



POLICY BRIEF

Turning a controversial plant into a health asset: Policy options for harnessing *Catha edulis* against hyperlipidemia

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Abstract

Cardiovascular diseases driven by hyperlipidemia are leading causes of death globally, with low- and middle-income countries carrying a disproportionate burden. Although statins continue to be the cornerstone of cholesterol therapy, unmet demands are sustained by cost, intolerance, and residual risk, especially in sub-Saharan Africa. When made as standardized extracts, *Catha edulis*, which has long been controversial due to its psychotropic alkaloids, is being explored more and more for its effects on metabolism. Improvements in lipid profiles (decreased low density lipoprotein-cholesterol and triglycerides, and increased high density lipoprotein-cholesterol), regulation of adipokines (decreased leptin and increased adiponectin) in high-fat diet animals are reported in preclinical study with lyophilized leaf extract. Gas chromatography-mass spectrometry and molecular docking implicate non-alkaloid phytochemicals that bind lipid-regulating targets, showing statin-like interactions with HMG-CoA Reductase. However, regular khat chewing is also linked to hepatic and cardiovascular problems in clinical and case-series research, highlighting an important difference between recreational exposures and regulated, standardized medication formulations. Standardization of extract manufacturing, regulatory pathways that distinguish medicinal from recreational use, ethically sound clinical trials, pharmacovigilance, and culturally sensitive communication are some of the policy options for African health systems that are outlined in this brief, which also summarizes the scientific evidence and clarifies the risks and benefits. With strict protections, *Catha edulis* may transform from a public health risk to a focused adjuvant in the treatment of dyslipidemia, particularly in areas where access to

cutting-edge lipid-lowering medications is still a problem.

Keywords

Adiponectin; Catha edulis, hyperlipidemia, HMG CoA Reductase, leptin, lyophilization, statins



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Introduction

Globally, cardiovascular diseases (CVDs) continue to be the leading cause of death. An estimated 19.8 million individuals died from CVDs in 2022, with heart attacks and strokes accounting for 85% of these deaths (World Health Organization, 2025). In low-and-middle-income countries (LMICs), which include a large portion of Africa, where risk is increased by urbanization, dietary changes, and limited access to chronic care, more than three-quarters of CVD deaths take place (World Health Organization, 2025). This burden is exacerbated by hyperlipidemia which promotes organ damage and atherosclerosis. Therefore, policies that increase access to safe, reasonably priced lipid-lowering solutions are essential to controlling CVD in an equitable manner (Yuyun et al., 2020). Statins have transformed prevention by lowering LDL-C, but intolerance, notably, myalgias and rare adverse events persist; even when tolerated, residual risk remains. High-efficacy agents such as monoclonal-antibody PCSK9 inhibitors and inclisiran can reduce LDL-C by ~50–60%, yet cost and delivery models restrict uptake in many African settings. Pipeline oral PCSK9-directed agents may help, but are not yet available for routine use. These realities motivate exploration of complementary, locally feasible therapeutics (Newman et al., 2019; Garwood et al., 2025).

Catha edulis, commonly known as khat, is a plant with cultural significance in Yemen and parts of East Africa. It has long been valued for its cathine and cathinone, two psychoactive alkaloids that stimulate the central nervous system (Alshagga et al., 2017; Al-duais, 2021; Asfaw et al., 2024). Nevertheless, a number of detrimental health effects, such as hepatotoxicity, ischemic cardiovascular events and hypertension have been linked to chronic khat chewing by observational studies and clinical reports (Naeem et al., 2025). At the same time, controlled laboratory studies show that standardized khat extracts have lipid-modulating, anti-inflammatory and antioxidant qualities that are different from those seen in recreational use when appropriately characterized and used within safe dosage ranges (Abdelwahab et al., 2018; Al-duais, 2021). This scientific divergence underscores a crucial pharmacological and policy question: *can a culturally controversial plant be repurposed into a safe therapeutic candidate with cardiometabolic benefits?* (Naeem et al., 2025).

A major determinant of this translational potential lies in the preparation method of the extract, which significantly influences its phytochemical composition and bioactivity. Among these methods, freeze-drying (lyophilization) is reported as a better approach for preserving heat-labile bioactive compounds, minimizing oxidative degradation, and maintaining the integrity of volatile and phenolic constituents relative to thermal drying techniques (Thamkaew et al., 2021; Rezvankhah et al., 2020; Sarthak et al., 2025). Research on a variety of medicinal plants continuously shows that lyophilization improves the stability and recovery of important phytochemicals, increasing the biological assays' potency and repeatability. Using lyophilization in the context of *Catha edulis* is therefore not only a methodological decision; rather, it is an essential step in guaranteeing uniformity, safety and bioefficacy in turning a traditionally chewed stimulant into a pharmaceutical product with scientific validation.

A Gas Chromatography–Mass Spectrometry (GC–MS) analysis of lyophilized khat extract identified several phytoconstituents including phytol and ethyl palmitate that are known to exert lipid-modulating and antioxidant activities (Mbina et al., 2025a). Complementary molecular docking studies of the selected compounds showed that they exhibited binding affinities to HMG-CoA reductase comparable to those of mevastatin, suggesting a plausible mechanistic basis for the observed hypolipidemic effects (Mbina et al., 2025b). In a high-fat diet–induced hyperlipidemic rat model, the lyophilized *Catha edulis* extract demonstrated significant dose-dependent lipid-lowering effects, evidenced by reductions in total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and triglycerides (TG), alongside a concurrent elevation in high-density lipoprotein cholesterol (HDL-C) (Mbina et al., 2025b). These biochemical improvements were accompanied by favorable modulation of adipokines, with decreased leptin and increased adiponectin levels, suggesting restoration of adipose tissue signaling and improved metabolic balance. The observed increase in adiponectin and reduction in leptin are particularly noteworthy, as these hormonal shifts are linked to cardiometabolic benefit and improved insulin sensitivity (Achari & Jain, 2017; Obradovic et al., 2021; Flier & Ahima, 2024). Collectively, these findings provide proof-of-concept evidence supporting the potential of standardized *Catha edulis* extracts as candidates for lipid regulation. However, such preclinical results represent early experimental insights rather than clinical endorsement, underscoring the need for rigorous translational evaluation.

Given the growing burden of dyslipidemia and cardiometabolic disorders in sub-Saharan Africa and the limited access to advanced lipid-lowering therapies, a validated and standardized *Catha edulis* based intervention could offer a culturally grounded and cost-effective adjunct to existing care. Achieving this goal, however, demands a deliberate research-to-policy continuum, encompassing standardization of plant extracts, regulatory frameworks, controlled clinical trials, pharmacovigilance systems, and culturally sensitive risk communication (Yuyun et al., 2020). Only through such integrative efforts can the medicinal potential of *Catha edulis* be safely harnessed while mitigating the public health risks associated with its recreational misuse.

Policy outcomes and implications

Lyophilized *Catha edulis* extract is positioned as a possible natural statin analog with multi-target lipid-lowering and organ-protective properties based on in-silico and animal research. The extract has potential as a phytotherapeutic option for dyslipidemia by modifying blood lipids and important molecular pathways, such as HMG-CoA reductase, leptin, and adiponectin. In low- and middle-income nations where access to traditional lipid-lowering medications is still restricted, it may provide an inexpensive supplementary therapy for cardiometabolic illnesses if clinical validation is obtained.

Catha edulis poses a regulatory paradox, its therapeutic potential contrasts with public health concerns arising from recreational use linked to liver and cardiovascular toxicity (Sidow & Hassan, 2024). This duality highlights the need for clear regulatory frameworks, including standardized formulations, labeling, pharmacovigilance, and public education, to distinguish medical applications from non-medical use (Naeem et al., 2025). Responsible translation of *Catha edulis* into a regulated therapeutic product thus represents both a scientific opportunity and a policy necessity, particularly for low- and middle-income countries.

Previous evidence of hepatotoxicity highlights the need for comprehensive preclinical toxicology studies, cautious dose-finding, and rigorous long-term safety monitoring in both clinical trials and post-marketing settings (Dirven et al., 2021; Cook et al., 2015). National pharmacovigilance centers should be readied to capture liver, cardiac, and neuropsychiatric events, with rapid signal detection and response mechanisms. Without pharmacopeial standards, batch variability can erase benefits and amplify harms. Ministries of Health and standards bodies should adopt Good Agricultural and Collection Practices (GACP) and Good Manufacturing Practices (GMP) tailored to lyophilized extracts. Regional production and technology transfer can strengthen supply chains and lower costs, aligning with African Union pharmaceutical manufacturing goals.

Effective public health communication is essential to ensure that emerging medicinal research on *Catha edulis* is not misconstrued as endorsing or legitimizing recreational khat chewing, which remains a deeply entrenched social and cultural behavior in several communities. Public messaging must therefore draw a clear distinction between standardized medicinal use and traditional chewing practices, emphasizing that any pharmacological application would be grounded in evidence, dosage control, and regulatory oversight.

Furthermore, future clinical and policy guidelines should delineate that any approved *Catha edulis*-derived pharmaceutical product be used strictly as an adjuvant therapy not a replacement for conventional evidence-based lipid-lowering treatments, particularly in cases where statins are contraindicated, poorly tolerated, or clinically inadequate. To justify adoption within resource-constrained health systems, cost-effectiveness analyses should benchmark the product against generic statins and novel lipid-lowering agents, such as PCSK9 inhibitors, to determine its economic viability and therapeutic competitiveness (Newman et al., 2019; Jeswani et al., 2024).

Actionable recommendations

Governments and regulatory agencies need to take a multipronged approach to successfully direct the safe and responsible development of *Catha edulis* as a possible therapeutic product through the highlighted actionable recommendations.

Standardization and clinical evaluation: Lyophilized *Catha edulis* extracts should be standardized in accordance with Good Manufacturing Practices (GMP) and Good Agricultural and Collection Practices (GACP). To guarantee formulation safety and consistency, this should involve the use of validated tests, stability evaluation, and thorough impurity profiling. Governments ought to finance thorough clinical evaluation in addition to uniformity. With a particular emphasis on dose-finding studies, hepatobiliary safety evaluation, and comparison of LDL-C outcomes to current medications like statins, support for phase I–III trials is crucial.

Regulatory framework and pharmacovigilance: Regulatory structures need to be modified to distinguish between khat recreational usage and medical formulations. To prevent misuse, this entails establishing clear legal paths, such as scheduling choices, prescription-only status, and prohibitions on direct-to-consumer advertising. The creation of hepatic and cardiovascular safety registries is another way to improve pharmacovigilance systems and allow for ongoing monitoring of adverse events when the medicine is used more widely.

Regional manufacturing and economic empowerment: Investments in regional manufacturing facilities and quality control laboratories should also be given top priority by governments. In addition to ensuring product purity, this will promote economic empowerment and regional self-reliance.

Culturally sensitive risk communication: The application of culturally aware risk communication techniques is equally crucial. These need to deter conventional chewing habits while also informing the public about the medical research and scientific justification for novel therapeutic uses.

Collaborative multisector partnerships: A cooperative strategy is essential. If efficacy is eventually proven, multisector collaborations involving academic institutions, national regulatory bodies, and public health institutes should be formed to guarantee data sharing, standard alignment, and coordinated planning for equitable access. These concerted efforts will offer a methodical, moral, and scientifically sound means to transform *Catha edulis* from a contentious plant into a controlled pharmaceutical with obvious advantages for public health.

Conclusion

The tight area between cultural practice and biomedical promise is occupied by *Catha edulis*. Improvements in lipid biomarkers, adipokines, and organ histology are suggested by preclinical findings on lyophilized extracts. Translational testing is needed due to the possible target engagement at HMG-CoA reductase signals. However, long-term chewing of *Catha edulis* is also linked to cardiovascular and hepatic damage. The way forward is a controlled, disciplined experiment that involves standardization, trialing, monitoring, and communication rather than outright banishment or naïve endorsement. A properly regulated medicinal *Catha edulis* could offer a locally significant addition to Africa's dyslipidemia toolset if its efficacy and safety are verified in people. Otherwise, the same procedure will safeguard the public and define boundaries. Either result improves regulatory frameworks and promotes science-based policy.

Ethics and consent

Ethical approval was given by Research Ethics Committee (REC) of Kampala International University-Western Campus, Uganda (approval number: KIU-2024-676).

Data availability

No data was associated with this article.

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