World Journal of Pharmaceutical Science and Research

www.wjpsronline.com

Short Communication

ISSN: 2583-6579
SJIF Impact Factor: 6.916
Year - 2026
Volume: 5; Issue: 6
Page: 629-632

LIMITATIONS OF WISTAR RATS AS PRECLINICAL MODELS FOR TAMARINDUS INDICA ANTI-OBESITY STUDIES: A SHORT COMMUNICATION

Mohit Kushwaha*, Shefali Usrethe

Department of Pharmacy, Shri Rawatpura Sarkar Institute of Pharmacy, Jabalpur, Madhya Pradesh, India.

Article Received: 14 April 2026 | | Article Revised: 05 May 2026 | | Article Accepted: 25 May 2026

***Corresponding Author: Mohit Kushwaha**
Department of Pharmacy, Shri Rawatpura Sarkar Institute of Pharmacy, Jabalpur, Madhya Pradesh, India.
DOI: https://doi.org/10.5281/zenodo.20446186

How to cite this Article: Mohit Kushwaha, Shefali Usrethe (2026) LIMITATIONS OF WISTAR RATS AS PRECLINICAL MODELS FOR TAMARINDUS INDICA ANTI-OBESITY STUDIES: A SHORT COMMUNICATION. World Journal of Pharmaceutical Science and Research, 5(6), 629-632.

ABSTRACT

Using Wistar rat models, recent studies have demonstrated the potential of tamarind's indica fruit pulp as a plant-based anti-obesity treatment. Due to key anatomical and physiological differences, the applicability of these rodent models in anti-obesity and hypolipidemic studies is still extremely questionable. Most notably, the absence of the gallbladder in Wistar rats directly affects the lipid profile and bile acid kinetics. Moreover, the majority of the cholesterol in rats' serum is found in high-density lipoprotein (HDL) fractions rather than low-density lipoprotein (LDL) particles, and unlike humans, they are naturally lacking in cholesteryl ester transfer protein (CETP). Efficacy findings from rats may not accurately reflect human metabolic outcomes since T. indica supplementation affects the composition of bile acids and has been clinically linked to an increased risk of cholelithiasis (gallstones) in species with gallbladders. This short communication emphasises these structural and metabolic discrepancies and proposes that swine models or pigs provide a better physiological priority for the conversion of plant-based anti-obesity and lipid-lowering treatments. In anti-obesity and hypolipidemic research, this report proposes that using the pig animal is more responsible than using the rat model.

KEYWORDS: *Tamarindus indica*, Wistar rats, gallstones, Obesity, animal models, hypolipidemic.

INTRODUCTION

Obesity remains a critical global public health challenge, with an expanding incidence of metabolic syndromes, type 2 diabetes, and cardiovascular diseases.[1] Due to the higher safety risks of synthetic weight-loss drugs, modern research now focuses on the plant-based bioactive phytochemicals. Among these, *Tamarindus indica* (tamarind) fruit pulp has demonstrated promising hypolipidemic and weight-reducing properties in some previous studies.[2] Multiple studies

have utilised “Wistar rats to evaluate their therapeutic efficacy against obesity induced by cafeteria diets or antipsychotic medications”.

However, the exclusive use of Wistar rats in predicting human metabolism creates critical factors in experimental designs. This paper evaluates these animal designs, identifying key limitations in rodent biliary anatomy and cholesterol transport systems that reconsider the Application of *T. indica* as an anti-obesity and hypolipidemic research candidate.

Limitations of Wistar Rats in Lipid and Biliary Research

Wistar rats are globally favoured in preclinical screenings due to cost-efficiency, ease of handling, and established protocols.[3] However, their macro-anatomy and systemic biochemistry show significant limits from human physiology in ways that directly impact metabolic profiling.

The most important anatomical difference is the complete absence of a gallbladder in rats.[4] In humans, the gallbladder acts as a dynamic reservoir that concentrates and releases bile acids in response to dietary lipid intake.[5] In contrast, rodents exhibit continuous, low-pressure bile secretion directly from the liver into the duodenum. Consequently, any drug or phytochemical that alters bile acid synthesis, micellar packaging, or cholesterol excretion cannot be accurately evaluated in a model lacking this specialised storage organ.

Impact of Tamarind on Gallstone Pathogenesis and Bile Kinetics

Chronic ingestion of *T. indica* has been shown to alter bile acid composition. In species possessing a gallbladder, regular exposure to concentrated tamarind extracts more than three times weekly can significantly elevate the risk of cholesterol supersaturation, following gallstone formation (cholelithiasis).[6]

Because Wistar rats lack the anatomical structure where bile stasis and crystal nucleation occur, the lithogenic potential of *T. indica* goes completely undetected in standard rodent bioassays. Consequently, concluding that tamarind fruit pulp is entirely safe or predicting its exact impact on human lipid handling based on rat models is incomplete.

Divergence in Serum Lipid Profiles and CETP Expression: Beyond structural biliary differences, the fundamental mechanism of cholesterol transport in rodents differs drastically from that of humans. Humans express robust levels of Cholesteryl Ester Transfer Protein (CETP), an essential enzyme that facilitates the transfer of cholesteryl esters from cardioprotective HDL particles to pro-atherogenic LDL and VLDL fractions. Consequently, humans circulate cholesterol primarily within LDL particles.[7]

Rodents, however, are naturally deficient in CETP. Their systemic cholesterol transport relies almost entirely on HDL as the primary vehicle, meaning their peripheral lipid clearance pathways bypass the critical LDL- receptor-mediated regulatory mechanisms seen in humans.[7] Even when subjected to high-fat or high-cholesterol diets, wild-type Wistar rats regulate circulating lipids via unique hepatic pathways, such as the highly efficient upregulation of HMG-CoA reductase and accelerated faecal excretion of bile acids.[7]

Therefore, evaluating the "hypolipidemic" actions of *T. indica* in a CETP-deficient rodent system fails to mirror the complex lipoprotein cascades of the human cardiovascular system.

Suitability of pigs as an Advanced Translational Model: To overcome the clinical failures of rodent-to-human translation in metabolic research, porcine (pig) models present a highly superior alternative. Pigs share remarkable anatomical, physiological, and metabolic homologies with humans.

In contrast to rodents, pigs possess a functional gallbladder with bile acid profiles and secretory cycles that mirror human digestion. Unlike rodents, pigs express active CETP and exhibit a comparable lipoprotein distribution where LDL serves as the dominant cholesterol carrier. Porcine omnivorous dietary habits and fat deposition tendencies closely mimic human metabolic syndrome progression.[8]

Using these models would allow researchers to simultaneously track the long-term effects of *T. indica* on actual LDL/HDL ratios, vascular lipid deposition, and gallbladder safety.

The use of Wistar rats in the study of Tamarindus indica for obesity treatment presents many limitations that question the validity of the results.

CONCLUSION

Although *Tamarindus indica* holds actual therapeutic potential as a metabolic regulator, there are significant safety concerns and metabolic realities associated with the preclinical use of the Wistar rat. The dual confounding factors of gallbladder absence and natural CETP deficiency mask potential side effects like cholelithiasis and misrepresent systemic lipoprotein responses. Future validation of plant-based anti-obesity candidates should shift toward higher-fidelity translational models, such as pigs, to guarantee safety and efficacy before clinical human deployment.

Conflicts of Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

REFERENCES

1. Ahmed SK, Mohammed RA. Obesity: Prevalence, causes, consequences, management, preventive strategies and future research directions. Metabol Open, 2025; 27: 100375. doi:10.1016/J.METOP.2025.100375
2. Jindal V, Dhingra D, Sharma S, Parle M, Harna RK. Hypolipidemic and weight reducing activity of the ethanolic extract of Tamarindus indica fruit pulp in cafeteria diet- and sulpiride-induced obese rats. J Pharmacol Pharmacother, 2011; 2(2): 80. doi:10.4103/0976-500X.81896 PubMed PMID: 21772765.
3. Deglaire A, Moughan PJ. Animal models for determining amino acid digestibility in humans – a review. British Journal of Nutrition, 2012; 108(S2): S273–81. doi:10.1017/S0007114512002346 PubMed PMID: 23107538.
4. Higashiyama H, Uemura M, Igarashi H, Kurohmaru M, Kanai-Azuma M, Kanai Y. Anatomy and development of the extrahepatic biliary system in mouse and rat: a perspective on the evolutionary loss of the gallbladder. J Anat, 2017; 232(1): 134. doi:10.1111/JOA.12707 PubMed PMID: 29023691.
5. Turumin JL, Shanturov VA, Turumina HE. The role of the gallbladder in humans. Rev Gastroenterol Mex, 2013; 78(3): 177–87. doi:10.1016/J.RGMX.2013.02.003 PubMed PMID: 23683886.
6. Panpimanmas S, Manmee C. Risk Factors for Gallstone Disease in a Thai Population. J Epidemiol, 2009; 19(3): 116. doi:10.2188/JEA.JE20080019 PubMed PMID: 19398852.

7. Mjaatveit M, Oldernes H, Gudbrandsen OA. Effects of diets containing fish oils or fish oil concentrates with high cetoleic acid content on the circulating cholesterol concentration in rodents. A systematic review and meta-analysis. Br J Nutr, 2023; 131(4): 606. doi:10.1017/S0007114523002118 PubMed PMID: 37737066.
8. Stein HH. The pig is an excellent model to determine amino acid digestibility of human foods and to generate data needed to meet human amino acid requirements. Front Nutr, 2024; 11: 1434430. doi:10.3389/FNUT.2024.1434430/TEXT