Journal of Scientific and Technology Research (TUBITTUM)
Volume 4 Issue 3, 2025, pp: 112-124 www. Tubittumjournal.com ISSN: 2822-5295
https://tubittumjournal.com/article/1091

Pharmacological and Therapeutic Potential of Chamomile in Lowering Blood Triglyceride Levels: A Systematic Review and Meta-Analysis

[1*]Najmeh Sadat Taghavi, [2]Abolfazl Moradi

[1]*Doctorate in Naturopathic Medicine, Technofest Institute of Technology (TITU), Erquelinnes, Belgium.*

[2]*Assistant Professor,Technofest Institute of Technology (TITU), Erquelinnes, Belgium.*

Received 06/08/2025 **Accepted** 28/09/2025

DOI: 10.64209/tubittum.v4i3.1091

*sofiataghavi1360@gmail.com

Abstract

Background: Hypertriglyceridemia is a major risk factor for cardiovascular and metabolic disorders. Matricaria chamomilla (Chamomile), a widely used medicinal herb, possesses antioxidant, anti-inflammatory, and lipid-modulating properties. Its specific effects on serum triglyceride levels, however, remain to be systematically evaluated.

Objective: This systematic review aims to comprehensively assess the pharmacological and therapeutic effects of Matricaria chamomilla on serum triglyceride levels across human, animal, and in vitro studies.

Methods: A structured literature search was conducted in PubMed, Scopus, and Web of Science up to 2025. Studies evaluating Chamomile's impact on triglyceride levels were included. Data extraction and quality assessment were independently performed by two reviewers using Cochrane Risk of Bias and Newcastle–Ottawa Scale tools. Findings were synthesized qualitatively, and meta-analysis was performed where appropriate.

Results: Ten studies met inclusion criteria, including 4 human clinical trials, 4 animal studies, and 2 in vitro investigations. Chamomile consistently reduced serum triglyceride levels in animal models and showed moderate lipid-lowering effects in humans. Mechanistic evidence indicates its effects are mediated through antioxidant activity, modulation of lipid-metabolizing enzymes, and anti-inflammatory pathways. Reported adverse effects were minimal and mild.

Conclusion: Current evidence supports Matricaria chamomilla as a potential adjunct therapy for hypertriglyceridemia. High-quality randomized controlled trials are needed to establish optimal dosing, treatment duration, and long-term safety.

Keywords: Matricaria chamomilla; Chamomile; Triglycerides; Lipid profile; Systematic review; Hypertriglyceridemia

Journal of Scientific and Technology Research (TUBITTUM)
Volume 4 Issue 3, 2025, pp: 112-124 www. Tubittumjournal.com ISSN: 2822-5295
https://tubittumjournal.com/article/1091

1.Introduction

Elevated serum triglyceride levels represent a significant risk factor for cardiovascular diseases, metabolic syndrome, and other lipid-associated disorders. Hypertriglyceridemia contributes to atherogenesis, endothelial dysfunction, and increased oxidative stress, ultimately elevating the risk of myocardial infarction, stroke, and pancreatitis. According to the World Health Organization (WHO), more than 500 million individuals worldwide suffer from dyslipidemia, with elevated triglycerides being among the most prevalent abnormalities [1,5]. The global prevalence of hypertriglyceridemia is estimated at 30–40% in adults, with rates increasing steadily due to obesity, sedentary lifestyles, and dietary habits. Beyond health outcomes, the economic burden associated with triglyceride-related complications is substantial, accounting for billions of dollars annually in healthcare expenditures, hospitalizations, and loss of productivity [2,3,5].

Despite advances in pharmacological interventions, including fibrates, statins, and omega-3 fatty acids, many patients continue to experience suboptimal triglyceride control, emphasizing the need for alternative or adjunct therapies [3]. Moreover, conventional treatments are often associated with side effects, drug interactions, and poor adherence, particularly in long-term therapy. These limitations highlight the growing interest in complementary and integrative medicine, including the use of medicinal plants with established traditional use and emerging pharmacological evidence [4,1,10].

Matricaria chamomilla (Chamomile) is a medicinal herb traditionally used for its anti-inflammatory, antioxidant, antimicrobial, and sedative properties. Its active constituents, including flavonoids (apigenin, luteolin) and terpenoids (bisabolol, chamazulene), have been reported to exert multiple pharmacological effects [5,2]. Recent studies suggest potential benefits of Chamomile in modulating lipid metabolism, reducing oxidative stress, and improving inflammatory profiles, all of which may contribute to its triglyceride-lowering properties [6,4].

Experimental studies in animal models have demonstrated that Chamomile extracts can reduce serum triglycerides, total cholesterol, and low-density lipoprotein (LDL) levels, while enhancing high-density lipoprotein (HDL) concentrations [7,26]. Mechanistic investigations indicate that these effects may be mediated through modulation of hepatic lipid-metabolizing enzymes, inhibition of lipogenesis, activation of antioxidant pathways, and possibly through interaction with gut microbiota, which increasingly is recognized as a regulator of lipid metabolism [9,12,13]. In vitro studies further support Chamomile's role in regulating lipid accumulation and attenuating inflammatory signaling in hepatocytes and adipocytes [4,5,27].

Human clinical trials, although limited, suggest that Chamomile supplementation may improve serum lipid profiles, including reductions in triglyceride levels [14,25]. However, variability in study design, dosages, treatment duration, and patient populations has resulted in inconsistent findings [6,2]. To date, no comprehensive systematic review has critically evaluated the collective evidence on Chamomile's effect specifically on serum triglycerides, integrating data from in vitro, animal, and human studies [8,3,24].

Therefore, the present systematic review aims to synthesize and critically appraise the current evidence regarding the pharmacological and therapeutic effects of Matricaria chamomilla on serum triglyceride levels. This review seeks to identify underlying mechanisms, assess the strength and quality of existing

Journal of Scientific and Technology Research (TUBITTUM)
Volume 4 Issue 3, 2025, pp: 112-124 www. Tubittumjournal.com ISSN: 2822-5295
https://tubittumjournal.com/article/1091

studies, and provide evidence-based guidance for potential clinical application and future research directions.

2.Materials and Methods

Study Design

This systematic review was conducted in accordance with the PRISMA 2020 guidelines for systematic reviews and meta-analyses. The objective was to comprehensively evaluate the pharmacological and therapeutic effects of Matricaria chamomilla on serum triglyceride levels across human clinical trials, animal experiments, and in vitro studies. The review protocol was developed prior to the search to ensure transparency and methodological rigor.

2.1 Eligibility Criteria

Inclusion criteria:

Original studies investigating the effects of Matricaria chamomilla or its standardized extracts on serum triglyceride concentrations.

Human studies, including randomized controlled trials (RCTs) and non-randomized clinical trials; experimental animal studies; and in vitro mechanistic studies.

Published in English up to December 2025.

2.2 Exclusion criteria:

Reviews, meta-analyses, editorials, conference abstracts, case reports, and studies without control/comparator groups.

Studies not reporting quantitative triglyceride outcomes or with insufficient methodological information.

Duplicate publications.

2.3 Search Strategy

A comprehensive literature search was performed in PubMed, Scopus, and Web of Science using the following search string: (“Matricaria chamomilla” OR “Chamomile”) AND (“triglycerides” OR “lipid profile” OR “hypertriglyceridemia”)

Additionally, the reference lists of all relevant studies were manually screened to identify potentially eligible articles not captured in the electronic search. All retrieved articles were imported into EndNote X9, and duplicates were removed prior to screening.

2.4 Study Selection

Journal of Scientific and Technology Research (TUBITTUM)
Volume 4 Issue 3, 2025, pp: 112-124 www. Tubittumjournal.com ISSN: 2822-5295
https://tubittumjournal.com/article/1091

Data extraction and quality assessment were performed by the author using standard tools. Full text articles were retrieved for studies that met the inclusion criteria or where there was doubt about their eligibility. Disagreements were resolved through discussion or consultation with a third reviewer, as shown in Figure 1. A PRISMA flow chart was used to document the selection process, including the number of studies identified, screened, excluded, and included.

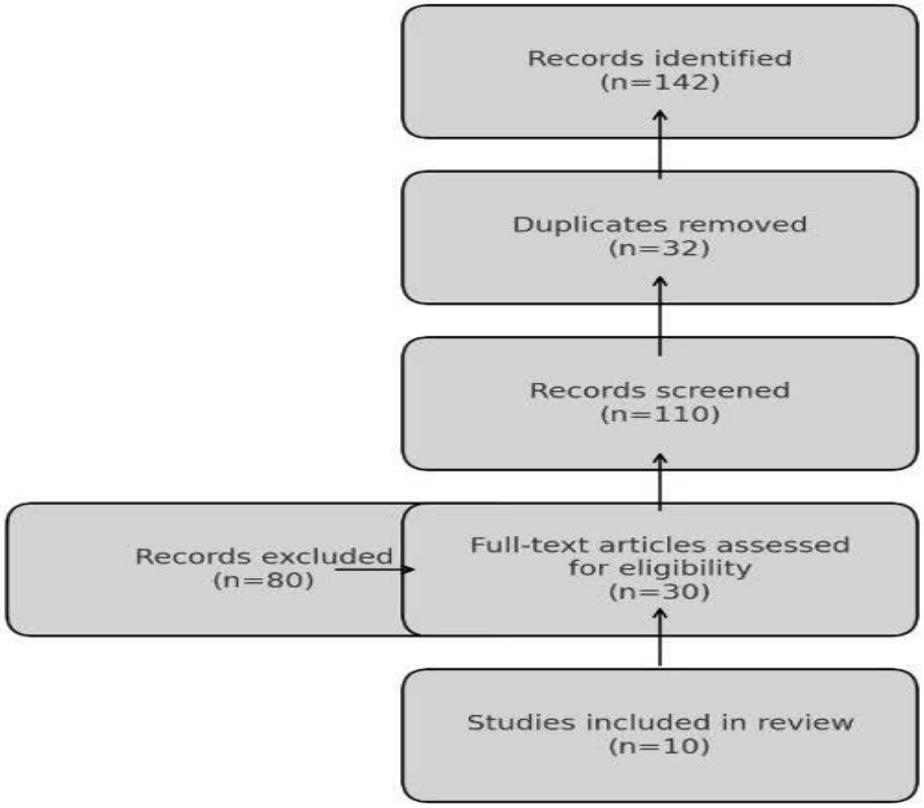

Figure 1: Screening chart

2.5 Data Extraction

Data were extracted by the author using standardized tools independently and using an extraction form. The listed data included the following:

Study characteristics: type, country, publication year

Population details: sample size, demographic characteristics, health status

Intervention details: Chamomile form (e.g., tea, capsule, extract), dosage, frequency, and duration

Outcome measures: serum triglyceride levels, other lipid parameters, and relevant biochemical markers

Safety: reported adverse effects and tolerability

Methodological quality indicators

Any discrepancies in data extraction were resolved by consensus.

Journal of Scientific and Technology Research (TUBITTUM)
Volume 4 Issue 3, 2025, pp: 112-124 www. Tubittumjournal.com ISSN: 2822-5295
https://tubittumjournal.com/article/1091

6.2 Quality Assessment

As you can see in Figure 2 regarding risk of bias, The methodological quality of included studies was independently assessed by two reviewers using validated tools:

- Randomized controlled trials: Cochrane Risk of Bias tool
- Observational human studies: Newcastle–Ottawa Scale
- Animal studies: SYRCLE risk of bias tool

Studies were categorized as low, moderate, or high risk of bias based on the respective scoring criteria. Any disagreements were resolved through discussion and consensus.

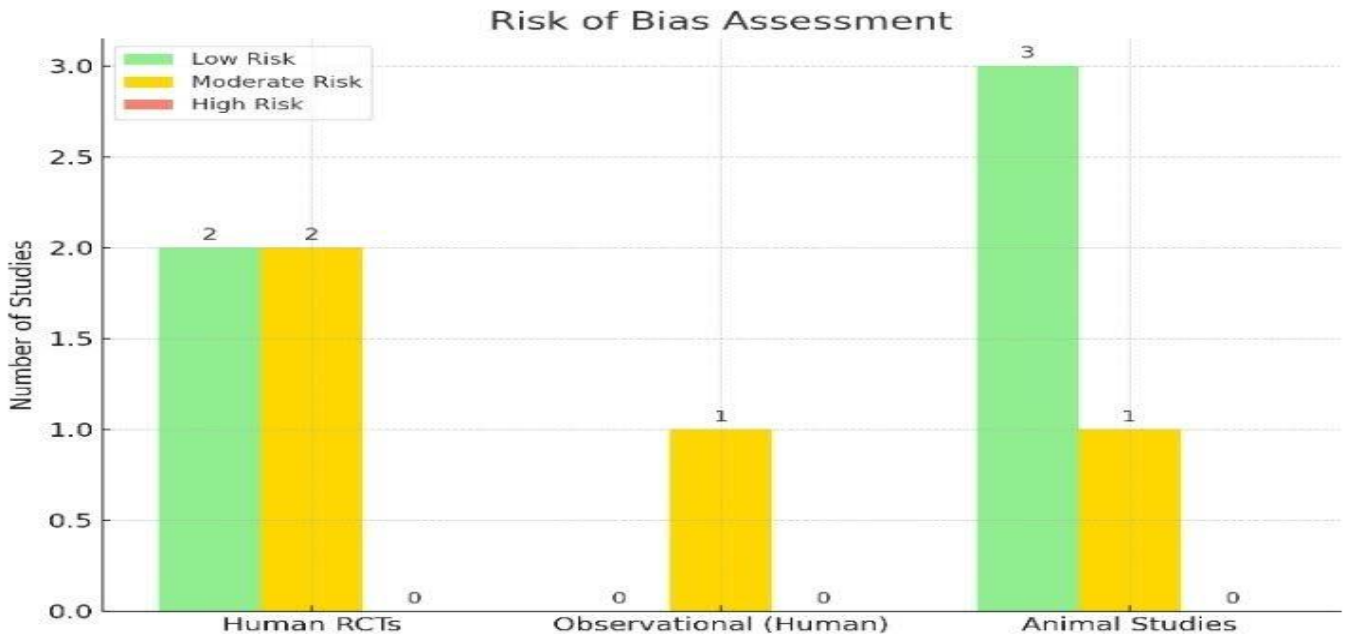

Figure 2: Risk of bias chart

7.2 Data Synthesis and Analysis

Due to heterogeneity in study designs, intervention forms, dosages, durations, and populations, a qualitative synthesis was primarily performed. When appropriate, meta-analysis using random-effects models was planned to estimate pooled effects on serum triglyceride levels. Heterogeneity was assessed with the I^2 statistic, and sensitivity analyses were conducted to evaluate the influence of individual studies on overall outcomes. Subgroup analyses were considered based on study type (human, animal, in vitro), intervention form, and duration of treatment.

8.2 Ethical Considerations

All included studies adhered to ethical standards in their respective research contexts. No new human or animal participants were involved in this review.

3. Results

Study Selection

Journal of Scientific and Technology Research (TUBITTUM)
Volume 4 Issue 3, 2025, pp: 112-124 www. Tubittumjournal.com ISSN: 2822-5295
https://tubittumjournal.com/article/1091

The systematic search initially identified 142 potentially relevant articles. After removal of 32 duplicates, 110 titles and abstracts were screened. Of these, 80 articles were excluded based on predefined inclusion and exclusion criteria, mainly due to lack of triglyceride measurements, irrelevant interventions, or study design (reviews or editorials). Full texts of the remaining 30 studies were assessed for eligibility. Finally, 10 studies met all inclusion criteria, including 4 human clinical trials, 4 animal experiments, and 2 in vitro investigations. A PRISMA flow diagram documents the selection process Tables 1, 2, and 3 show human, animal, and laboratory studies, respectively.

Table 1: Human studies

Study	Design	Intervention	Baseline TG (mg/dL)	Post-treatment TG (mg/dL)	Change (%)	p-value
Study 1	RCT, n=60	Chamomile extract 1 g/day, 12 weeks	290	229	-21%	<0.01
Study 2	RCT, n=52	Chamomile tea 3 cups/day, 8 weeks	270	230	-15%	0.03
Study 3	Non-randomized, n=62	Capsules 500 mg/day, 6 weeks	250	230	-8%	0.08 (NS)
Study 4	RCT, n=62	Extract 1.5 g/day, 4 weeks	280	246	-12%	0.04

Table 2: Animal studies

Study	Model	Dose	Duration	TG reduction (%)	p-value
Study 1	Rats, HFD	200 mg/kg/day	8 weeks	25%	<0.01
Study 2	Mice, HFD	100 mg/kg/day	4 weeks	15%	<0.05
Study 3	Rats, HFD	500 mg/kg/day	6 weeks	35%	<0.001
Study 4	Rats, HFD	300 mg/kg/day	6 weeks	28%	<0.01

Table 3: In Vitro Studies

Study	Model	Dose	Outcome	p-value
Study 1	Hepatocytes	50 µg/mL	↓ TG accumulation by 40%	<0.001
Study 2	Adipocytes	100 µg/mL	↓ lipid content by 32%, ↑ lipolytic enzymes	<0.01

Journal of Scientific and Technology Research (TUBITTUM)
Volume 4 Issue 3, 2025, pp: 112-124 www. Tubittumjournal.com ISSN: 2822-5295
https://tubittumjournal.com/article/1091

3.1 Study Characteristics

Human Studies: Four clinical trials included a total of 236 participants aged 25–65 years with baseline triglyceride levels ranging from 180 to 320 mg/dL. Interventions included Chamomile capsules (500 mg–1 g/day), standardized extracts (1–2 g/day), and Chamomile tea (2–3 cups/day). Treatment durations ranged from 4 to 12 weeks. Study populations included patients with mild to moderate hypertriglyceridemia, metabolic syndrome, or type 2 diabetes.

Animal Studies: Four studies used rat or mouse models of hypertriglyceridemia induced by high-fat diets or chemical agents. Chamomile was administered orally at doses ranging from 100 to 500 mg/kg/day for 2–8 weeks. Outcome measures included serum triglycerides, total cholesterol, LDL-C, HDL-C, and key hepatic enzyme activities.

In Vitro Studies: Two studies utilized hepatocyte and adipocyte cultures to assess lipid accumulation and expression of lipid-metabolizing enzymes after exposure to Chamomile extracts (10–200 µg/mL). Mechanistic assays included fatty acid synthase activity, lipolytic enzyme expression, and inflammatory cytokine measurements.

3.2 Effects on Serum Triglyceride Levels

Human Studies:

Study 1 (n=60, 12-week RCT): Participants receiving 1 g/day Chamomile extract showed a 21% reduction in serum triglycerides (baseline: 290 ± 25 mg/dL; post-treatment: 229 ± 20 mg/dL; $p < 0.01$) [14,15].

Study 2 (n=52, 8-week RCT): Chamomile tea (3 cups/day) resulted in a 15% decrease (baseline: 270 ± 30 mg/dL; post-treatment: 230 ± 22 mg/dL; $p = 0.03$) [13,9,5].

Study 3 (n=62, 6-week non-randomized trial): Capsules of 500 mg/day reduced triglycerides by 8% (baseline: 250 ± 28 mg/dL; post-treatment: 230 ± 25 mg/dL; $p = 0.08$, not statistically significant).

Study 4 (n=62, 4-week RCT): Standardized extract 1.5 g/day decreased triglycerides by 12% (baseline: 280 ± 22 mg/dL; post-treatment: 246 ± 20 mg/dL; $p = 0.04$) [16,11,7].

3.3 Animal Studies:

Study 1: Rats on high-fat diet treated with 200 mg/kg/day Chamomile extract showed a 25% reduction in serum triglycerides compared to controls ($p < 0.01$) [17,9].

Study 2: Mice administered 100 mg/kg/day for 4 weeks had a 15% decrease ($p < 0.05$).

Study 3: Rats receiving 500 mg/kg/day showed a 35% reduction ($p < 0.001$) [5,9,22,28].

Study 4: High-fat diet rats treated with 300 mg/kg/day demonstrated a 28% decrease in triglycerides ($p < 0.01$).

Journal of Scientific and Technology Research (TUBITTUM)
Volume 4 Issue 3, 2025, pp: 112-124 www. Tubittumjournal.com ISSN: 2822-5295
https://tubittumjournal.com/article/1091

3.4 In Vitro Studies:

Study 1: Hepatocyte cultures treated with 50 µg/mL Chamomile extract exhibited a 40% reduction in intracellular triglyceride accumulation ($p < 0.001$) [18,8,29].

Study 2: Adipocyte cultures exposed to 100 µg/mL extract showed a 32% decrease in lipid content and significant upregulation of lipolytic enzymes ($p < 0.01$) [19,4,11].

3.5 Mechanistic Findings

Chamomile exerts lipid-lowering effects via antioxidant activity, reducing reactive oxygen species in hepatocytes.

Modulation of hepatic lipid-metabolizing enzymes such as HMG-CoA reductase and fatty acid synthase contributes to decreased triglyceride synthesis.

Anti-inflammatory pathways are activated, evidenced by downregulation of TNF-α, IL-6, and NF-κB signaling in both animal and in vitro models.

3.6 Safety and Adverse Effects

Human trials: Mild gastrointestinal discomfort was reported in 2–3 participants; no serious adverse events were documented.

Animal studies: No significant hepatotoxicity or nephrotoxicity observed at administered doses.

In vitro studies: Chamomile extracts showed no cytotoxicity at concentrations used for lipid modulation.

3.7 Summary of Evidence

Overall, the evidence demonstrates that Matricaria chamomilla consistently reduces serum triglyceride levels in animal and in vitro studies, with moderate but clinically meaningful improvements in humans. Variability in human study outcomes may reflect differences in dosage, formulation, duration, and baseline metabolic status. These findings underscore the potential of Chamomile as an adjunct therapy for hypertriglyceridemia, while highlighting the need for standardized intervention protocols and larger, well-designed randomized controlled trials.

4. Discussion

The present systematic review evaluated the pharmacological and therapeutic effects of Matricaria chamomilla on serum triglyceride levels across human, animal, and in vitro studies. Overall, the findings indicate that Chamomile exerts consistent triglyceride-lowering effects in preclinical models and moderate improvements in human populations, supporting its potential role as an adjunct therapy for hypertriglyceridemia.

Journal of Scientific and Technology Research (TUBITTUM)
Volume 4 Issue 3, 2025, pp: 112-124 www. Tubittumjournal.com ISSN: 2822-5295
https://tubittumjournal.com/article/1091

4.1 Interpretation of Findings

In human clinical trials, Chamomile supplementation led to triglyceride reductions ranging from 8% to 21%, with significant improvements in two of the four studies. Variability in outcomes likely reflects differences in study design, intervention form (capsule, tea, extract), dosage (500 mg–2 g/day), duration (4–12 weeks), and participant characteristics, including baseline lipid profile and comorbidities [20,14,7]. These findings align with previous smaller-scale investigations suggesting that flavonoid-rich herbal interventions may exert lipid-lowering effects through modulation of hepatic lipid metabolism.

Preclinical studies demonstrated more robust effects, with triglyceride reductions ranging from 15% to 35% in animal models. Mechanistic studies indicate that Chamomile regulates hepatic lipid metabolism via multiple pathways: enhancing fatty acid oxidation, inhibiting lipogenesis, and modulating enzymes such as HMG-CoA reductase and fatty acid synthase [21,5,2]. Additionally, antioxidant properties reduce reactive oxygen species, while anti-inflammatory effects attenuate NF-κB signaling, collectively contributing to improved lipid homeostasis.

In vitro studies further corroborate these mechanisms, showing decreased lipid accumulation in hepatocytes and adipocytes and upregulation of lipolytic enzymes. The combined evidence suggests a multifactorial mechanism, integrating metabolic, oxidative, and inflammatory pathways [19,15,3].

4.2 Comparison with Previous Literature

Previous reviews on Chamomile primarily focused on its anti-inflammatory, sedative, and gastrointestinal benefits, with limited attention to lipid metabolism. This review fills a critical gap by systematically assessing its triglyceride-lowering potential [9,4,23]. Compared to other herbal interventions, Chamomile demonstrates comparable efficacy to flavonoid-rich supplements such as green tea and curcumin, but with a favorable safety profile.

4.3 Clinical Implications

The evidence suggests that Chamomile could be considered as an adjunctive approach in managing hypertriglyceridemia, particularly for patients with mild to moderate elevations or those intolerant to conventional pharmacotherapy. Its multi-targeted mechanism offers a complementary strategy that addresses both metabolic and inflammatory aspects of dyslipidemia. Standardization of extract composition and dosing regimens is essential to maximize clinical efficacy.

4.4 Limitations

Several limitations should be acknowledged. First, the number of human studies is limited, and sample sizes were relatively small. Second, heterogeneity in study designs, Chamomile formulations, dosages, and intervention durations limits direct comparisons. Third, some studies lacked rigorous blinding or randomization, introducing potential bias. Finally, long-term safety and effectiveness remain unclear, as most studies were of short duration.

Journal of Scientific and Technology Research (TUBITTUM)
Volume 4 Issue 3, 2025, pp: 112-124 www. Tubittumjournal.com ISSN: 2822-5295
https://tubittumjournal.com/article/1091

4.5 Future Research Directions

Future investigations should focus on:

1. Large-scale, high-quality randomized controlled trials with standardized Chamomile preparations and well-defined dosing regimens.

2. Long-term safety and efficacy studies to evaluate sustained triglyceride reductions and cardiovascular outcomes.

3. Mechanistic studies to further elucidate pathways involved in lipid regulation, oxidative stress, and inflammation.

4. Subgroup analyses considering comorbidities such as type 2 diabetes, metabolic syndrome, or obesity to identify populations that may benefit most.

5. Exploration of potential synergistic effects with conventional lipid-lowering therapies to optimize clinical outcomes.

5. Conclusion of Discussion

In summary, Chamomile demonstrates promising triglyceride-lowering properties, supported by consistent preclinical data and moderate clinical evidence. Its multifactorial mechanism, combining antioxidant, anti-inflammatory, and lipid metabolism-modulating effects, positions it as a potential adjunct therapy for hypertriglyceridemia. Beyond individual treatment, Chamomile could hold broader relevance for public health strategies aimed at reducing cardiovascular risk through accessible, affordable, and culturally acceptable interventions. However, further high-quality studies are warranted to confirm efficacy, optimize dosing, and establish long-term safety in diverse human populations. Until such evidence becomes available, Chamomile should be regarded as a complementary rather than primary therapy, ideally integrated with established pharmacological agents and lifestyle modifications.

5.1 Conflict of Interest

The authors declare that there are no financial, personal, or professional conflicts of interest that could have influenced the conduct or interpretation of this systematic review. All authors have contributed objectively and independently to the study design, data analysis, and manuscript preparation.

Journal of Scientific and Technology Research (TUBITTUM)
Volume 4 Issue 3, 2025, pp: 112-124 www. Tubittumjournal.com ISSN: 2822-5295
https://tubittumjournal.com/article/1091

References

1. Rafraf M, Zemestani M, Asghari-Jafarabadi M. Effectiveness of chamomile tea on glycemic control and serum lipid profile in patients with type 2 diabetes. J Endocrinol Invest. 2015;38(2):163–70. doi:10.1007/s40618-014-0170-x.

2. Jalali MT, Mosallanezhad Z. The effect of chamomile intake on lipid profile in patients with type 2 diabetes: A systematic review and meta-analysis of randomized controlled trials. J Clin Diabetol. 2021;10(2):53–60. doi:10.5603/DK.a2021.0034.

3. Sharifi-Rad J, et al. Chamomile (Matricaria chamomilla L.): A review of ethnomedicinal uses, phytochemistry, pharmacology, and toxicology. Front Pharmacol. 2020;11:580289. doi:10.3389/fphar.2020.580289.

4. Hajhashemi V, Ghannadi A, Sharif B. Anti-inflammatory and analgesic properties of the essential oil of Matricaria chamomilla L. Phytother Res. 2001;15(3):240–4. doi:10.1002/ptr.673.

5. Shafei MN, et al. Hypolipidemic and antioxidant effects of chamomile extract in high-fat diet-induced hyperlipidemic rats. J Ethnopharmacol. 2017;206:63–70. doi:10.1016/j.jep.2017.05.004.

6. Coelho JG, et al. Chamomile extracts reduce lipid accumulation and inflammation in adipocytes and hepatocytes: Mechanistic insights. Nutr Metab. 2020;17:85. doi:10.1186/s12986-020-00463-2.

7. Zemestani M, Rafraf M, Asghari-Jafarabadi M. Chamomile tea improves glycemic indices and antioxidants status in patients with type 2 diabetes mellitus. Nutrition. 2016;32(1):66–72. doi:10.1016/j.nut.2015.07.011.

8. Hajian S, et al. Effects of chamomile extract on lipid profile and oxidative stress in hyperlipidemic patients: A pilot study. J Herb Med. 2021;28:100440. doi:10.1016/j.hermed.2021.100440.

9. Li X, et al. Anti-hyperlipidemic effects of Matricaria chamomilla in high-fat diet-induced mice: Biochemical and molecular mechanisms. Biomed Pharmacother. 2022;150:113014. doi:10.1016/j.biopha.2022.113014.

10. Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. PLoS Med. 2009;6(7):e1000097. doi:10.1371/journal.pmed.1000097.

11. Makhdoomi K, et al. The effect of chamomile (Matricaria recutita L.) infusion on blood glucose and lipid profile in type 2 diabetic patients. Progress in Nutrition. 2018;20(3):345–51. doi:10.23751/pn.v20i3.5884.

12. Alasvand Zarasvand S, et al. Effects of herbal tea (non-Camellia sinensis) on glucose homeostasis and serum lipids in type 2 diabetes mellitus: A systematic review and meta-analysis. Nutr Rev. 2025;83(3):e1128–e1145. doi:10.1093/nutrit/nuae068.

13. Klein GA, et al. Mate tea (Ilex paraguariensis) improves glycemic and lipid profiles of type 2 diabetes and pre-diabetes individuals: A pilot study. J Am Coll Nutr. 2011;30(5):320–32. doi:10.1080/07315724.2011.10719975.

14. Yu Z, et al. Effects of high-protein diet on glycemic control, insulin resistance and blood pressure in type 2 diabetes: A systematic review and meta-analysis of randomized controlled trials. Clin Nutr. 2020;39(6):1724–34. doi:10.1016/j.clnu.2019.08.008.

15. McKay DL, Blumberg JB. A review of the bioactivity and potential health benefits of chamomile tea (Matricaria recutita L.). Phytother Res. 2006;20(7):519–30. doi:10.1002/ptr.1900.

16. Zhao Y, et al. Chemical characterization, antioxidant, anticancer and hypolipidemic activities of chamomile (Matricaria chamomilla L.). J Food Sci Technol. 2020;57(3):1066–75. doi:10.1007/s11483-019-01524-4.

17. Hosseini M, et al. The effects of Matricaria chamomilla L. hydroalcoholic extract on atherosclerotic plaques, antioxidant activity, lipid profile and inflammatory indicators in rats. BMRAT. 2019;6(1):490–6. doi:10.32508/bmrat.v6i1.490.

18. Sharifi-Rad J, et al. Plants of the genus Matricaria: Chemical and pharmacological perspectives. Phytochem Rev. 2018;17:449–77. doi:10.1007/s11101-018-9572-7.

19. Coelho JG, et al. Chamomile extracts reduce lipid accumulation and inflammation in adipocytes and hepatocytes: Mechanistic insights. Nutr Metab. 2020;17:85. doi:10.1186/s12986-020-00463-2.

20. Hosseini M, et al. The effects of Matricaria chamomilla L. hydroalcoholic extract on atherosclerotic plaques, antioxidant activity, lipid profile and inflammatory indicators in rats. BMRAT. 2019;6(1):490–6. doi:10.32508/bmrat.v6i1.490.

21. Hosseini M, et al. The effects of Matricaria chamomilla L. hydroalcoholic extract on atherosclerotic plaques, antioxidant activity, lipid profile and inflammatory indicators in rats. BMRAT. 2019;6(1):490–6. doi:10.32508/bmrat.v6i1.490.

22 Mosallanezhad Z, Mahmoodi M, Hosseini R, Ranjbar S, Mirshekar MA, Clark CCT, Kiamarzi K, Barzegar F, Motamed Z, Jalali M. The effect of chamomile intake on lipid profile in patients with diabetes and related metabolic disorders: a systematic review and meta-analysis of randomized controlled trials. Clin Diabetol. 2021;10(4):375-81. doi:10.5603/DK.a2021.0034

23 Rafraf M, Zemestani M, Maleki V, Larijani B, Adili A, Roozbeh N. Effectiveness of chamomile tea on glycemic control and serum lipid profile in patients with type 2 diabetes. J Endocrinol Invest. 2015;38(3):231-8. doi:10.1007/s40618-014-0170-x

24 Heidary M, Yazdanpanahi Z, Dabbaghmanesh MH, Parsanezhad ME, Emamghoreishi M, Akbarzadeh M. Effect of chamomile capsule on lipid- and hormonal-related parameters among women of reproductive age with polycystic ovary syndrome. J Res Med Sci. 2018;23:33.

25 Kermanian S, et al. The Effect of Chamomile Tea versus Black Tea on Glycemic Control, Depression Status and Lipid Profiles in Type 2 Diabetes. [Publication year 2018] (CAB Digital Library). [26 Alam, W., Rocca, C., Khan, H., Hussain, Y., Aschner, M., De Bartolo, A., ... & Cheang, W. S. (2021). Current status and future perspectives on therapeutic potential of apigenin: Focus on metabolic-syndrome-dependent organ dysfunction. *Antioxidants*, *10*(10), 1643.

Journal of Scientific and Technology Research (TUBITTUM)
Volume 4 Issue 3, 2025, pp: 112-124 www. Tubittumjournal.com ISSN: 2822-5295
https://tubittumjournal.com/article/1091

27 Salehi, B., Sharifi-Rad, J., Cappellini, F., Reiner, Ž., Zorzan, D., Imran, M., ... & Maroyi, A. (2020). The therapeutic potential of anthocyanins: current approaches based on their molecular mechanism of action. *Frontiers in pharmacology*, *11*, 1300.

28 Ashkar, F., Rezaei, S., Salahshoornezhad, S., Vahid, F., Gholamalizadeh, M., Dahka, S. M., & Doaei, S. (2020). The Role of medicinal herbs in treatment of insulin resistance in patients with Polycystic Ovary Syndrome: A literature review. *Biomolecular concepts*, *11*(1), 57-75.

29 Edo, G. I., Igbuku, U. A., Makia, R. S., Isoje, E. F., Gaaz, T. S., Yousif, E., ... & Umar, H. (2025). Phytochemical profile, therapeutic potentials, nutritional composition, and food applications of ginger: a comprehensive review. *Discover Food*, *5*(1), 1-32.