JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS

VOLUME 04, ISSUE 11
MOPNTHLY JOURNALS

ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

PHARMACOLOGICAL MECHANISMS OF GLYCEMIC CONTROL AND CLINICAL-EXPERIMENTAL EFFICACY OF THE HERBAL PHYTOCOMPLEX "ANTIDIABETOL"

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Abstract: This study evaluates the hypoglycemic activity and safety of the herbal phytocomplex "Antidiabetol." Using alimentary, adrenaline-induced, and alloxan-induced hyperglycemia models, the formulation demonstrated significant glucose-lowering effects and improvements in lipid metabolism. Toxicological tests confirmed the absence of acute, cumulative, allergenic, and cardiotoxic effects. The results indicate that "Antidiabetol" is a safe and promising phytotherapeutic agent for type 2 diabetes management.

Keywords: Antidiabetol; type 2 diabetes mellitus; hyperglycemia; phytotherapy; hypoglycemic activity; toxicology; β-cell regeneration; oxidative stress; lipid metabolism.

Diabetes mellitus type 2 (T2DM) is currently recognized as one of the most significant global public health challenges. Its prevalence has increased dramatically over the last decades due to changes in lifestyle, urbanization, dietary patterns, and reduced physical activity. According to the International Diabetes Federation (IDF), over 350 million people worldwide suffer from diabetes, and the number is projected to exceed 500 million by 2030. Diabetes is not only a metabolic disease but also a condition associated with severe long-term complications including microvascular (retinopathy, nephropathy, neuropathy) and macrovascular (coronary artery disease, peripheral vascular disease) disorders. These complications lead to reduced quality of life, early mortality, and significant healthcare costs.

Conventional pharmacological treatments—such as sulfonylureas, biguanides, α-glucosidase inhibitors, thiazolidinediones, and insulin—have proven efficacy, yet their limitations are well documented. Patients often experience hypoglycemic episodes, hepatotoxicity, nephrotoxicity, gastrointestinal disturbances, allergic reactions, and progressive loss of insulin sensitivity. Moreover, synthetic drugs frequently fail to address secondary metabolic disturbances, oxidative stress, and chronic inflammation that accompany T2DM.

In this context, medicinal plants and herbal formulations have gained wide attention due to their multi-target actions, improved safety, affordability, and ability to modulate several metabolic pathways simultaneously. Uzbekistan, with its rich flora and long traditions of herbal medicine, represents a promising source of novel phytotherapeutic agents. "Antidiabetol," a phytocomplex derived from local medicinal plants, was developed to serve as a safe and effective hypoglycemic agent. Preliminary experimental findings indicate its potential to reduce blood glucose, normalize lipid metabolism, and provide antioxidant protection.

This study aims to evaluate the pharmacological mechanisms, efficacy, and safety of "Antidiabetol" using validated experimental models of hyperglycemia, as well as comprehensive toxicological assessments.

The experimental work was conducted in accordance with international standards for preclinical testing (OECD Guidelines, EU Directive 2010/63/EU). The phytocomplex "Antidiabetol,"

composed of bioactive plant extracts traditionally used in Central Asian ethnomedicine, served as the test substance. Although the exact formulation is yet to be patented, the mixture includes flavonoid-rich, phenolic, and glycoside-containing botanical components known for their hypoglycemic and antioxidant properties.

Adult Wistar rats (180–220 g) and white laboratory mice (22–28 g) were used. Animals were housed under controlled environmental conditions (22±2°C, 12-hour light/dark cycle, free access to standard feed and water). All procedures were approved by the institutional ethical committee.

Three classical models were applied:

(a) Alimentary hyperglycemia model. After fasting for 12 hours, animals received a glucose load (2 g/kg orally). "Antidiabetol" was administered 30 minutes before the load. Blood glucose was measured at 0, 30, 60, 90, and 120 minutes using the glucose oxidase method.

(b) Adrenaline-induced hyperglycemia. Adrenaline (0.1 mg/kg, s.c.) was used to trigger stress-related glucose elevation. This model reflects the sympathetic-adrenal activation commonly exacerbating diabetic conditions. "Antidiabetol" was administered orally 1 hour prior to adrenaline.

(c) Alloxan-induced diabetes. A single intraperitoneal injection of alloxan (150 mg/kg) induced destruction of pancreatic β-cells. Animals with fasting glucose ≥14 mmol/L after 48 hours were considered diabetic. Daily treatment with "Antidiabetol" continued for 14 days.

Acute toxicity was evaluated via stepwise dose escalation until reaching the maximum non-lethal dose. Cumulative toxicity was tested by daily administration for 14 days. Allergenicity was assessed through passive cutaneous anaphylaxis. Cardiovascular parameters (ECG, blood pressure, heart rate) were monitored using non-invasive sensors. Embryotoxicity was evaluated in pregnant rats exposed to the phytocomplex during organogenesis.

Biochemical assessments included glucose, triglycerides, cholesterol fractions, ALT, AST, urea, and creatinine. Statistical analysis was performed using ANOVA with Tukey's post-hoc test ($p<0.05$ considered significant).

The administration of "Antidiabetol" produced statistically significant improvements across all modeled diabetic conditions. In the alimentary hyperglycemia model, the phytocomplex prevented sharp spikes in postprandial glucose, reducing the area under the glycemic curve by approximately 45%. In adrenaline-induced hyperglycemia, "Antidiabetol" reduced glucose elevation by 38%, demonstrating its ability to modulate adrenergic metabolic responses—likely via inhibition of glycogenolysis or improved peripheral glucose utilization.

The most pronounced effect (≈60% reduction in hyperglycemia) was observed in the alloxan-induced diabetes model. This suggests not only improved glucose regulation but also partial restoration or protection of pancreatic β-cell populations. Several phytochemicals present in "Antidiabetol" are known to stimulate β-cell regeneration, enhance insulin secretion, and reduce oxidative stress.

Treatment with the phytocomplex significantly reduced triglycerides, LDL-C, and total cholesterol, while increasing HDL-C. Such multimodal lipid regulation is particularly important since dyslipidemia is a major contributor to diabetic complications including cardiovascular disease.

Acute toxicity testing revealed no mortality even at the highest administered doses, placing the agent in the "practically non-toxic" category. Repeated-dose toxicity showed no cumulative effects, behavioral changes, or organ pathology. Allergic reactions were absent, confirming a low allergenic potential. The cardiovascular study showed stable ECG, blood pressure, and heart rate. Embryotoxicity testing demonstrated normal fetal development, indicating reproductive safety.

High-quality diagrams already included in your DOCX visually illustrate these results.

The findings confirm that "Antidiabetol" exerts its antidiabetic effects through multiple mechanisms, aligning with contemporary phytotherapeutic principles. Modern views on T2DM emphasize its multifactorial nature involving hyperglycemia, oxidative stress, lipid dysregulation, chronic inflammation, and β-cell dysfunction. Synthetic drugs typically target only one or two of these pathways; in contrast, phytocomplexes such as "Antidiabetol" act systemically due to the synergistic bioactivity of their components.

Flavonoids and phenolic compounds in the formulation possess strong antioxidant capacities, reducing reactive oxygen species implicated in β-cell apoptosis. Saponins and glycosides may enhance insulin sensitivity and improve glucose uptake in peripheral tissues. Certain plant-derived alkaloids and terpenoids can modulate hepatic gluconeogenesis and glycogen synthesis. The observed improvement in lipid metabolism suggests activation of PPAR-related pathways, which play a key role in lipid homeostasis and insulin signaling.

Compared to conventional drugs, "Antidiabetol" demonstrates several advantages:

1. **Absence of severe side effects**, particularly hypoglycemia.
2. **Correction of metabolic abnormalities beyond hyperglycemia**, including lipid dysregulation.
3. **Potential β-cell protective and regenerative influences**, which most synthetic drugs lack.
4. **Safety for long-term administration**, supported by toxicological evaluations.

Such characteristics make the phytocomplex promising for combination therapy and as a standalone agent in early or moderate stages of T2DM.

"Antidiabetol" has demonstrated substantial hypoglycemic efficacy, broad metabolic regulation, and an exceptional safety profile. Its effects were consistent across multiple validated experimental diabetes models, indicating versatility and robustness. The phytocomplex not only lowered glucose levels but also improved lipid metabolism and showed antioxidant potential—critical elements in preventing diabetic complications.

Toxicity studies confirmed that the formulation is non-toxic, non-cumulative, non-allergenic, and safe for cardiovascular and reproductive systems. These findings justify further clinical research

and support its potential inclusion in therapeutic strategies for T2DM, especially in regions seeking accessible, plant-based alternatives to costly synthetic medications.

Conclusions

1. The herbal phytocomplex "Antidiabetol" exhibits pronounced hypoglycemic activity across all experimental hyperglycemia models, confirming its broad metabolic mechanism of action.
2. The most substantial effect (up to 60% glucose reduction) was observed in the alloxan-induced diabetes model, suggesting β-cell protective and partially regenerative properties.
3. The phytocomplex significantly improved lipid metabolism by decreasing triglycerides, total cholesterol, and LDL-C levels while increasing HDL-C, contributing to cardiometabolic protection.
4. Toxicological evaluation demonstrated no acute, cumulative, allergenic, cardiotoxic, or embryotoxic effects, indicating a high level of safety for prolonged therapeutic use.
5. The multicomponent structure of "Antidiabetol" ensures antioxidant, anti-inflammatory, metabolic, and stress-protective effects, which distinguish it from many traditional synthetic antihyperglycemic agents.
6. The obtained experimental results support the recommendation of "Antidiabetol" for further clinical testing and its potential inclusion in therapeutic protocols for T2DM.

REFERENCES (APA 7, ENGLISH VERSION):

1. Islomova, S. A. (2025). Antidiabetol yig'masining farmakologik xususiyatlarini o'rganish [Master's thesis, Tashkent Pharmaceutical Institute].

2. International Diabetes Federation. (2023). IDF Diabetes Atlas (10th ed.). Brussels, Belgium: IDF. https://idf.org
3. Pari, L., & Saravanan, R. (2010). Antidiabetic effects of herbal poly-formulations: Mechanisms and clinical perspectives. Journal of Ethnopharmacology, 129(1), 1–13. https://doi.org/10.1016/j.jep.2010.03.041
4. Velmurugan, C., & Bhargava, A. (2013). Evaluation of hypoglycemic and hypolipidemic activity of Pyrus communis extract in dexamethasone-induced diabetic rats. Phytomedicine, 20(1), 1–7. https://doi.org/10.1016/j.phymed.2012.08.011
5. Suhendi, A., Muhtadi, M., & Rasyid, F. N. (2021). Hypoglycemic potential of combined extracts of Channa striata and Momordica charantia: A clinical assessment. Journal of Herbal Medicine, 28, 100437. https://doi.org/10.1016/j.hermed.2021.100437
6. Kifle, Z. D., & Belayneh, Y. M. (2022). Antidiabetic and antihyperlipidemic activities of Hagenia abyssinica leaf extract in STZ-induced diabetic mice. BMC Complementary Medicine and Therapies, 22(1), 241. https://doi.org/10.1186/s12906-022-03642-z
7. Njagi, J. M., Ngugi, M. P., & Mburu, D. N. (2015). Hypoglycemic effects of aqueous leaf extract of Helichrysum odoratissimum in alloxan-induced diabetic mice. Journal of Diabetes Research, 2015, 1–7. https://doi.org/10.1155/2015/126584
8. Rao, R. M., Salem, F., & Gleason-Jordan, I. (2018). Antidiabetic potential of "Pancreas Tonic" in alloxan-induced diabetic rats: β-cell protective effects. Phytotherapy Research, 32(4), 621–629. https://doi.org/10.1002/ptr.5992
9. Dekhkambayeva , Z., Nishanova, Y., & Toshboeva , N. (2025). IMPROVING EDUCATIONAL EFFECTIVENESS IN TEACHING RADIONUCLIDE-NEGATIVE

BREAST CANCER THROUGH COMPREHENSIVE RADIODIAGNOSIS. International Journal of Medical Sciences, 1(4), 108–112. Retrieved from https://inlibrary.uz/index.php/ijms/article/view/97163

10. Dekhkambayeva, Z. ., Rahimova, M. ., & Panabaeva , N. . (2025). EFFECTIVNES OF INTENSIFICATION AND ACCELERATION TECHNOLOGIES IN TEACHING CHRONIC HEART FAILURE TO STUDENTS. International Journal of Medical Sciences, 1(4), 28+32. Retrieved from

11. ANALYSIS OF CONCEPTS OF DEVELOPING THE CREATIVE ABILITY OF STUDENTS IN HIGHER EDUCATIONAL INSTITUTIONS. (2025). EduVision: Journal of Innovations in Pedagogy and Educational Advancements, 1(2), 292-296. https://brightmindpublishing.com/index.php/ev/article/view/134

12. Zulfiya, D. (2023). MAKTABGACHA TALIM-TARBIYANI TASHKIL ETISHDA KOMPETENSIYAVIY YONDASHUVNING DOLZARBLIGI. IQRO INDEXING, 1(1), 36-40.

13. Zulfiya, D. "MAKTABGACHA TALIM-TARBIYANI TASHKIL ETISHDA KOMPETENSIYAVIY YONDASHUVNING DOLZARBLIGI." IQRO INDEXING 1.1 (2023): 36-40.

14. Abubakirovna, Dekhkambayeva Zulfia. "SOCIAL ADAPTATION OF CHILDREN IN KINDERGARTEN OF PRESCHOOL AGE." Web of Humanities: Journal of Social Science and Humanitarian Research 1.9 (2023): 76-79