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Evaluation of anti-diabetic and antihyperlipidemic activity of hydro-alcoholic extract of *Alternanthera sessilis* root

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Abstract
Diabetes mellitus is a dangerous, chronic metabolic illness defined by high blood sugar levels caused by either insufficient insulin production by the pancreas or ineffective insulin utilization by the body. Type 2 Diabetes Mellitus (T2DM) accounts for about 90% of all diabetes diagnoses in adults. As of 2025, the global epidemiology of diabetes mellitus reflects a growing and urgent public health crisis. The number of people living with diabetes worldwide has surged to approximately 830 million, a dramatic increase from 1500 million in 2030*Alternanthera sessilis* dried root was ground into a fine, coarse powder using an electric laboratory blender. *Alternanthera sessilis* powder was macerated in ethanol and water (hot maceration in a 70:30 v/v ratio) to complete the extraction. The hydroalcoholic extract of *Alternanthera sessilis* root (HEAS) was cooled and stored in a well-closed container in a dry state. The "Fixed Dosage Method" of the OECD 423 guideline was utilised in the current investigation to determine the acute toxicity of the substance In this study, 16-week-old normal (fasting blood glucose level of 90–110 mg/dl) rats were used. A single dose of intraperitoneal injection of STZ (55 mg/kg/i. p) dissolved in 0.1M citrate buffer (pH 4.5) was used to induce diabetes in overnight fasted male wistar rats weighing 170–200 gm. Biochemical analysis and Estimation of serum lipid profile was done after 28th days**.** The blood sugar levels in these rats stayed high and did not decrease much during the same period. The larger drop in blood sugar levels in the Group IV rats shows that HEAS 200 was effective in lowering blood sugar. The results point to the potential benefits of using HEAS 200 as a natural way to manage blood sugar. This suggests that *Alternanthera sessilis* extracts could be an exciting option for new herbal medicines aimed at treating diabetes and related conditions like abnormal lipid levels which is called dyslipidaemia.

Keywords: *Alternanthera sessilis* root, hydroalcoholic extract, high blood glucose, dyslipidemia

Introduction
As of 2025, the global epidemiology of diabetes mellitus reflects a growing and urgent public health crisis. The number of people living with diabetes worldwide has surged to approximately 830 million, a dramatic increase from 529 million in 2021. This rise is largely attributed to the increasing prevalence of type 2 diabetes, which accounts for more than 90% of all diabetes cases globally. Key drivers of this trend include rapid urbanization, sedentary lifestyles, unhealthy diets, population aging, and rising rates of obesity—particularly in low- and middle-income countries (LMICs), where healthcare systems often struggle to cope with chronic diseases. Regions such as North Africa, the Middle East, and South Asia are experiencing the highest prevalence rates, with projections indicating that some of these areas could reach age-standardized diabetes prevalence rates of up to 16.8% by 2050(Huang *et al*., 2025) [3].

Diabetes mellitus is a dangerous, chronic metabolic illness defined by high blood sugar levels caused by either insufficient insulin production by the pancreas or ineffective insulin utilization by the body. Type 2 Diabetes Mellitus (T2DM) accounts for about 90% of all diabetes diagnoses in adults. The most prevalent kind of diabetes is type 2 diabetes mellitus (T2DM), often known as age-onset or adult-onset diabetes. It is a milder form of diabetes since it develops gradually (sometimes over time) and is typically manageable with diet and oral medicines. Untamed and untreated T2DM, on the other hand, has as serious outcomes as Type I diabetes. The genesis of Type 2 diabetes is unknown. However, it appears that both inherited (genetic) and environmental variables are involved. Type 2 diabetes accounts for 85-95% of all diabetes in Which-income nations, with a greater percentage in low- and middle-income countries as a result of fast sociocultural changes, aging populations, increased urbanization, decreased physical activity, and poor lifestyle and behavioural habits. Untamed and untreated T2DM, on the other hand, has as serious outcomes as Type I diabetes. The genesis of Type 2 diabetes is unknown. However, it appears that both inherited (genetic) and environmental variables are involved. Type 2 diabetes accounts for 85-95% of all diabetes in high-income nations, with a greater percentage in low- and middle-income countries as a result of fast sociocultural changes, aging populations, increased urbanization, decreased physical activity, and poor lifestyle and behavioural habits (Nyenwe *et al*., 2033) [6]. Several plant-derived secondary metabolites have been shown to have anti-diabetic action, and clinical data supports their potential for diabetes management. These metabolites, which include alkaloids, flavonoids, phenols, saponins, tannins, terpenes, and coumarins, have been proven to help regulate blood glucose and improve insulin sensitivity. According to research, these chemicals can alter a variety of cellular and molecular pathways involved in carbohydrate metabolism, such as blocking glucose absorption, increasing insulin secretion, and decreasing oxidative stress (Chauhan *et al*., 2020) [2]. Alternanthera sessilis, also known as sessile joyweed or dwarf copperleaf, is a plant with a long history of ethnomedicinal use in many cultures and there so many ethno-medicinal and traditional uses of *Alternanthera sessil*-like It has traditionally been used to cure a variety of conditions, including diarrhea, dysentery, fever, and skin disorders. Furthermore, it is known for its diuretic, cooling, tonic, and laxative qualities.

Materials Methods

Materials

Analytical-grade chemicals were used throughout. Enzo Life Sciences Pvt provided Streptozotocin and Merck provided the ethanol (Germany). All research were conducted using deionized and milli-Q water. Absolute methanol 99.9% (Nice Chemicals, India) was used.

Collection of the Plant

Alternanthera sessilis roots were harvested from a local garden in Indore, Madhya Pradesh. The plants were validated by Botanist at Holkar Science Government College Indore MP in the department of Botany. The plant's roots (*Alternanthera sessilis*) were collected in bulk, rinsed using tap water, and air-dried for two weeks at ordinary temperature. The roots were pounded into a coarse powder and kept in a plastic container until ready for extraction.

Extraction and phytochemical

Alternanthera sessilis dried root was ground into a fine, coarse powder using an electric laboratory blender. *Alternanthera sessilis* powder was macerated in ethanol and water (hot maceration in a 70:30 v/v ratio) to complete the extraction. After fifteen days of mixing the powdered material with the hydroalcoholic solvent, Whatman separated the combination using filter paper. The specimen was heated with a magnetic stirrer in an electric oven set to 50 degrees Celsius before being boiled for 45 minutes. (Laxmi *et al*., 2017) [6]. The hydroalcoholic extract of *Alternanthera sessilis* root (HEAS) was cooled and stored in a well-closed container in a dry state. We kept the extract in the shade to continue drying. After weighing the dried extract, we estimated the percentage yield of individual extracts using the following mathematical calculation [Yadav *et al*., 2012]. The % yield = (Weight of dried extract / Weight of starting material) × 100. This enabled us to quantify extraction efficiency and assess the concentration of bioactive components in the hydroalcoholic extract the phytochemical analysis of the extracts was performed under the protocols that are conventional [Trease and Evans., 1989, Kokate *et al*., 2006] [5]. A preliminary phytochemical screening was performed on both extracts to determine the different Phyto-constituents that were present in both of it. A big variety of natural resources compounds, including alkaloids and terpenoids as well as glycosides and steroids as well as flavonoids, saponin, and tannin, were examined.

Acute oral toxicity studies

All *in vivo* experiments creatures were given by the swami Vivekanand college of pharmacy Indore (1627/PO/Re/S/12/CPCSEA). The Institutional Animal Ethical Committee (IAEC no- IAEC/SVCP/2025/Feb/09) endorsed the system. All creature research observed CPCSEA guidelines. Rodents had promotion limit um food and water (standard pellet). The exploratory work with the rodents started following a seven-day acclimation period. Each enclosure obliged two rodents, who were dispensed into two gatherings utilizing a randomized conveyance system. The treatment bunch got treatment (HEAS and standard), while the benchmark group got no treatment. Utilizing a 12-hour light/dull cycle, the rodents' lodging was kept at 24°C & 2°C (OECD,2001). The "Fixed Dosage Method" of the OECD 423 guideline was utilised in the current investigation to determine the acute toxicity of the substance. The rats were given HEAS extract orally, and three albinos female Wistar rats were chosen for each phase of the study. The rats were given dosages of Five mg, Fifty mg, three hundred mg, and two thousand mg by oral administration. It may take anyway HEAS from two to four phases before a conclusion can be reached on the toxic effect of the test substance and/or the morbidity condition of the animals. This will depend on the death rate [Alfredo *et al*.,2004] [1].

In vivo antidiabetic activity

- **Induction of diabetes in wistar rats**

In this study, 16-week-old normal (fasting blood glucose level of 90–110 mg/dl) rats were used. A single dose of intraperitoneal injection of STZ (55 mg/kg/i. p) dissolved in 0.1M citrate buffer (pH 4.5) was used to induce diabetes in overnight fasted male wistar rats weighing 170–200 gm. Rats were allowed to free access to 10% glucose water to prevent hypoglycaemia associate death. After 72 h (3 days), the rats were checked for the blood glucose level from the tail vein using glucometer (Accu-check, Roche Diagnostic, Indianapolis, IND, United states). Only the rats with fasting blood glucose levels ≥ 250 mg/dl were considered as diabetic-induced rats and included in this study [Saravanan et a.,2021] [7].

- **Animal experimental design**

Five normal healthy rats were chosen randomly for the control group (study design show in table-01). Thirty diabetic-induced rats were selected, and six rats were randomly assigned for each group for the study. All the treatments were started on the fourth day after STZ injection and once a day continued for 28 days. Fasting blood glucose mg/dl was measure at 0 (fourth day after STZ injection),7,14,21,28 days (Satyanarayana *et al*., 2022) [8].

Table 1: Study Design

S. No	Group No	Group Name	Dose, drugs, and Schedule
1	Group --I	Control	Streptozotocin-induced diabetic rats administered orally with distilled water.
2	Group II	Negative control	Streptozotocin-induced diabetic rats administered orally with distilled water.
3	Group III	Diabetic control untreated	Streptozotocin-induced diabetic rats administered orally with *Glibenclamide* (05 mg/kg) dissolved in distilled water.
4	Group IV	HEAS Low dose	STZ induced diabetic rats administered orally with ethanolic extract of hydro-alcoholic extract of *Alternanthera sessilis* root (100 mg/kg) dissolved in distilled water.
5	Group V	HEAS High dose	STZ induced diabetic rats administered orally with ethanolic extract of hydro-alcoholic extract of *Alternanthera sessilis* root (200 mg/kg) dissolved in distilled water.

- **Biochemical analysis**

After 28 days of treatment, blood samples were collected from the retro-orbital plexus, and blood glucose levels were estimated using glucometer (Accu-check, Roche Diagnostic, Indianapolis, IND, United states) [Mandoria *et al*.,2021]. The remaining blood was centrifuged at 3000 rpm for 5 min. Serum was collected immediately and stored at −70°C until the analysis of biochemical parameters.

- **Estimation of serum lipid profile**

Blood lipid profile (LDL—direct cholesterol and triglycerides or TG) was analysed after 28 days. LDL cholesterol and TG were estimated using commercially available kits (Raj Biosis Pvt Ltd., India) and the results were recorded according to the manufacturer's instructions. The data obtained were then compared to baseline values to assess any significant changes in lipid levels over the study period. The findings indicated a notable variation in lipid levels, with a significant reduction in LDL cholesterol and triglycerides observed in the treatment group. Further statistical analysis will be conducted to determine the clinical implications of these changes on cardiovascular health. Estimation of serum lipid profile is essential for assessing cardiovascular risk and managing conditions such as hyperlipidaemia. Regular monitoring can help in making informed decisions regarding lifestyle changes and pharmacological interventions (Chauhan *et al*., 2020) [2].

The values are expressed in mean ± SEM. The results were analysed by using one way analysis of variance (ANOVA) followed by Dunnet's "t" test to determine the statistical significance. p< 0.05 was chosen as the level of significance. Statistical analysis was performed using Graph Pad Prism Software 5.0 version.

Results and Discussion

The present study was designed to investigate the antidiabetic and Antihyperlipidemic activity of hydro-alcoholic extract of *Alternanthera sessilis* root. Diabetes Type 1 symptoms appeared within 2-4 days of receiving a single intraperitoneal injection of STZ. STZ destroys insulin-secreting pancreatic β-cells, resulting in impaired glucose absorption by peripheral organs. The extract yield from the powdered root material was 14.07% w/w. The hydroalcoholic extract was screened for phytochemicals and found to include Carbohydrates, Terpenoids, flavonoid Tannins and phenolic compounds. proteins, alkaloids, saponin glycosides, amino acids, and flavonoids, as stated. Carbohydrates, glycosides, sterols, and tannins were missing.

Toxicity testing was carried out on HEAS extract under OECD 423 criteria. Toxicological tests HEAS were supplied orally to the rats at doses ranging from 5 mg/kg to ranging from 300-2000 mg/kg. The rats showed no preclinical symptoms of toxicity or mortality after being given the tests HEAS. All the animals gained weight and showed no signs of behavioural alteration, indicating that the administration on HEAS extracts had a minor effect on the animals' growth. LD50 values were shown to have concentrations of more than 2,000 mg/kg across all of the dosages tested and whole toxicity studies found that HEAS is no deaths or clinical symptoms of toxicity at any of the doses examined (Table-2). When given to rats at a dosage of 2000 mg/kg, it has been shown that the extract HEAS are not deadly. As per guideline of OECD, a 1/10th dose of 100 mg/kg was chosen as the lower dose and 200 mg/kg as higher dose. The results of the observations are listed in the following table:

Table 2: Mortality at various doses in Acute oral toxicity studies

S.no	Test Sample (mg/kg)	05	50	300	2000
1	HEAS	None	None	None	None

Streptozotocin induced antidiabetic activity

The hypoglycaemic effects of HEAS (at doses of 100 and 200 mg/kg body weight) were examined in Wistar rats with STZ-induced hyperglycaemia (Table -03). The results showed a considerable drop in blood glucose levels (Fig. 1) compared to the negative control group (STZ induced) on the 14th, 21st, and 28th days. The statistical tests were not passed before 14 days. HEAS 100 mg/kg dose, not significant in whole studies. Glibenclamide (Group III) was highly significant and markedly decreased glucose levels all days. The findings suggest that while HEAS at a 100 mg/kg dose did not show significant effects throughout the study, the 200 mg/kg dosage may warrant further investigation due to its potential benefits. Additionally, the consistent efficacy of Glibenclamide reinforces its role as a standard treatment in managing hyperglycaemia in this model.

Table 3: Streptozotocin induced antidiabetic activity

Groups	-3th days Mean±SD	0th day Mean±SD	7th day Mean±SD	14th day Mean±SD	21st day Mean±SD	28th days Mean±SD
Group I (Control)	98.87±2.61	99.15± 2.98	98.11±3.21	97.47±3.36	99.04±3.09	98.24±3.32
Group II (Negative Control)	96.31±1.95^{b**}	210.42±2.45 ^{b**}	215.12±2.97 ^{b**}	218.94±3.24 ^{b**}	219.85±2.85 ^{b**}	217.65±2.99 ^{b**}
Group III (Standard)	97.73±2.01	176.52±2.77	155.00±2.39	162.10±2.90	116.70±2.58	101.47±2.75
Group IV (HEAS 100)	97.55±2.57	215.67±2.14	215.51±2.88	218.17±2.68	219.47±2.45	220.27±2.58 ^{a*}
Group V (HEAS 200)	95.08±2.23	213.42±1.03	209.22±2.71 ^{a*}	185.55±2.11 ^{a*}	192.44±2.21^{a*}	191.04±3.24 $^{c\& a**}$

Statistical significance was evaluated by one-way analysis of variance (ANOVA) and Bonferroni multiple pairwise comparisons between group means by Bio-stat 4.0 version Each Value represent in Mean±SD and n=5. 'a' indicates that the value is compare with negative control groups. 'b' indicate the value is compare with control group and 'c' is indicate the value is compare with standard group. asterisk (*) is represent significant (P<0.05) and double asterisk, (**) High Significance (p < 0.001).

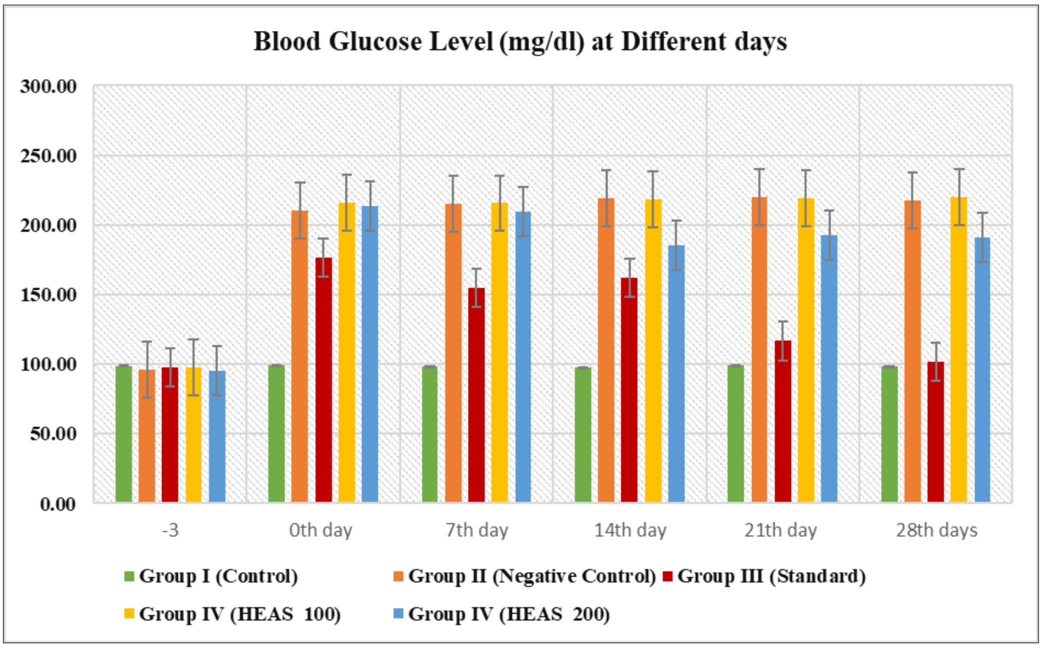

Fig 1: blood glucose level

Estimation of serum lipid profile by LDL—Direct cholesterol and Triglycerides (TG)

As the results of the study showed that the LDL-C at the 28th day increases significantly as compared to the normal control group. Similarly, group V HEAS 200 mg/kg has shown (Table.02) a highly significant decrease in the LDL level compared to the negative control group, whereas group IV HEAS 200 mg/kg has not shown a significant difference compared to the negative control group (Fig 02). These findings suggest that the administration of HEAS may have a beneficial effect on lipid profiles, particularly at the higher dosage. Further research is necessary to understand the underlying mechanisms and to explore the potential clinical implications of these results. In the same way, the study showed (Fig 03.) that the triglyceride level increased in all induction groups after treatment; both Group IV and Group V have found a not significant decrease any triglyceride level compared to the negative control group. This suggests that the treatments applied in these groups may be effective in managing triglyceride levels, potentially offering a therapeutic benefit for individuals with elevated levels.

Table 4: Lipid Profile Level

	28^{th} days	
Groups	**(LDL—direct)** Mean ± SD	**Triglycerides** Mean ± SD
Group I (Control)	49.22±3.25	104.08±3.33
Group II (Negative Control)	181.65±3.33	206.218±3.24
Group III (Standard)	56.79±3.01[b]	110.738±2.01[b]
Group IV (HEAS 100)	177.24±3.87	194.754±2.99
Group IV (HEAS 200)	130.25±3.09**[a]	187.19±2.37[a]

Statistical significance was evaluated by one-way analysis of variance (ANOVA) and Bonferroni multiple pairwise comparisons between group means by Bio-stat 4.0 version Each Value represent in Mean±SD and n=5. 'a' indicates that the value is compare with negative control groups. asterisk (*) is represent significant (P<0.05) and double asterisk, (**) High Significance (p < 0.001).

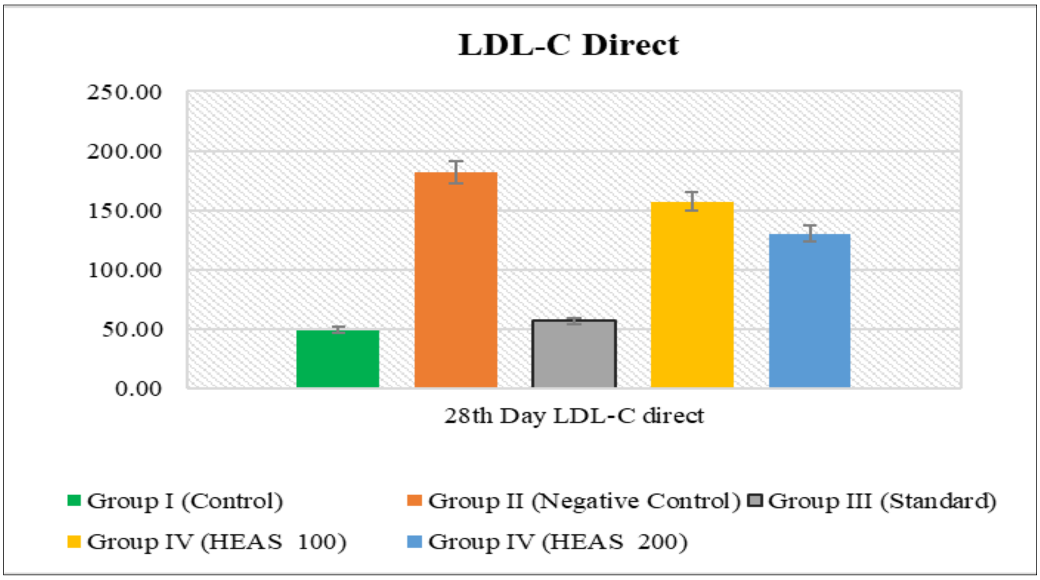

Fig 2: serum LDL level

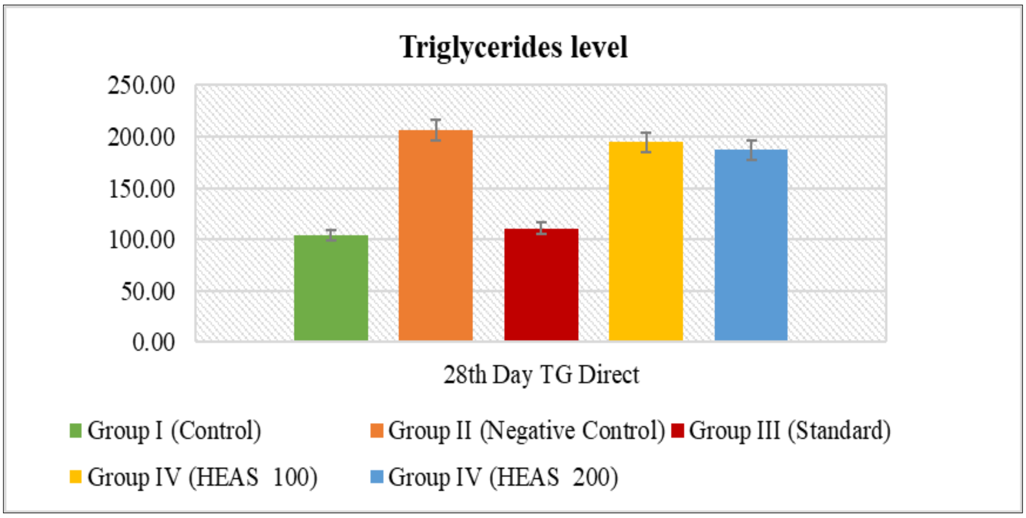

Fig 3: Triglycerides level

Discussion

There are different types of diabetes. Type 1 is an autoimmune disease where the immune system mistakenly attacks the cells that produce insulin in the pancreas. People with type 1 often need insulin injections to control their blood sugar. Type 2 is more common and is linked to genetics, poor lifestyle choices, and insulin resistance. In this form, the body's cells stop responding well to insulin, leading to higher blood sugar levels. Factors like unhealthy eating habits, lack of exercise, obesity, and age increase the risk of developing type 2 diabetes.

Scientists are exploring natural ways to help manage diabetes. One promising area is the use of phytochemicals—special molecules found naturally in plants. These compounds may help improve how the body uses insulin, reduce damage caused by oxidative stress, and help keep blood sugar levels in check. Because they come from natural sources, phytochemicals could offer a safer, gentler alternative or complement to standard medicines.

When blood sugar stays high, a condition known as hyperglycaemia, it triggers the production of free radicals. These unstable molecules cause oxidative stress, which damages cells and tissues. Over time, this damage leads to serious diabetic complications like nerve problems, kidney disease, and eye issues. The damage caused by free radicals is a key reason why managing blood sugar and reducing oxidative stress is so important in diabetes care.

In recent years, researchers have studied various types of plant-based compounds for their potential to fight diabetes. They focus on groups like flavonoids, phenolic acids, and terpenoids. Flavonoids are found in fruits, vegetables, and green tea. Phenolic acids are present in foods like berries, apples, and coffee. Terpenoids are abundant in herbs like thyme and peppermint. These compounds have shown in studies to help regulate blood sugar levels and make the body more sensitive to insulin. They also tend to have extra health benefits, such as acting as antioxidants to fight free radicals and reducing inflammation in the body.

Many experiments have demonstrated that these plant chemicals can lower blood sugar and improve how insulin works. For example, some studies show that flavonoids can boost the production of insulin, while others suggest they can slow the absorption of sugar in the gut. Phenolic acids may help protect cells from damage caused by oxidative stress. Terpenoids can also reduce inflammation, which is often high in people with diabetes.

Because of these positive effects, phytochemicals are gaining attention as part of the effort to prevent and manage diabetes. They offer a natural way to support the body's own defences against the illness. Some experts believe that including a variety of plant-based foods and supplements rich in these compounds could help control blood sugar levels. Their antioxidant and anti-inflammatory properties add even more health benefits, making them a valuable addition to traditional treatments.

Overall, plant-derived compounds hold promise as tools in the fight against diabetes. They may not replace insulin or medication entirely, but they can support better blood sugar control and overall health. Continued research aims to better understand how these natural molecules work and how they can be most effectively used. As we learn more, new options may emerge to help millions living with this chronic disease. After treating the root powder of *Alternanthera sessile with* hydroalcoholic solution, some phytochemicals were found to be positive like, Terpenoids, Flavonoids, Tannins and phenolic compounds etc. The LD50 value of the hydroalcoholic extract of *Alternanthera sessilis* (HEAS) is 2000 mg/kg. This indicates that the extract can be administered at relatively high doses before reaching a lethal threshold in experimental subjects. In this experiment, rats were given STZ, which caused hyperglycaemia. Injecting STZ intraperitoneally disrupts the DNA strands of pancreatic cells responsible for insulin synthesis. This action reduces insulin production and secretion. STZ is hypothesized to cause hyperglycaemia due to its toxic effects on pancreatic β-cells. This impairs blood glucose regulation and leads to problems in multiple organs. These complications can result in symptoms such as increased thirst, frequent urination, and fatigue. Over time, chronic hyperglycaemia may contribute to the development of diabetes-related complications, including neuropathy, nephropathy, and cardiovascular disease. Streptozotocin (55 mg/kg/i.p.) successfully produced hyperglycaemia in all groups except group in the vehicle-treated control group. Group IV, which received HEAS 100, showed a significant decrease in glucose levels only on the 28th day of the study. This change was notable because the reduction in blood sugar was not seen at earlier checkpoints such as day 7 or day 21. From day 7 to day 21, the glucose levels remained relatively unchanged, indicating that the effect of HEAS 100 on lowering glucose was delayed rather than immediate. This suggests that the compound may require a longer period to exert its full influence on blood sugar regulation. Group IV, which was given a dose of HEAS 200, showed a clear and strong reduction in blood sugar levels. The data shows that this reduction started from the seventh day of treatment and continued up to the twenty-first day. This means the rats in this group experienced a steady and noticeable drop in their blood sugar over those three weeks. The results are quite impressive because the decrease was significant, indicating the treatment had a real effect.

In comparison, rats in the negative control group, which did not receive any treatment with HEAS 200, did not show such reductions. The blood sugar levels in these rats stayed high and did not decrease much during the same period. The larger drop in blood sugar levels in the Group IV rats shows that HEAS 200 was effective in lowering blood sugar. The results point to the potential benefits of using HEAS 200 as a natural way to manage blood sugar. The fact that the reduction was highly significant means that it was unlikely to happen by chance. The data suggests that the treatment could be useful in controlling high blood sugar, which is a common problem in diseases like diabetes. Overall, these findings give hope that HEAS 200 could become an important option for managing blood sugar. The consistent decrease seen in the study supports the idea that this substance has strong blood sugar-lowering properties. Generally, diabetes is accompanied by hyperglycaemia and hyperlipidaemia. Hypercholesterolemia and hypertriglyceridemia are major risk factors for atherosclerosis, which could be prevented by hypocholesterolaemia drugs. During diabetic conditions, serum fatty acids are produced in excess and converted into phospholipids and cholesterol in the liver. These two substances, along with excess triglycerides formed at the same time in the liver, may be discharged into the blood in the form of lipoproteins. The abnormally high concentration of serum lipids in the diabetic condition is mainly due to an increase in the mobilization of free fatty acids from the peripheral fat depots, since insulin inhibits the hormone-sensitive lipase.

In this study, blood samples were collected from the rats on the 28th day of the experiment. The results showed that a dose of 100 mg per kilogram (HEAS 100) of the extract did not produce a noticeable effect in lowering low-density lipoprotein (LDL) cholesterol levels in rats that had diabetes. This suggests that this smaller dose may not be strong enough to make a significant change in LDL levels in these animals. However, when the dose was increased to 200 mg per kilogram, there was a clear and statistically significant reduction in LDL levels. This indicates that the higher dose is more effective at managing LDL cholesterol in diabetic rats. The study also looked at the impact of two different extracts, referred to as HEAS 200 and HEAS 400 mg/kg doses, on triglyceride levels. These groups are called groups III to V. The findings showed that neither of these extracts produced a significant change in triglyceride levels. The levels remained relatively unaffected by the treatments, meaning the extracts did not have a strong influence on this type of fat in the blood at these doses. Although the extracts did not significantly alter triglyceride levels, their potential role in how the body processes fats and lipids is still worth exploring. Abnormal levels of triglycerides can increase the risk of heart disease and other health problems, especially in diabetic individuals. The fact that these extracts showed some effect on LDL cholesterol but not on triglycerides suggests they might act differently on various parts of lipid metabolism. This makes them interesting candidates for further research, as they could someday help treat or prevent health issues related to abnormal cholesterol and triglyceride levels.

Conclusion

In summary the study emphasizes the potential benefits of using extracts from the root of *Alternanthera sessilis* especially at higher doses of 200 mg/kg for managing high blood sugar levels known as hyperglycaemia and improving lipid profiles in people with diabetes. This means that these extracts might serve as a promising natural option for treating diabetes although they do not seem to affect triglyceride levels. However more research is needed to fully understand how these extracts work in the body. We need to find out the best dosages that are both effective and safe for people. Understanding how *Alternanthera sessilis* interacts with the body's systems is crucial for ensuring that it can be used safely over a long period. If future studies particularly clinical trials confirm its benefits *Alternanthera sessilis* could be a valuable addition to the treatments available for diabetes. Including *Alternanthera sessilis* in standard diabetes treatment plans might not only help in controlling blood sugar levels but could also provide other health advantages such as better heart health. This suggests that *Alternanthera sessilis* extracts could be an exciting option for new herbal medicines aimed at treating diabetes and related conditions like abnormal lipid levels which is called dyslipidaemia. To fully realize the potential of these extracts we need to conduct more studies to understand exactly how they work and how to make them most effective. Additionally clinical trials will be necessary to assess their safety and effectiveness in humans. This research will help determine if *Alternanthera sessilis* can truly be beneficial for those suffering from diabetes and how it can be best used in treatment plans. In conclusion the exploration of *Alternanthera sessilis* offers hope for new natural ways to manage diabetes and improve overall health.

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