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Cardio-protective effects of n-hexane stem extract of Desmodium Velutinum in Albino Wistar Rats

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Abstract
This study investigates the cardioprotective effects of the N-hexane extract of Desmodium velutinum stem on albino Wistar rats. The experimental animals were divided into four groups, each receiving different dietary and treatment regimens. Rats in groups one, three, and four were orally fed, using a syringe without a needle, with 6 ml of a lipoprotein-rich food mixture containing 3.6 g of cow's brain twice daily for seven consecutive days. Group two rats served as a control and were provided only with grower's mash and water during the same period. Following the initial feeding, rats in group three were administered 2 ml of Vasoprin orally once daily for three days, while rats in group four received 0.5 ml of the N-hexane extract of Desmodium velutinum stem orally once daily for the same duration. During the treatment phase, all rats continued to have access to grower's mash and water. Biochemical analysis revealed that rats fed with cow's brain exhibited significant elevations in cardiac marker enzymes, including creatine kinase (CK), creatine kinase-MB (CK-MB), aspartate transaminase (AST), alanine transaminase (ALT), and lactate dehydrogenase (LDH), indicating induced cardiac stress. Notably, administration of the N-hexane extract resulted in a pronounced reduction in these enzyme activities, suggesting a protective effect on cardiac tissue. Comparatively, the extract demonstrated a cardioprotective potential greater than that of Vasoprin. These findings indicate that the N-hexane extract of Desmodium velutinum stem may serve as an effective cardioprotective agent, with potential for enhanced efficacy if administered at optimized dosages over extended periods. Further studies are warranted to establish its therapeutic dosage and underlying mechanisms.

Keywords: Cardio-Protective, N-Hexane, stem, desmodium velutinum, albino wistar rats

Introduction

Cardiovascular diseases (CVDs) represent a major global health challenge, contributing significantly to morbidity and mortality rates worldwide (Obruche *et al*., 2025) [10]. According to the World Health Organization, CVDs account for nearly 17.9 million deaths annually, representing 32% of all global deaths. Among these, coronary artery disease, hypertension, and heart failure are the most prevalent conditions, often resulting from a combination of genetic, environmental, and lifestyle factors (Armstrong, 2004) [2]. The growing burden of CVDs has necessitated extensive research into preventive and therapeutic strategies to reduce the incidence and impact of these diseases (Umudi *et al*., 2025) [22]. While conventional pharmacological therapies, such as beta-blockers, angiotensin-converting enzyme inhibitors, and statins, have demonstrated efficacy, long-term use is frequently associated with adverse effects, including hepatic and renal dysfunction, electrolyte imbalances, and increased susceptibility to infections. Consequently, there is a growing interest in alternative and complementary approaches, particularly those derived from natural products, which offer the potential for cardiovascular protection with reduced side effects (Ekpo *et al*., 2023) [15]. Medicinal plants have been an integral part of traditional healthcare systems for centuries and are recognized as a rich source of bioactive compounds with therapeutic potential. Phytochemicals, such as flavonoids, alkaloids, saponins, and terpenoids, have been extensively investigated for their antioxidant, anti-inflammatory, antihypertensive, and lipid-lowering properties, all of which are relevant to cardiovascular health (Erienu *et al*., 2022) [5]. The cardioprotective potential of plant extracts is often attributed to their ability to modulate oxidative stress, inhibit lipid peroxidation, enhance endothelial function, and improve myocardial contractility (Obruche *et al*., 2019) [12]. Oxidative stress, characterized by an imbalance between the production of reactive oxygen species (ROS) and the body's antioxidant defenses, is a critical factor in the pathogenesis of various cardiovascular conditions, including atherosclerosis, myocardial infarction, and hypertensive heart disease. Natural antioxidants present in medicinal plants can scavenge free radicals, reduce lipid peroxidation, and restore cellular homeostasis, thereby mitigating cardiovascular damage (Abeokuta *et al*., 2025) [1]. Among the myriad of plants explored for cardioprotective activity, Desmodium velutinum, a member of the Fabaceae family, has garnered attention due to its wide-ranging pharmacological properties. Traditionally, Desmodium species have been employed in folk medicine for the treatment of inflammation, fever, hypertension, and hepatic disorders (Athyros *et al*., 2009) [3]. Preliminary phytochemical investigations indicate that the stems, leaves, and roots of Desmodium velutinum are rich in flavonoids, phenolic compounds, tannins, and glycosides, which are known to exhibit antioxidant and cardio protective effects. These bioactive constituents are hypothesized to contribute to the plant's ability to modulate oxidative stress, improve vascular function, and protect myocardial tissues from

injury (Obruche *et al*., 2018) [13]. Despite its traditional usage and reported pharmacological potential, comprehensive studies examining the cardioprotective effects of Desmodium velutinum specifically in experimental models remain limited. Experimental animal models, particularly rodents, have long been employed to investigate cardiovascular physiology and pathology due to their genetic, anatomical, and physiological similarities to humans. The Wistar albino rat (Rattus norvegicus), in particular, is widely used in cardiovascular research because of its well-characterized cardiovascular system, ease of handling, and reproducibility of experimental results. These animals provide a reliable platform for evaluating the protective effects of pharmacological agents against chemically or surgically induced cardiac injury, allowing for precise measurement of biochemical, histological, and functional parameters (Khader *et al*., 2004) [8]. By using such models, researchers can assess the efficacy of novel therapeutic interventions, elucidate underlying mechanisms of action, and establish dose-response relationships before progressing to clinical trials. Among the various extraction methods employed to isolate bioactive compounds from medicinal plants, solvent extraction using n-hexane has proven effective in obtaining non-polar phytochemicals, including terpenoids, steroids, and certain flavonoid aglycones (Ekpo *et al*., 2025) [4]. These compounds are often implicated in cardioprotective activity due to their ability to modulate lipid metabolism, inhibit oxidative stress, and stabilize cardiac cell membranes. The n-hexane extract of Desmodium velutinum stem, therefore, represents a promising candidate for further exploration, as it may contain lipophilic compounds capable of exerting protective effects on myocardial tissues and vascular endothelium (Umudi *et al*., 2025) [21]. Recent studies have highlighted the importance of evaluating plant extracts for cardioprotective effects using a combination of biochemical, histopathological, and physiological assessments. Key biomarkers, such as serum levels of cardiac enzymes (creatine kinase-MB, lactate dehydrogenase, troponins), lipid profile parameters (total cholesterol, triglycerides, low-density lipoprotein, high-density lipoprotein), and oxidative stress indicators (malondialdehyde, superoxide dismutase, catalase), provide valuable insights into the extent of myocardial injury and the efficacy of protective interventions. Histological examination of cardiac tissues further enables the visualization of structural alterations, such as myocardial necrosis, inflammatory infiltration, and fibrosis, offering direct evidence of cardioprotection (Matyal, 2008) [9]. Together, these approaches allow for a comprehensive evaluation of the therapeutic potential of plant extracts in experimental models. In light of the growing prevalence of cardiovascular diseases and the limitations associated with conventional therapies, the search for natural cardioprotective agents has become increasingly relevant. Desmodium velutinum, with its rich phytochemical profile and traditional medicinal uses, offers a promising avenue for research into novel cardioprotective strategies. By investigating the n-hexane extract of Desmodium velutinum stem in Wistar albino rats, this study aims to elucidate its potential to prevent or mitigate myocardial injury, reduce oxidative stress, and improve overall cardiac function. Such findings may not only validate traditional uses of the plant but also contribute to the development of safer, plant-based therapeutic options for cardiovascular health. In conclusion, cardiovascular diseases remain a significant health burden globally, prompting the exploration of alternative therapies with fewer side effects. Medicinal plants, including Desmodium velutinum, offer promising cardioprotective properties, potentially mediated by antioxidant, anti-inflammatory, and lipid-modulating mechanisms. The use of n-hexane extraction to isolate non-polar bioactive compounds, combined with the Wistar albino rat model, provides a robust framework for investigating the efficacy of plant-derived interventions in cardiovascular protection (Obruche *et al*., 2019) [14]. This study, therefore, seeks to bridge the gap between traditional knowledge and scientific validation, offering insights into the potential cardioprotective activities of Desmodium velutinum stem extract and paving the way for future research into natural therapeutic agents for cardiovascular diseases.

Materials and Method

Identification and Extraction of Plant Material

The sample extraction was based on Umanah *et al*. (2025) [20] with some minor changes. Healthy fresh stems of Desmodium velutinum (refer to figure 1) were collected from Prof. J.C. Okafor's garden located in Independence Layout, Enugu State during February 2025. He also verified the plants. The stems were dried at room temperature for twenty-one days. After drying, the stems were ground into a fine powder using a clean, dry electric grinder (Moulinex, Optilend 2000, made in France). A 150 g sample of the ground stem was soaked in 150 mL of distilled water for 12 hours, then filtered and extracted using double-distilled water through the hot continuous percolation method with a Soxhlet apparatus. The solid dry extract was weighed on a balance, resulting in a weight of 15.0 g. This extract was placed in a sterile container, labeled, and stored in a refrigerator at 40°C. The 15.0 g was subsequently divided into two containers: the first container with 4.0 g was designated for the experimental animal model, while the remaining 11.0 g was allocated for phytochemical analysis.

Fig 1: *Desmodium Velutinum*-Typical Appearance

Hot Continuous Percolation Method

The hot continuous percolation method is used when the active components of herbs do not dissolve well in a solvent. In such cases, it is essential to extract the crude using hot menstruum for an extended period. Fixed oils from seeds and alkaloids from herbs are extracted through a continuous hot percolation process using solvents like

benzene, chloroform, and petroleum ether. This method is also employed to measure fat content by continuously extracting food with a non-polar organic solvent, such as petroleum ether, for at least one hour in a Soxhlet apparatus.

Phytochemical Analysis

All the Phytochemical Analysis method followed the process outlined by (Obruche *et al*., 2019) [14].

Determination of Terenoid

One gram of the sample was weighed, macerated with 50 mls of ethanol, and then filtered. A volume of 2.5 mls of the filtrate was pipetted and mixed with 2.5 mls of 5% aqueous phosphomolybdic acid solution and 2.5 mL of concentrated H_2SO_4. This mixture was allowed to stand for 30 minutes, then made up to 12.5 mL with ethanol, and the absorbance was measured at 700 nm.

Determination of Glycoside

One gram of the sample was weighed, and 2.5 mls of 15% lead acetate was added before filtering. Next, 2.5 mL of chloroform was added, and the mixture was shaken vigorously. The lower layer was evaporated to dryness. Afterward, 3 mL of glacial acetic acid, 0.1 mL of 5% ferric chloride, and 0.25 mL of concentrated H_2SO_4 were added and shaken. The mixture was kept in the dark for 2 hours, and the absorbance was measured at 530 nm.

Determination of Steroid

One gram of the sample was weighed, macerated with 20 mls of ethanol, and filtered. A volume of 2 mls of the filtrate was pipetted, and 2 mls of color reagent was added. This mixture was allowed to stand for 30 minutes, and the absorbance was measured at 550 nm.

Determination of Saponin

One gram of the sample was weighed, macerated with 10 mls of petroleum ether, and decanted into a beaker. An additional 10 mls of petroleum ether was added and decanted into another beaker. The filtrates were amalgamated and evaporated until completely dry. Subsequently, 6 mL of ethanol was introduced into the filtrate along with 2 mL of the color reagent using a pipette. An additional 2 mL of the color reagent was incorporated, and the mixture was allowed to stand for 30 minutes. The absorbance was recorded at 550 nm.

Determination of Flavonoids

Approximately one (1) gram of the sample was measured, macerated with 20 mL of ethyl acetate, and then filtered. A volume of 5 mL of the filtrate was pipetted, and 5 mL of diluted ammonia slake was added. The upper layer was collected, and the absorbance was measured at 490 nm.

Determination of Reducing Sugar

About one (1) gram of the sample was weighed, macerated with 20 mL of distilled water, and filtered. A volume of 1 mL of the filtrate was pipetted and combined with 1 mL of alkaline copper reagent, then boiled for 5 minutes. Following this, another 1 mL of phosphomolybdic acid reagent and 7 mL of distilled water were added, and the absorbance was measured at 420 nm.

Determination of Alkaloids

Approximately one (1) gram of the sample was weighed, macerated with 20 mL of 20% H_2SO_4 in ethanol (1:1), and filtered. A volume of 1 mL of the filtrate was pipetted and mixed with 5 mL of 60% H_2SO_4 and 5 mL of 0.5% formaldehyde in 60% H_2SO_4, then allowed to stand for 3 hours. The absorbance was measured at 567 nm.

Determination of Cyanide

About one (1) gram of the sample was weighed, macerated with 50 mL of distilled water, and allowed to stand for 24 hours before filtering. A volume of 1 mL of the filtrate was pipetted and combined with 4 mL of alkaline picrate solution, boiled for 5 minutes, and then allowed to cool. The absorbance was measured at 490 nm.

Experimental Animal Model

The experimental animal method was based on Umanah *et al*. (2025) [20] with some minor changes. Twelve healthy male albino Wistar rats were procured from the University of Nigeria, Nsukka, Enugu State, and their weights were recorded using a weighing balance. The rats were divided into four (4) groups, I-IV, with each group consisting of 3 rats. The rats were kept in separate housing and provided with water and grower's mash (guinea feed Nigeria) to acclimatize for a period of three days. A high lipoprotein food source, specifically cow's brain, was procured from the local market, and 300g was accurately measured using a weighing balance. This 300g was then dissolved in 500ml of distilled water, resulting in a semi-solid mixture. Additionally, a known cardiovascular medication, with the generic name aspirin at a dosage of 25mg and the brand name vasoprin, was prepared by dissolving 12.5 mg (which is half of one tablet) in 2ml of distilled water. The N-hexane extract from the leaves of Desmodium velutinum, weighing 4.0g, was dissolved in 8ml of distilled water to create a liquid drug extract. Rats in groups i, iii, and iv were administered 6ml of the lipoprotein food mixture, containing 3.6g of cow's brain, twice daily for seven days using a syringe without a needle. In contrast, rats in group ii were solely provided with grower's mash and water for the same duration. Subsequently, rats in group iii received 2 mL of the dissolved vasoprin drug orally once a day for three days. Similarly, rats in group iv were given 0.5 mL of the liquid drug extract from Desmodium velutinum stem orally once daily for three days. Throughout this three-day period, all rats were supplied with grower's mash and water.

Collection of Blood Sample

The collection of blood sample was based on Umanah *et al*. (2025) [20] with some minor changes. Blood samples were obtained by dissecting the rats, followed by cardiac puncture after administering mild anesthesia with chloroform. Approximately 6-9ml of blood samples were collected from each group using a medical syringe and stored in EDTA tubes. Serum was separated from the blood after clotting through centrifugation and was utilized for heart marker enzyme testing. Blood samples from rats in groups i and ii were collected the day after the seventh day of oral feeding with the lipoprotein food mixture and normal feed (grower's mash and water), respectively. Blood samples from rats in group's iii and iv were collected the day after the third day of oral administration of the known drug vasoprin and the liquid drug extract, respectively.

Enzyme Profile Analysis
In the analysis of enzyme profiles, the following tests were performed: Creatine Kinase (CK-MB), Troponin, and Myoglobin.

Test for Troponin
The specimen and test components were allowed to reach room temperature if they had been refrigerated or frozen, and were mixed thoroughly. The test device was then placed on a clean, flat surface, and the plastic dropper was filled with the specimen. While holding the dropper vertically, 2-3 drops (approximately 60-90 mls) of the specimen were added into the sample well, ensuring that no air bubbles were present. A timer was set, and the results were read after 10 minutes. The pouch was opened at the notch, and the device was removed and placed on a clean, flat surface.

Test for Creatine Kinase (CK-MB)
The required number of coated wells was secured in the holder, and 20 mls of standard specimens were dispensed along with controls into the appropriate wells. An additional 200 mls of enzyme conjugate reagent was added to each well and mixed thoroughly for 30 seconds. The mixture was incubated at room temperature (18-25°C) for 60 minutes. After incubation, the plate was emptied into a waste container, and the microtiter wells were rinsed and emptied five times with distilled water. The wells were then struck sharply onto absorbent paper or paper towels to eliminate any residual water droplets. Subsequently, 100 µl of TMB reagent was added to each well, mixed gently for 5 seconds, and incubated at room temperature for 20 minutes. Finally, 100 µl of stop solution was added to each well, mixed gently for 30 seconds to halt the reaction, and the optical density was measured at 450 nM using a microtiter plate reader.

Test for Myoglobin
The testing device, along with whole blood, serum, or plasma, was permitted to reach room temperature (15-30°C) before the testing commenced. The test devices were placed on a clean and flat surface, and the plastic dropper was filled with the specimen. By holding the dropper in a vertical position, two (2) drops of the specimen were transferred to the specimen well in the test device, and a waiting period of 1-5 minutes was observed until the plasma became visible in the test window. The results were read within 10 minutes.

Statistical Analysis
The data were displayed in tables as mean ± SD. The concentrations of heavy metals found in sediments, water, crab, and fish in this study were analyzed using ANOVA statistical tools within SPSS. A 95% confidence level was utilized in all cases to compare the means. All descriptive statistics and graphs were created using Microsoft Excel version 10.

Results and Discussion
This section presents and discusses the results of the data analysis performed for the study, which are shown in tables 1 and 2.

Table 1: phytochemical Composition of sample

Sample code	Soluble CHO Cyanide Reducing sugar Saponin Tannin Flavonoid Alkaloid Steroid Terpenoids
E	1.49 ± 0.003^{c} 0.58 ± 0.020^{b} 373.682 ± 0.006^{e} 1.43 ± 0.004^{e} 3.31 ± 0.007^{e} 3.35 ± 0.004^{a} 3.25 ± 0.003^{e} 0.55 ± 0.007^{d} 0.39 ± 0.003^{e}

E=N-hexane extract of stem

Table 2: Qualitative Phytochemical

Sample parameters	N-hexane extract
Tannin	+++
Alkaloid	+++
Carbohydrate	+
Saponin	+
Steroid	+
Hydrogen	+
Cyanide	
Flavonoid	++
Reducing sugar	++
Terpenoid	+

Table 3: Heart Maker Emzymes of Rats Feed With Various Samples

Samples	Troponin T	Troponin I	Ck-Total	Ck-MB	Myoglobin	Myosim	LD-1	AST
A1 Cow's Brain	70.00 ± 2.83^{a}	90.00 ± 1.41^{a}	75.00 ± 1.41^{a}	93.00 ± 1.41^{a}	70.00 ± 1.41^{a}	60.00 ± 2.83^{a}	85.00 ± 1.41^{a}	75.00 ± 2.83^{a}
A2 Normal Feed	60.00 ± 2.83^{b}	75.00 ± 1.41^{b}	70.00 ± 2.83^{b}	85.00 ± 0.00^{b}	60.00 ± 1.41^{b}	55.00 ± 1.41^{b}	70.00 ± 0.00^{b}	65.00 ± 0.00^{b}
B1 Vasoprin	40.00 ± 1.41^{c}	35.00 ± 0.00^{c}	30.00 ± 0.00^{c}	50.00 ± 0.00^{c}	30.00 ± 2.83^{c}	20.00 ± 0.00^{c}	40.00 ± 0.00^{c}	35.00 ± 16.01^{c}
B2 Extract	45.00 ± 1.41^{d}	45.00 ± 0.00^{d}	30.00 ± 0.00^{c}	40.00 ± 1.41^{d}	25.00 ± 0.00^{c}	30.00 ± 2.83^{d}	45.00 ± 1.41^{d}	40.00 ± 0.00^{d}

A1- Rat fed with cow's brain (group 1 rats), A2- Rats fed with Normal feed (group 2 rats), B1- Rats fed with cow's brain + vasoprin (group 3 rats), B2-Rats fed with cow's brain+ N-hexane extract of Desmodium Velutinum stem (group 4 rats)

Discussion
From Table 2, the qualitative analysis revealed a significant presence of tannins, alkaloids, carbohydrates, flavonoids, and reducing sugars. Additionally, saponins, steroids, hydrogen cyanide, and terpenoids were also detected. The quantitative analysis of phytochemicals in the stem of Desmodium velutinum indicated that the N-hexane extract contained (1.49±0.003) grams of carbohydrates, which are essential nutrients and serve as a primary energy source for the body. The N-hexane extract also showed a cyanide content of (0.58±0.20) grams. Cyanide is known to be harmful to the human body as it inhibits aerobic respiration;

however, the amount present in the N-hexane extract of Desmodium velutinum stem is minimal and does not pose a threat to human health. Furthermore, the stem contained (1.43±0.004) grams of saponins. Saponins are beneficial secondary metabolites that can lower Low-Density Lipoprotein (LDL) levels in the blood, thereby mitigating the effects of atherosclerosis (Tapsell *et al*., 2006; Abeokuta *et al*., 2025) [1,16]. This reduction in atherosclerosis contributes to a cardioprotective effect. The tannin content was measured at (3.31±0.007) grams in the N-hexane extract of the stem. Although tannins have been traditionally viewed as having anti-nutritional properties, it is now understood that these effects are contingent upon their chemical structure and dosage. Tannins also promote blood clotting, lower blood pressure, and decrease serum lipid levels (Umudi *et al*., 2025) [17]. The flavonoid content was recorded at (3.35±0.004) grams in the N-hexane extract of the stem. Flavonoids are polyphenolic compounds with antioxidant properties that protect the body from vascular damage, thereby reducing the risk of cardiovascular diseases. They also help lower blood pressure and cholesterol levels, which further diminish the risk of heart disease (Ogwuche and Obruche, 2020) [11]. Lastly, the N-hexane extract of Desmodium velutinum stem contained (3.43±0.006) grams of alkaloids. Alkaloids are a class of naturally occurring nitrogen-containing bases (Umudi *et al*., 2025) [19]. The substance possesses numerous medicinal properties, and in relation to its impact on cardiac health, it functions as both an anti-hypertensive and an anti-arrhythmic agent. The terpenoid content in the N-hexane extract of the stem was measured at (0.39±0.003). Terpenoids exhibit antioxidant properties, making them highly beneficial for heart health, thus qualifying them for use as cardiovascular medications. Terpenoids represent a broad and varied category of naturally occurring organic compounds (Ugochukwu *et al*., 2025) [18]. As illustrated in Table 3, which details the heart enzyme markers in rats subjected to various dietary samples, the rats that consumed cow's brain (A1 rats) exhibited elevated lipoprotein levels in their biomarkers. Specifically, Troponin T (70.00±2.83), Troponin I (90.00±1.41), CK-Total (75.00±1.41), CK-MB (93.00±1.41), Myoglobin (70.00±1.41), Myosin (60.00±2.83), LD-I (85.00±1.41), and AST (75.00±2.83) were significantly higher compared to those fed a standard diet, indicating that cow's brain lacks protective properties and may exacerbate cardiovascular diseases. This necessitates a thorough investigation into the cardioprotective effects of the extract and the established drug, Vasoprin. Conversely, rats on a normal diet (A2 rats) displayed elevated lipoprotein levels in biomarkers such as Troponin T (60.00±0.00), Troponin I (75.00±1.41), CK-Total (70.00±2.82), CK-MB (85.00±0.00), Myoglobin (60.00±1.41), Myosin (55.00±1.41), LD-I (70.00±0.00), and AST (65.00±0.00). The grower mash also lacks protective effects while raising lipoprotein levels, contributing to cardiovascular issues. In contrast, rats administered Vasoprin (B1 rats) demonstrated a reduction in lipoprotein levels, with Troponin I (35.00±0.00), CK-Total (40.00±1.41), Troponin T (30.00±0.00), CK-MB (50.00±0.00), Myoglobin (30.00±2.83), Myosin (20.00±0.00), LD-I (40.00±0.00), and AST (35.00±16.01) showing significant decreases. This indicates that Vasoprin is effective in treating cardiovascular diseases. Although the cardioprotective effect of Vasoprin was found to be superior to that of the N-hexane extract of Desmodium velutinum stem, the extract still demonstrated considerable cardioprotective potential. Nevertheless, increasing the dosage and duration of administration in accordance with body weight may enhance its efficacy.

Conclusion

This study, which incorporated qualitative and quantitative analyses along with heart marker enzyme tests, demonstrated that the N-hexane extract of Desmodium velutinum stem possesses promising cardioprotective potential. The qualitative phytochemical screening revealed the presence of several bioactive compounds that are often associated with therapeutic effects, including flavonoids, tannins, and other phenolic constituents. These compounds are widely known for their antioxidant and anti-inflammatory properties, which play important roles in protecting cardiac tissues from oxidative stress and cellular damage. Quantitative analysis further supported these findings by measuring the concentration of these bioactive constituents in the extract, indicating that the N-hexane fraction contained appreciable levels of compounds that could contribute to cardioprotection. In addition, heart marker enzyme tests were performed to evaluate the extract's protective effect on cardiac tissue. The results showed a significant reduction in the levels of cardiac marker enzymes typically associated with myocardial injury, suggesting that the extract may help stabilize cardiac cell membranes and reduce tissue damage. Overall, the combined results from phytochemical screening, quantitative evaluation, and biochemical assays suggest that the N-hexane extract of Desmodium velutinum stem exhibits notable cardioprotective activity. These findings indicate that the plant could serve as a potential natural source for the development of cardioprotective drugs, although further pharmacological and clinical studies are necessary to confirm its safety, efficacy, and mechanisms of action.

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