
	400	45.36 ± 1.64*	39.15 ± 1.46*
	500	57.97 ± 1.36*	51.63 ± 1.78*
	600	68.12 ± 1.56*	68.73 ± 1.94*
	700	79.59 ± 1.74*	82.24 ± 1.06*

Hydrogen peroxide free radical scavenging activity

The consequence of the Hydrogen peroxide free radical scavenging venture of extract and fractions showed a concentration-dependent pattern. The highest concentration of standard (Butylated hydroxytoluene) and BFPZ (700 µg/ml) show the highest percentage inhibition nearly 86.78 ± 1.53% and 82.24 ± 1.06% respectively. IC_{50} values of Standard and BFPZ are found to be 194.92 ± 1.45 (µg/mL) and 474.33 ± 1.26 (µg/mL) sequentially as shown in Figure 3.

BRIEF SUMMARY OF RESULTS

In the present research part of plant used was root, hence for the further study for the future prospects some one can used other parts of the plant such as root and stem bark of leaves or directly stems. Then by using other parts of plant drug may be more potent against diabetes. Same time researchers can also alter the solvent system for the extraction of drugs instead of hydroalcoholic ethanol can be used for future research ten it would might be give better yield as hydroalcoholic extract obtained is 5.98% w/w. if we talk about limitations then particular dosages forms ahs its own limitations to evaluate the effectiveness of drug, we can use direct extract or other forms of dosages forms such as phytosomes or herbosomes to enhance the bioavailability of the drug. The drug contains several active principles of different class such flavonoid and terpenoids, saponins alkaloids. Thus, the drug may used to treat the other diseases such as nephrotoxicity. For evaluation point of view in the present study researchers may proceed for the HPTLC Profile as well as HPLC for the plant extracts to prove the presence of active principles. Previously informations about the research on this plant has been given in various review and research articles such Phytochemistry and pharmacological studies of *Plumbago zeylanica* L. medicinal plant in this review. Antioxidant activity has been studies by Using Both water soluble and alcohol soluble extracts of roots with known plumbagin. Evaluation of antioxidant property of Ferric reducing agent with antioxidant

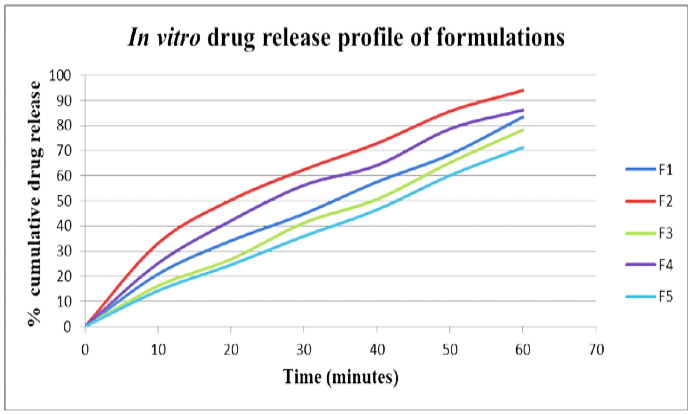

Figure 1: Comparative *in vitro* drug release profiles of formulations F1-F5.

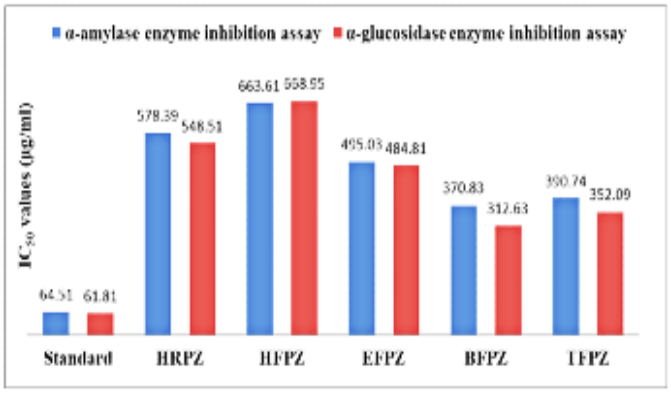

Figure 2: Antidiabetic activities of *Plumbago zeylanica* root extract and IC_{50} value of different fractions.

potential free radical scavenging of 1,1-diphenyl-2-picryl hydrazy (DPPH) and 2,2′-azobis-3-ethylbenzthiazoline-6-sulfonic acid (ABTS), if we DPPH assays, ethanolic extracts were shown to be more effective, whereas in the ABTS assay aqueous extracts were reported to be the highly effective.[19] In recent study result shows that with an increase in the conc. of extract as well as fractions, percentage inhibition also increases which shows that it is a concentration-dependent pattern. Strength of this research work is that researchers has shown the antioxidant and antidiabetic potentials of herbal tablets and found significant results.

DISCUSSION

In the present study the percentage yield of *Plumbago zeylanica* root in a hydroalcoholic solvent was reported maximum as 5.98% w/w which indicates good results of percentage yield. In the FTIR spectra of physical mixture (active fraction, excipients, and the optimized formulation) major peaks appeared intact or without any major shift which indicated absence of any interaction between drug and polymer in physical mixture. Preformulation results indicate that the prepared blend exhibited good flow properties and all the formulations were passed in pre formulation studies. Similarly results obtained by evaluation of tablets were found within the range. Antioxidant activity showed that with an increase in the conc. of extract as well as fractions, percentage inhibition also increases which shows that it is a concentration-dependent pattern. As a result, prepared formulations may be a promising candidate for management of diabetes.

Thus, current research work relating to this medicinal plant could serve as the baseline knowledge to enforce to do in depth studies for the discovery of new potent compounds and more investigations for their biological activities.

CONCLUSION

The roots of the plant *Plumbago zeylanica* Linn. which belongs to the family plumbaginaceae were used and investigated for the phytochemical screening, formulation of tablets, antidiabetic

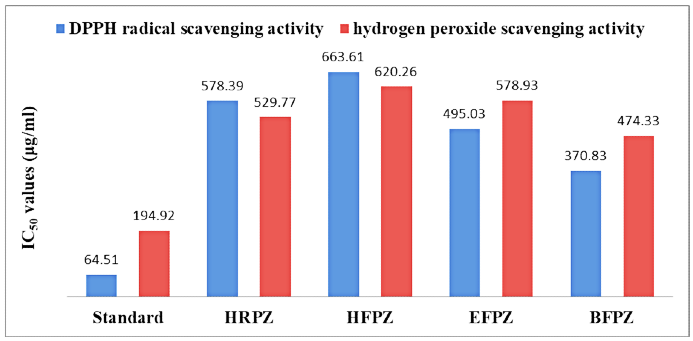

Figure 3: Antioxidant activities of *Plumbago zeylanica* root extract and IC_{50} value of different fractions.

and antioxidant activity of extracts of root along with other fractions. Hence current research related with the preparation and analysis of tablets prepared from the n-butanol fraction of root of *Plumbago zeylanica* Linn. Soxhlet extraction of the plant material was done with hydroalcoholic solvent and different fractions are prepared by using different solvent like as n-hexane and ethyl acetate, and n-butanol using a separating funnel. The extract and its different fractions were screened for the presence of various pharmacological active phytoconstituents. Furthermore, different polymers such as microcrystalline cellulose, polyvinylpyrrolidone, chitosan, magnesium stearate, and talc were used to formulate the n-butanol fraction as a tablet. The tablets were prepared in five batches. From these five batches, one batch (F2) was found to be the best formulation in terms of drug uniformity and disintegration time taken. Therefore, the F2 formulation was selected for antihyperglycemic activity. Finally, the hypoglycemic activity was investigated and established as remarkable. The antioxidant activity was also studied. As a result, this formulation can be used to prevent and treat diabetes. The current study opens up new avenues for future research into these various anti-diabetic medications. In the future, this could lead to better integrative management of these endocrine metabolic disorders.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

PVP: Polyvinylpyrrolidone; **IC:** Inhibitory concentration; **DPPH:** (2,2-diphenyl-1-picryl-hydrazyl-hydrate.

SUMMARY

The roots of the plant *Plumbago zeylanica* Linn. Which belongs to the family plumbaginaceae were used and investigated for the phytochemical screening, formulation of tablets, antidiabetic and antioxidant activity of extracts of root along with other fractions. Five formulations have been prepared from which formulation F2 showed significant result for antidiabetic activity.

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