Program Profile		
Program	Program name	Unveiling the Phytochemical Profile and Pharmacological Activities of various Medicinal plant
	Category	**"A1"**

Summary of Program	
Program Name	Unveiling the Phytochemical Profile and Pharmacological Activities of various Medicinal plant
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Abstract of Program	Plants are a lot of interest as a source of nutrients and nutraceuticals of their possible health benefit. Also, natural substances found in plants are used as alternative medicine and play an important role in the health and wellbeing of people worldwide. Studying medicinal plants helps to understand the plant toxicity and protect human and animals from natural poisons. Medicinal plants are blessings for human being of their herbal therapeutic uses. Some example of medicinal plant such as: *Centella asiatica* leaves are commonly used in the treatment of dysentery, cholera, tuberculosis, common cold, urinary tract infection, leprosy, psoriasis and eczema, bronchitis and asthma; Juice of different parts of *Mirabilis jalapa* are used to manage pain, abdominal cramps, diarrhoea, diabetes, constipation, hepatitis, etc; *Andrographis paniculata*, has been used for centuries for the treatment of cancer, influenza, diabetes, hypertension, ulcer etc; *Vitex negundo* also used in diabetes, fever, inflammation, diarrhoea etc. These medicinal values of plants are exhibited by the presence of plant metabolites such as phenols and flavonoids, alkaloids, saponins, steroids and glycosides. Therefore, our studies are designed to evaluate the antioxidant, analgesic, hypoglycemic and hypolipidemic activity of numerous medicinal plants. To peform this research, we designed sequential processes such as collection and preparation of plant extracts, estimation of plant metabolite, evaluation of antioxidant, analgesic, hypoglycemic and hypolipidemic activities. Further we will also identify and characterize the specific chemical compounds present in the plant extract by using spectroscopic and chromatographic techniques such as UV, IR, GC-MS/MS analysis. Later, a computational model will be applied to predict the physicochemical, pharmacokinetic, and toxicokinetic parameters of these compounds. In conclusion, by improving public information about the safe use of plant parts, our studies might enhance the availability of these products in the market and translate plant research into useful information for consumers, scientists, and other stake holders.

Details of Program		
Planning		
Objectives	Long-term Goals	The long-term goals of this project are to develop research culture among the faculties and their student. By developing research culture among the students, they will be expertise to do their own research work. The publication of research work will enhance the academic excellence of the university and increase its international recognition.

	Short-term Targets	• To develop new plant metabolite for therapeutic purposes in various ailments. • Elucidation of interactions between chemical constituents within a given plant, or between constituents of plants commonly used in combination, that are significant for their effects on human biology. Relevant outcomes may include, but are not limited to bioavailability, distribution, metabolism, safety/toxicity, mechanism of action, and efficacy. • Development of *in silico*, *in vitro* and/or preclinical *in vivo* models to accelerate and/or enhance understanding of the activities and mechanism(s) of action of chemically complex botanical preparations/dietary supplement. Research using *in silico* models must be closely integrated with parallel research *in vitro* or in animal models to ensure and validate the biological relevance of the combined approaches. • Development of optimized approaches to obtain clearly interpretable outcomes of strong potential clinical relevance from studies of complex botanical mixtures.
	Rationale	Human being suffering from various diseases such as diabetes, cancer, obesity and analgesia due to the nutritional deficiency or any other pathological causes. These problems can be counter act by nutritional supplement. Plant and plant metabolites are the rich sources of nutrition of animals. Plant sources are the blessings for the human being for their nutrition. Along with nutritional values, many plants have medicinal values for the management of various ailments.
Subject (Leader)	Initiator(s)	RASHID, Md. Harun-Or-
	Champion(s)	CHOUDHURY, Musfiq Mannan
	Major team member(s)	LABONI, Farhina Rahman; ARIFUZZAMAN Sarder; AHMED Tahsin; JAHAN Khurshid
Environment	Nature/Society	The proposal contains prospective application of conventionally used medicinal plants
	Industry/Market	The proposal illustrates research-based experiment for developing new drug. Hence University can make a collaboration with an industry to maintain the expenses of the research work.
	Citizen/Government	The people or government can emphasize the researcher by financing to develop the project work.
Resources	Human resources	The research proposal is supported by a group of mentioned faculties of the department. Besides this one research associate and some research students are involved in this project for smooth operation of the research work.
	Financial resources	Funding would be necessary for research and development. The research laboratory is satisfactorily enriched with chemicals, apparatus and instruments. The University provided research fund (3,00,000/- BDT) to purchase additional chemicals and apparatus, and to bear the salaries for researchers and technical staff; and also, for other miscellanies costs.
	Technological resources	Maximum research experiment was done under present laboratory facilities. More over some sophisticated experiment such as IR spectroscopy, HPLC, GC-MS/MS analysis, Computational modeling will be done by our research collaborators from BCSIR and Wazed Miah Science Research Centre, Jahangirnagar University.
Mechanism	Strategy (Weight/ Sequence)	• Analysis for background of the research. • Analysis of plant review and their application. • Determination of objectives of the research. • Fixation of experimental methods for the research work.

		• Data presentation and interpretation for the objective of the research. • Mention the recommendations for further step. **Importance of research:** • Research on medicinal plant will uncover the new window to discover noble drug molecules which may overcome the present conventional drug crisis. **Work execution sequences:** • Selection, collection and preparation of plant materials. • Extraction of plant metabolite by various organic solvents sequentially. • Qualitative and quantitative screening of prepared plant extract. • Antioxidant, studies by various experimental analysis. • Summarize & interpretation of data according to the objective of the study.
	Organization	The Institutional Quality Assurance Cell (IQAC) and Centre of Excellence of the University monitor all research project belong to the World University of Bangladesh.
	Culture	World University of Bangladesh has an IQAC authorized from UGC; Centre of Excellence and a team for research project execution. All the board monitored the ongoing research work belong to the University for smooth execution.
Doing		
Launch date		January, 2024
Responsible organization		IQAC and Centre of Excellence of World University of Bangladesh
Program content and process		• Qualitative and quantitative phytochemical and pharmacological screening study will be conducted with the plant extracts. • After that, the physicochemical, pharmacokinetic, and toxicokinetic parameters will be precited and tested in preclinical and clinical settings if we predict it to be safe and effective.
Key highlights of the content/process		• Qualitative analysis of phytochemical revealed the presence of phenolics and flavonoids along with other bioactive constituents. • The total antioxidant capacity of the plant extractives was determined based on their ability to reduce Mo (VI) to Mo (V). • The free radical scavenging potential of the extractives was evaluated by spectrophotometric method using the synthetic DPPH free radicals. • The *in-vivo* cytotoxicity of the extracts was determined against brine shrimp by brine shrimp lethality bioassay. • The different fractions of plant were assayed for thrombolytic activities by determining the ability to clot lysis as compared with Streptokinase. • The extractives will be evaluated for analgesic, hypoglycemic and hypolipidemic activities. • The plant metabolite characterization and their ADMET analysis by computational modelling.
Differences from traditional approaches		• Traditional medicine causing various adverse effect and having hypersensitivity. • So, plant and plant derived metabolite can be considered as alternative way.
Progress as of today		This research aims to isolate and characterize the plant metabolite and to reveal their pharmacologic activities. We already accomplished literature review, extraction, plant metabolite content characterization and analgesic and anti-diabetic activity studies. Further we will characterize compounds by GC-MS/MS analysis and ADMET analysis by their computational modeling.
Problems in implementation		There is a shortage of all advanced instruments (IR spectroscopy, HPLC, GC-MS/MS analysis, Computational modeling) and animal handling facilities in the

	University.
Approaches to solve the problems	• Collaborate with advanced research institute (National Research Centre, BCSIR) to perform FTIR, GC-MS/MS analysis. • Apply research grants to provide support for essential chemicals and reagents. • Expertise research students and assistants to perform the cost-effective experimental methods.
Completion date, if completed	Will be completed up to 30th June, 2026
Seeing	
Impacts on students	• Students can learn various technology to do the research work. This program will also help to widen the arena of knowledge of students in research field. • Inspire students to pursue similar research, fostering innovation, critical thinking and deepening understanding in this field. • Bridge theoretical learning with real life applications.
Impacts on Professors	Research work has significant impact on Professor and University by enhancing academic excellence and institutional visibility. Professors are getting opportunities to contribute to the nation through the University and University's qualities are improving. By publishing the research work in peer review journal, the Professor can get international recognition, increase the possibility to get research grants and interdisciplinary collaboration and conference participation.
Impacts on university administration	This project will enhance the academic excellence of the university by publishing and presenting the research work in various peer reviewed journals, conferences and various academia. This also enhances the university's visibility and reputation in national and international rankings, which is a strategic priority for most administrations.
Responses from industry/market	It bridges between university and industry by sharing their resources. The research result shared with collaborative researcher, industry and other entrepreneur involved with the project.
Responses from citizen/government	N/A
Measurable output (revenues)	Research report based on unified research results and publications. • Arifuzzaman S, **Rashid MHO**, Laboni FR, Khatun MR, Chowdhury NS **(2025).** Revisiting the Role of Liver X Receptors (LXRs) in Disease: In-Silico Discovery of Novel Modulators through Molecular Docking and Chemico-Pharmacokinetic Profiling. ***Comput. Toxicol.*, 2025; 34:(100361).** https://doi.org/10.1016/j.comtox.2025.100361 • Arifuzzaman S, Labu ZK, **MHO Rashid**, Laboni FR, Khatun MR, Ali MS, Hossain S, Chowdhury NS **(2024)**. Identification of novel compounds targeting the liver X receptor (LXR): in-silico studies, screening, molecular docking, and chemico-pharmacokinetic analysis. ***Biomedical and Pharmacol. J.*, 2024; 17(3).** https://dx.doi.org/10.13005/bpj/2960 • **MHO Rashid,** Akter S, Habiba U, Laboni FR, Uddin J, **Labu ZK**, Mim F, Reza MS (2023). Antioxidant, antibacterial, cytotoxic and thrombolytic activities of flowers of *Mirabilis jalapa* L: possible roles of phenols and flavonoids. ***J. Agri. Food Research*, 14: 100893**. https://doi.org/10.1016/j.jafr.2023.100893 • **MHO Rashid*,** Akter MM, Uddin J, Islam S, Rahman M, Jahan K, Sarker MMR, Sadik G (2023). Antioxidant, cytotoxic, antibacterial and thrombolytic activities of *Centella asiatica* L: Possible role of phenolics and flavonoids**. *Clinical Phytoscience,* 2023, 9(1): 1-9**. https://doi.org/10.1186/s40816-23-00353-8
Measurable input (expenses)	• Purchasing chemicals & reagents ---------- 35% • Expenses for research Lab ---------- 20%

	• Conference & Publication ----------15% • Transport ---------- 10% • Salary/wages ---------- 20%
Cost-benefit analysis for effectiveness	**Costs:** • Research and Development: Significant investment in developing methods and result oriented report. • Data Analysis: Costs associated with data generation, analysis and validation. • Training and Implementation: Costs for training professionals and students to use new techniques and integrating them into existing workflows. **Benefits:** • Improved Predictive Accuracy: Enhanced accuracy to obtain accurate data-oriented report. • Innovative Research and Education: The study in force to become skilled and experienced students and personnel. • Long-term Cost Savings: The research practice produces skilled personnel for the nation. Students learned research strategy to help them in their future planning in research.
Future Planning	
Where does the project go from here?	This research project was designed to identify and to characterize the pharmacological important plant metabolites. For this purpose, we prepare ground plant. The ground plant parts were extracted with different organic solvent by increasing the polarities gradually (n-Hexane, Chloroform and Methanol). The important active plant metabolites were extracted by methanol after washing with less polar solvent such as n-hexane and chloroform. The plant metabolite consisting of polyphenols, flavonoids and proanthocyanidins were estimated and MeE was found to rich fraction of estimated plant metabolites. Among the three extractives MeE was shown to be significant antioxidant activities when measured in term of total antioxidant activities, free radical scavenging activities, inhibition of lipid peroxidation and ferric iron reducing properties. In *in-vivo* studies MeE and ChE also showed to possess analgesic and anti-diabetic activities). The biochemical lipid profiles of the treated mice in anti-diabetic activity studies were also normal & hence the plant extracts were non-toxic to the experimental animals. Further we will characterize the plant metabolite by GC-MS/MS analysis. ADMET analysis will be performed by computational modelling.
Addendum	
Exhibits, pictures, diagrams, etc.	**See the listed document at the end of this template.** **Table 1.** Phytochemical screening of various extract obtained from plant powder. **Table 2:** ATR-FTIR spectral data (cm^{-1}) for the crude extracts of n-hexane, methanol, and chloroform from powdered plant. **Table 3.** The observed phytochemical contents in different extractives. **Table 4.** The *in-vitro* antioxidant activities of different extractives of ground plant. **Table 5.** Peripheral analgesic activity of different dose of ChE and MeE from ground plant and standard drug. **Table 6.** Central analgesic activity of ChE and MeE from ground plant & standard drug **Table 7.** Blood glucose level of mice after treatment with ChE, MeE & standard drug. **Table 8.** Biochemical profile of diabetic mice and treated mice with various

	extracts and compared with standard. **Figure 1.** FTIR analysis of different extractives. **Figure 2.** Effect on blood glucose level of diabetic mice for different extractives.
Reports, mimeos, monographs, books, etc.	**Details of the listed document at the end of this template** The ground plat parts were extracted with different organic solvent by increasing the polarities gradually (n-Hexane, Chloroform and Methanol). The important active plant metabolites were extracted by methanol (Table 1, Table 2, & Figure 1) after washing with less polar solvent n-hexane and chloroform. The plant metabolite consisting of polyphenols, flavonoids and proanthocyanidin contents were estimated and MeE was found to rich fraction of estimated plant metabolites (Table 3). Among the three extractives MeE was shown to be significant antioxidant activities when measured in term of total antioxidant activities, free radical scavenging activities, inhibition of lipid peroxidation and ferric iron reducing properties (Table 4). In *in-vivo* studies MeE and ChE also showed to possess analgesic and anti-diabetic activities (Table 5–Table 7 & Figure 2). The biochemical lipid profiles of the treated mice in anti-diabetic activity studies were also normal & hence the plant extracts were non-toxic to the experimental animals (Table-8).
Others which may help explain the program (including website links)	• https://doi.org/10.1016/j.comtox.2025.100361 • https://dx.doi.org/10.13005/bpj/2960 • https://doi.org/10.1016/j.jafr.2023.100893 • https://doi.org/10.1186/s40816-23-00353-8

Table 1. Phytochemical screening of various extract obtained from plant powder.

Extract	Tannins	Saponin	Steroid	Glycoside	Alkaloid	Phenols	Flavonoids	Carbohydrates
nHE	-ve	-ve	-ve	+ve	-ve	+ve	+ve	-ve
ChE	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve
MeE	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve

nHE, Hot n-Hexane extract; ChE, hot Chloroform extract, MeE, hot methanol extract; +ve; present; -ve, absent.

Table 2. ATR-FTIR spectral data (cm^{-1}) for the crude extracts of n-hexane, methanol, and chloroform from powdered plant.

n-HE	ChE	MeE	Assigned group	Possible class of compounds
3267	3389	3333	N-H/O-H stretch	Alcohol, phenols, amines
2916	2920	2980	C-H Asymmetric stretch	Aromatic ring
2848	2850	2855	C-H Symmetric stretch	Aromatic ring
1734, 1709	1730	-	C=O stretch	Flavonoids
1631	1642	1609	C=C stretch	Conjugated double bond in aromatic ring
1462	1453-1499	-	C-N stretching	Alkaloid ring
1376	1375	1346	CH2 bending	Terpene ring
1245-1110	1203-1161	1235	O-C stretch	Phenol, flavone, flavonoids
1030-978	1075-1031	1034	>C-OH stretch	Tertiary alcohol

nHE, Hot n-Hexane extract; ChE, hot Chloroform extract, MeE, hot methanol extract; FTIR data represents as cm^{-1}.

Table 3. The observed phytochemicals contents in different extractives.

Test Sample	TPC (mg GAE/ gm of extract)	TFC (mg CAE/ gm of extract)	TPAC (mg CAE/ gm of extract	TTC (mg of TA/gm of extract)
nHE	41.42±5.824	132.70±1.980	264.71±9.062*	
ChE	144.55±2.179	167.94±17.247	331.72±11.722*	
MeE	235.35±12.552	182.38±1.771	425.46±15.986*	342±16.57

Results taken as mean ± SD, (n= 3, *p < 0.05); nHE, n-hexane hot extract; ChE, chloroform hot extract; MeE, methanol hot extract.

Table 4. The *in-vitro* antioxidant activities of different extractives of ground plant.

Test Sample	TAC (mg AAE /gm extract	IC_{50} for DPPH scavenging	IC_{50} for hydroxyl radical scavenging	IC_{50} for lipid peroxidation inhibition	Ferric iron reduction (abs at 700 nm)
nHE	154.39±5.103	3548.13±81.56	757.88±11.28	1605.46±50.51	0.420±0.24
ChE	173.99±21.160	86.10±1.77	208.93±3.20	149.45±14.95	0.666±0.07
MeE	214.42±24.414	10.68±0.26	20.74±0.88	140.45±18.06	1.595±0.12
AA					1.983±0.06
CA		7.45±0.18	16.18±0.85	54.87±6.48	

Results taken as Mean±SD, (n=3, p<0.05); nHE, n-hexane hot extract; ChE, chloroform hot extract; MeE, methanol hot extract; CA, standard catechin; AA, ascorbic acid.

Table 5: Peripheral analgesic activity of different dose of ChE and MeE from ground plant and standard drug ibuprofen.

Group	Test sample	Dose (mg/kg bw)	No. of writhing	% of Inhibition
A	**Control**	0	13.25±1.48	
B	**Ibuprofen**	10	3.75±0.83	71.70
C	MeE	100	5.75±0.83	56.60
D		200	3.50±0.50	73.58
E		400	1.75±0.43	86.79
F	**ChE**	100	7.75±0.83	41.51
G		200	4.50±1.12	66.04
H		400	3.00±0.71	77.36

The values are mean ± SD (where, n=4, p<0.05); A, Control group (1%v/v tween in saline); B, standard (1buprofen 10 mg/kg); C, methanol extract 100 mg/kg; D, methanol extract 200 mg/kg; E, methanol extract 400 mg/kg; F, chloroform extract 100 mg/kg; G, chloroform extract 200 mg/kg; H, chloroform extract 400 mg/kg.

Table 6. Central analgesic activity of ChE and MeE from ground plant and standard drug ibuprofen.

Group	Test Sample	Dose (mg/kg, bw)	Duration for response time in seconds			% Inhibition after 90 mins
			After 30 mins	After 60 mins	After 90 mins	
A	Control	Saline	3.75±0.43	4.00±0.71	4.50±0.50	
B	Ibuprofen	10	5.50±1.12	7.50±0.50	7.50±0.50	66.67
C	MeE	100	5.25±0.43	6.25±0.43	6.25±0.43	38.89
D		200	5.50±1.12	6.50±1.12	7.00±0.71	55.56
E	ChE	100	5.00±0.71	5.75±0.83	5.75±0.43	27.78
F		200	5.50±1.12	6.25±0.8/3	6.75±0.83	50.00

The values are mean ± SD (where, n=4, $p<0.05$); A, Control group (1%v/v tween in saline); B, standard (1buprofen 10 mg/kg); C, methanol extract 100 mg/kg; D, methanol extract 200 mg/kg; E, chloroform extract 100 mg/kg; F, chloroform extract 200 mg/kg;

Table 7. Blood glucose level of mice after treatment with ChE, MeE and standard drug.

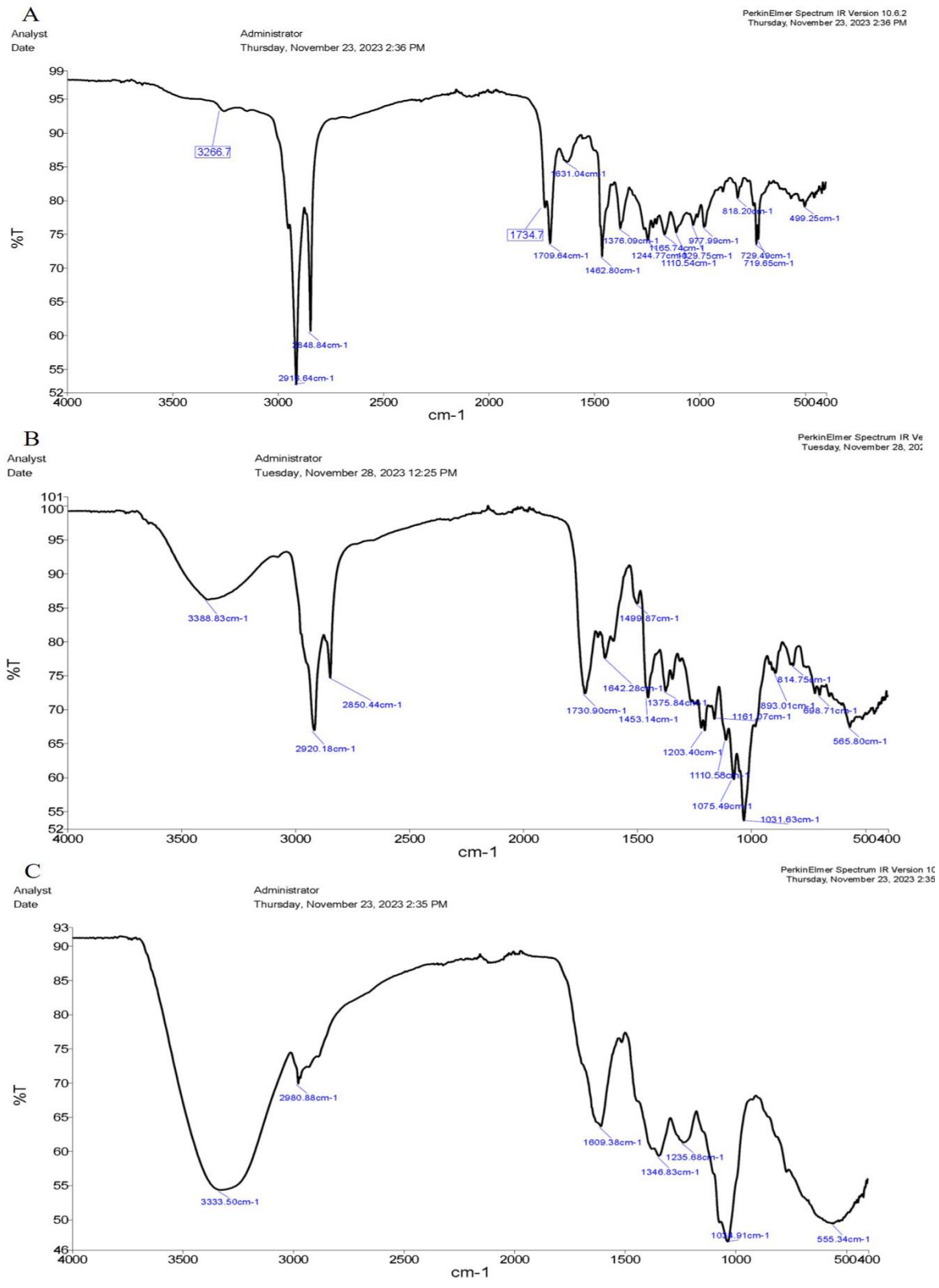
Group	Test sample	Dose (mg/kg, bw)	Blood glucose level (Bt mmol/L)					% of Inhibition after 10th day
			At 0 day	At 3rd day	At 5th day	At 7th day	At 10th day	
I	Control (-)	Saline	6.97±0.17	7.17±0.12	7.00±0.22	7.23±0.48	7.10±0.22	
II	Control (+)		6.27±0.26	7.93±0.12	8.23±0.21	8.30±0.08	8.37±0.12	
III	MetF	100	6.57±0.34	8.03±0.26	6.67±0.69	6.53±0.53	6.23±0.26	25.50
IV	MeE	100	6.47±0.12	7.83±0.12	7.07±0.12	6.70±0.16	6.33±0.54	24.30
V		200	6.67±0.33	8.03±0.58	7.07±0.05	6.53±0.12	5.43±0.41	35.06
VI	ChE	100	6.27±0.21	8.27±0.12	7.27±0.29	7.20±0.40	7.30±0.21	12.75
VII		200	6.73±0.21	8.03±0.12	6.90±0.29	6.97±0.40	7.17±0.21	14.34

The values are mean ± SD (where, n=3, $p<0.05$); I, Non diabetic control (1.0 mL 1%v/v tween-80 in saline); II, diabetic control; (1.0 mL 1%v/v Tween-80 in saline); III, diabetic treated (metformin 100 mg/kg); IV, diabetic treated (methanol extract 100 mg/kg); V, diabetic treated (methanol extract 200 mg/kg; VI, diabetic treated (chloroform extract 100 mg/kg;); VII, diabetic treated (chloroform extract 200 mg/kg).

Table 8. Biochemical profile of diabetic mice and treated mice with various extracts and compared with standard.

Parameter	Group	Test sample	Blood lipid profile (Lt mg/dL)		% of Inhibition after 10th day
			At 0 day	At 10th day	
TC	I	Control (-)	105.33±1.70	106.67±1.25	
	II	Control (+)	105.00±1.63	210.67±3.30	
	III	MetF-100	106.33±2.05	107.00±0.82	49.21
	IV	MeE-100	106.67±2.05	135.00±4.55	35.92
	V	MeE-200	106.00±2.16	115.33±2.87	45.25
	VI	ChE-100	107.33±2.05	151.33±5.56	28.16
	VII	ChE-200	105.00±1.63	142.33±4.99	32.44
TG	I	Control (-)	116.00±2.94	116.33±2.05	
	II	Control (+)	115.00±3.27	260.00±4.08	
	III	MetF-100	118.33±2.05	120.33±3.40	53.72
	IV	MeE-100	119.33±1.70	147.00±5.89	43.46
	V	MeE-200	116.00±2.16	125.67±2.36	51.67
	VI	ChE-100	116.67±5.56	160.33±2.87	38.33
	VII	ChE-200	117.00±1.63	142.33±1.99	45.26
HDL	I	Control (-)	35.00±1.63	36.33±1.25	
	II	Control (+)	37.33±4.08	21.33±1.25	
	III	MetF-100	38.33±1.70	32.00±1.63	
	IV	MeE-100	35.33±1.25	28.33±1.25	
	V	MeE-200	35.00±1.63	33.33±1.25	
	VI	ChE-100	35.67±1.25	23.67±0.47	
	VII	ChE-200	36.00±1.63	22.67±1.25	
LDL	I	Control (-)	47.13	47.07	
	II	Control (+)	44.67	137.33	
	III	MetF-100	44.33	50.93	62.91
	IV	MeE-100	47.47	77.27	43.74
	V	MeE-200	47.80	56.87	58.59
	VI	ChE-100	48.33	95.60	30.39
	VII	ChE-200	45.60	91.20	33.59

The values are taken as mean ± SD (where, n=3, $p<0.05$); Control (-), (1.0 mL 1%v/v tween-80 in saline); Control (+), (1.0 mL 1%v/v tween-80 in saline); MetF-100, diabetic treated (metformin 100mg/kg); MeE-100, diabetic treated (methanol extract 100 mg/kg); MeE-200, diabetic treated (methanol extract 200 mg/kg; VI, ChE-100, diabetic treated (chloroform extract 100 mg/kg;); ChE-200, diabetic treated (chloroform extract 200 mg/kg).



F**igure 1: FTIR analysis of different extractives.** A. FTIR analysis spectrum of nHE; B. FTIR analysis spectrum of ChE and C. FTIR analysis spectrum of MeE. Analysis was performed spectrum instrument from Perkin-Elmer 1650, USA.

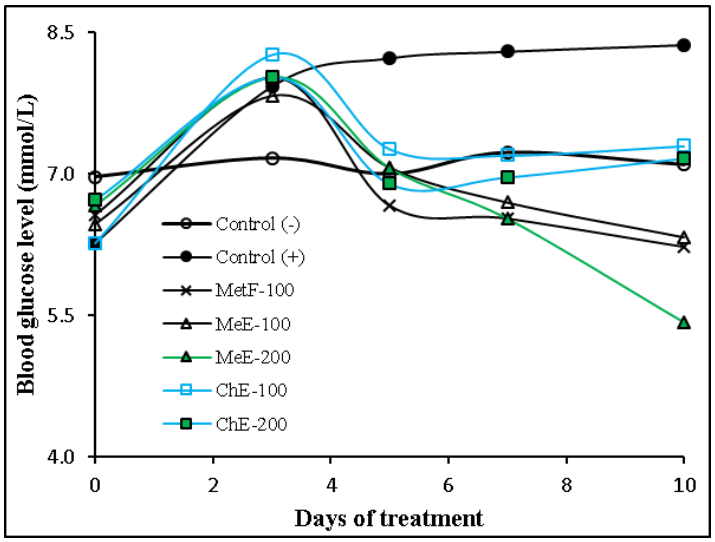


Figure 2. Effect on blood glucose level of diabetic mice for different extractives. The results are taken as mean±SD values (where, n=3, $p<0.05$); Control (-), (1.0 mL 1%v/v tween-80 in saline); Control (+), (1.0 mL 1%v/v tween-80 in saline); MetF-100, diabetic treated (metformin 100 mg/kg); MeE-100, diabetic treated (methanol extract 100 mg/kg); MeE-200, diabetic treated (methanol extract 200 mg/kg; VI, ChE-100, diabetic treated (chloroform extract 100 mg/kg;); ChE-200, diabetic treated (chloroform extract 200 mg/kg).