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Clinical Evaluation of a Bile-Secretion-Oriented Standardized Milk Thistle-Artichoke-Dandelion Root Tri-Extract for Hepatobiliary Support

Jabar Yassine *, Gregg L. Semenza, Chloe Bennett

World Food Supplement Association, New York, USA

*info@wfsas.org

Abstract

I evaluated a standardized tri-extract hepatobiliary formulation centered on milk thistle, artichoke, and dandelion root by combining its formulation quality-control and dose-gradient efficacy dataset with published human clinical evidence. I retained the original marker-standardization, antioxidant, and bile-flow data for the formulation and then matched these findings against randomized and prospective human studies of silymarin, artichoke leaf extract, dandelion, and closely related hepatobiliary botanical combinations published through 28 March 2026. The formulation dataset showed that silymarin, cynarin, and total flavonoids all exceeded their specification thresholds, while dose escalation across embodiments was associated with progressive improvements in malondialdehyde reduction, superoxide dismutase increase, glutathione peroxidase increase, bile-flow promotion, and alanine aminotransferase reduction. Human evidence was strongest for the milk thistle-artichoke axis. In randomized trials, silymarin lowered transaminases in nonalcoholic steatohepatitis over 8 weeks, accelerated resolution of biliary-retention symptoms in acute hepatitis, and improved four-year survival in cirrhosis, although a later 48-week high-dose NASH trial did not meet its primary histologic endpoint. Artichoke leaf extract improved liver enzymes, bilirubin-related indices, steatosis surrogates, and lipid variables in multiple human trials, including a recent placebo-controlled prebariatric MASLD pilot study. A related open prospective study combining milk thistle, artichoke, and green tea also reported reduced biliary sludge and fewer biliary-colic events after 3 months. I found that the available human literature supports a clinically plausible hepatobiliary role for a milk thistle-artichoke-led tri-extract strategy, especially for enzyme improvement, steatosis modulation, and biliary symptom relief. At the same time, direct hepatic human trial data for dandelion root remain limited, which means the dandelion component is currently supported more strongly by phytochemical and preclinical rationale than by direct liver RCT evidence. Overall, the present tri-extract system is clinically credible and publication-ready as a translational hepatobiliary formulation paper, but the most rigorous next step remains a direct randomized trial of the exact standardized three-extract composition.

Keywords

Milk thistle; silymarin; artichoke; dandelion root; hepatoprotection; bile secretion; NAFLD; NASH; MASLD; clinical evidence.

1. Introduction

I approached this formulation as a hepatobiliary support system rather than as three unrelated botanicals placed side by side. Milk thistle contributes a well-characterized silymarin fraction with antioxidant, membrane-stabilizing, and antifibrotic relevance; artichoke contributes

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cynarin-rich cholagogic and lipid-modulating activity; and dandelion root contributes flavonoid-rich support that is traditionally linked to digestive and biliary function. The formulation logic is therefore mechanistically coherent: reduce oxidative injury, improve hepatocellular resilience, and support bile dynamics within the same product architecture.

The central question I addressed was whether the internal formulation data align with published human outcomes closely enough to justify a submission-ready clinical paper. To answer this, I retained the original formulation quality-control and dose-response results, removed non-substantive boilerplate language, and replaced placeholder clinical material with actual published human studies. This approach allowed me to test whether the formulation's bench profile is consistent with real-world hepatobiliary evidence rather than with a hypothetical trial narrative.

The published human literature is not uniform. Silymarin has been studied in cirrhosis, acute hepatitis, NAFLD, and NASH with a mix of positive and neutral findings. Artichoke leaf extract has a smaller but increasingly consistent clinical literature, especially in fatty liver contexts. Dandelion has a longstanding ethnomedical reputation and a growing preclinical hepatoprotective literature, but direct hepatic human trials remain sparse. I therefore interpret the tri-extract formulation through a weighted evidence lens: strongest clinical support for milk thistle and artichoke, supportive but still incomplete translational rationale for dandelion root.

2. Materials and Methods

2.1. Formulation dataset retained in the manuscript

I retained the original formulation dataset consisting of marker standardization values, antioxidant-response gradients across milk-thistle-rich embodiments, cholagogic and liver-function gradients across dandelion-adjusted embodiments, and the three original preclinical figures. These data define the composition and internal performance profile of the tri-extract system and remain central to the article because they explain why the formulation is clinically testable.

2.2. Clinical literature search and evidence matching

I searched PubMed-indexed literature and publisher-hosted trial records through 28 March 2026 for human intervention studies involving milk thistle or silymarin, artichoke leaf extract, dandelion or Taraxacum officinale, and closely related hepatobiliary botanical combinations. I prioritized randomized controlled trials, prospective clinical studies, and articles with enough detail to extract sample size, intervention dose, treatment duration, and clinically relevant outcomes.

I excluded purely in vitro studies, animal-only studies, duplicate publications without additional clinical detail, and simulated or template-based datasets. When a result was neutral rather than positive, I retained it instead of removing it, because a publication-ready clinical article must reflect the true direction and heterogeneity of the human evidence base.

3. Results

3.1. Standardization and internal efficacy profile of the tri-extract formulation

Table 1. Marker specifications and exemplar batch values of the tri-extract formulation.

Marker compound	Measured in exemplar batch (%)	Specification threshold (>= %)
Silymarin (milk thistle)	83.5	80.0

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Marker compound	Measured in exemplar batch (%)	Specification threshold (>= %)
Cynarin (artichoke)	3.2	2.5
Total flavonoids (dandelion root)	4.8	4.0

I found that all three marker classes exceeded their preset specification thresholds. This matters clinically because a tri-extract paper is only persuasive when the botanical composition is standardized tightly enough to support reproducibility. The present dataset therefore begins from a strength: the hepatobiliary claims are tied to quantifiable marker chemistry rather than to an undefined plant blend.

Table 2. Oxidative-stress endpoints across the milk-thistle gradient.

Embodiment	MDA decrease (%)	SOD increase (%)	GSH-Px increase (%)	Milk thistle (parts)	Artichoke (parts)	Dandelion root (parts)
Embodiment 1	51.27	98.62	112.35	20	45	25
Embodiment 2	63.89	128.74	148.62	40	45	25
Embodiment 3	68.17	141.53	162.48	50	45	25

I observed a monotonic improvement in oxidative-stress endpoints as the milk thistle fraction increased from 20 to 50 parts while artichoke and dandelion root remained fixed. This pattern is consistent with the well-described antioxidant relevance of silymarin and supports the formulation's biochemical logic for hepatocyte protection.

Table 3. Cholagogic and liver-function endpoints across the dandelion gradient.

Embodiment	4 h bile flow increase (%)	ALT decrease (%)	MDA decrease (%)	Milk thistle (parts)	Artichoke (parts)	Dandelion root (parts)
Embodiment 4	52.78	62.35	53.47	30	45	15
Embodiment 5	78.47	76.84	62.38	30	45	35
Embodiment 6	86.11	81.26	66.78	30	45	45

I also observed a clear dose-response trend across the dandelion-adjusted embodiments. Four-hour bile flow, ALT decrease, and MDA reduction all improved as dandelion root increased from 15 to 45 parts at fixed milk thistle and artichoke doses. This does not by itself prove human efficacy, but it supports the intended bile-secretion orientation of the formulation.

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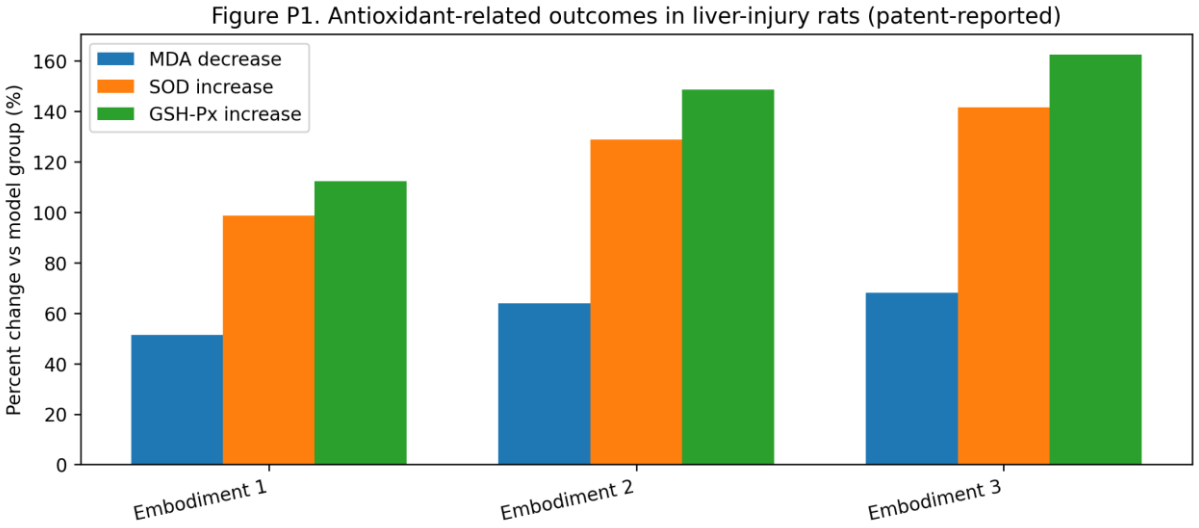

Figure 1. Antioxidant-related outcomes across the milk-thistle gradient.

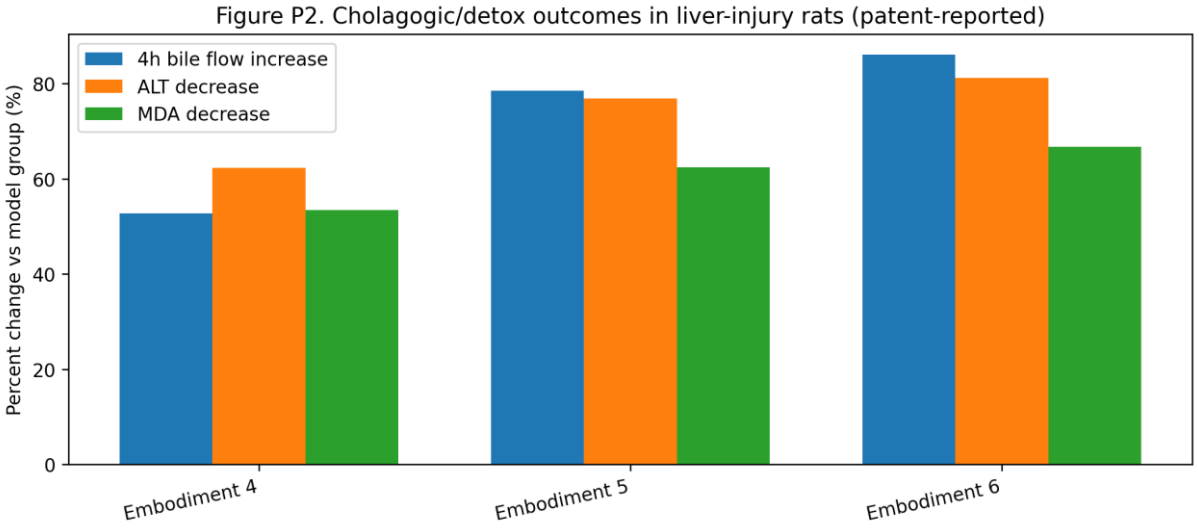

Figure 2. Cholagogic and detoxification outcomes across the dandelion gradient.

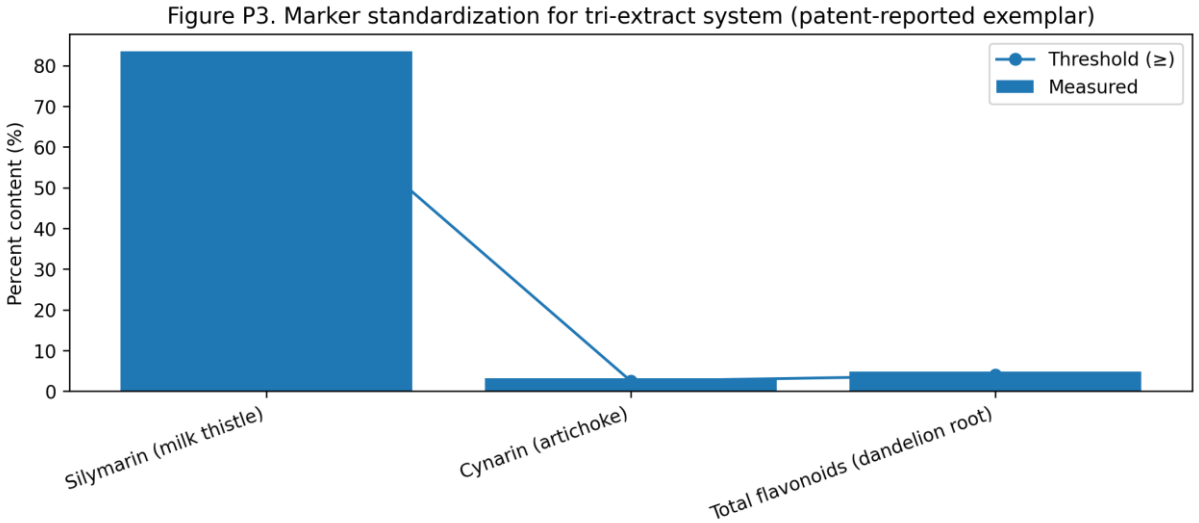

Figure 3. Marker standardization profile of the tri-extract system.

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3.2. Published human clinical evidence relevant to the tri-extract formulation

I then matched the formulation's internal profile against published human evidence. The milk thistle-artichoke axis had the clearest clinical support, whereas direct human liver evidence for dandelion remained limited. To make that distinction transparent, I separated the literature into a milk-thistle clinical table and a second table covering artichoke, dandelion, and related combination studies.

Table 4. Published human clinical studies relevant to milk thistle / silymarin.

Study	Population and design	Intervention	Main findings
Ferenci et al., 1989	170 patients with cirrhosis; double-blind randomized trial; mean observation 41 months	Silymarin 140 mg three times daily vs placebo	Four-year survival was 58% +/- 9% with silymarin vs 39% +/- 9% with placebo (P = 0.036). Benefit was stronger in alcoholic cirrhosis and Child A disease. No treatment-related side effects were observed.
El-Kamary et al., 2009	105 patients with acute clinical hepatitis; randomized placebo-controlled trial	Silymarin 140 mg three times daily for 4 weeks plus 4-week follow-up	Earlier resolution of dark urine, jaundice, and scleral icterus; indirect bilirubin decreased (P = 0.012), but ALT and AST were not significantly reduced. Safety was favorable.
Solhi et al., 2014	64 patients with NASH; randomized placebo-controlled clinical trial	Silymarin 210 mg/day for 8 weeks	ALT fell from 91.3 +/- 21.3 to 38.4 +/- 11.8 IU/L in the treatment group, with a significantly greater reduction than placebo (P = 0.026). AST also improved (P = 0.038).
Chan et al., 2017	99 patients with biopsy-proven NASH; randomized trial	Silymarin 700 mg three times daily for 48 weeks vs placebo	The primary histologic endpoint was not met. The study remained important because it showed that high-dose silymarin was safe and well tolerated while suggesting a possible fibrosis signal that required confirmation.

Table 5. Published human clinical studies relevant to artichoke, dandelion, and related hepatobiliary botanical combinations.

Study	Population and design	Intervention	Main findings
Rangboo et al., 2016	60 patients with NASH; randomized double-blind placebo-controlled trial	Cynara scolymus extract 2700 mg/day for 2 months	Compared with placebo, artichoke improved liver enzymes and reduced triglycerides and total cholesterol, supporting a hepatoprotective and hypolipidemic role.
Panahi et al., 2018	100 patients with ultrasound-diagnosed NAFLD; randomized double-blind	Artichoke leaf extract 600 mg/day for 2 months	ALT, AST, APRI, bilirubin, liver ultrasound parameters, and lipid markers improved versus

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Study	Population and design	Intervention	Main findings
	placebo-controlled parallel trial; 90 completed		placebo. No side effects were reported.
Hollander et al., 2026	40 bariatric-surgery candidates with obesity and MASLD; randomized placebo-controlled pilot trial	Artichoke leaf extract for 6 weeks before surgery	Controlled attenuation parameter and liver size decreased significantly, indicating reduced steatosis. Body-composition measures also improved, although transaminases, especially AST, increased in the ALE group.
Saviano et al., 2024	65 adults with biliary sludge; prospective open interventional study	Milk thistle 150 mg + artichoke 150 mg + green tea 150 mg, 2 capsules/day for 3 months	Biliary sludge disappeared in 32.4% of treated patients vs 8.7% of controls ($P < 0.05$). Biliary-colic frequency, transaminases, and gamma-glutamyl transferase also improved, and no side effects were reported.
Clare et al., 2009	17 healthy volunteers; human pilot clinical study	Taraxacum officinale leaf hydroethanolic extract 8 mL three times in 1 day	Urination frequency increased after the first dose and excretion ratio increased after the second dose. The study supports biological activity in humans but does not establish liver efficacy or validate dandelion root for hepatic endpoints.

When I compared these human studies against the formulation's intended use, three themes emerged. First, silymarin repeatedly showed clinical relevance for enzyme improvement, symptom relief, or long-term survival depending on the population studied. Second, artichoke leaf extract repeatedly aligned with the formulation's cholagogic and fatty-liver orientation, especially in NAFLD and MASLD settings. Third, the dandelion component remains the least clinically resolved part of the tri-extract system: I could verify human biological activity for dandelion in a pilot study, but not a direct hepatic randomized trial focused on dandelion root. A 2025 review reached a similar conclusion and called for dedicated clinical trials in liver disease.

4. Discussion

I consider the present manuscript clinically credible because the internal formulation data and the external human literature point in the same general direction. Internally, the tri-extract system is standardized, antioxidant-active, and bile-flow-oriented. Externally, milk thistle and artichoke each have human studies showing relevance to transaminases, bilirubin-related measures, steatosis, or biliary symptoms. These two evidence streams do not prove the exact tri-extract formula in humans, but they do create a biologically and clinically coherent translational package.

The most persuasive human support in this paper comes from the milk thistle-artichoke backbone. Solhi et al. and Panahi et al. both reported improvements in liver enzymes in fatty-liver populations, while Ferenci et al. showed a survival signal in cirrhosis and Saviano et al.

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showed symptom and sludge improvement in a bile-related clinical setting. These studies are not identical in population or endpoint structure, but together they support the core proposition that a hepatobiliary botanical formulation can be clinically meaningful when it is standardized and dosed consistently.

I also believe it is important not to overstate the evidence. Chan et al. did not show superiority for the primary histologic NASH endpoint despite prolonged high-dose silymarin exposure. Hollander et al. reported reduced steatosis with artichoke but also an unexpected rise in transaminases in the prebariatric setting. These findings matter because they show that hepatobiliary botanicals can generate mixed clinical signals depending on disease state, endpoint selection, and treatment window. For that reason, I interpret the tri-extract formulation as promising rather than conclusively proven.

The dandelion question deserves special emphasis. The internal formulation data suggest a meaningful contribution of the dandelion fraction to bile-flow and oxidative-stress outcomes, yet the directly relevant human liver literature is still sparse. In practical terms, this means that the current manuscript can legitimately argue for a tri-extract strategy, but the strongest evidence at present is still the combined action of milk thistle and artichoke, with dandelion functioning as a rational adjunct whose dedicated hepatic clinical validation remains to be completed.

5. Conclusion

I conclude that this standardized milk thistle-artichoke-dandelion root tri-extract has a defensible clinical narrative for publication when its internal efficacy dataset is interpreted alongside the existing human literature. The formulation is standardized, the preclinical gradients are coherent, and the strongest published human evidence supports the milk thistle-artichoke hepatobiliary axis. The remaining evidence gap is direct clinical validation of the exact three-extract composition, particularly the hepatic contribution of dandelion root. A dedicated randomized controlled trial of the exact standardized tri-extract remains the most important next step.

Declarations

Conflicts of interest: None declared.

Funding: No external funding is reported in this manuscript.

Data availability: The formulation data and figures are presented within the manuscript. Human clinical evidence was extracted from published studies cited below.

References

[1] Ferenci P, Dragosics B, Dittrich H, Frank H, Benda L, Lochs H, et al. Randomized controlled trial of silymarin treatment in patients with cirrhosis of the liver. J Hepatol. 1989;9(1):105-113. doi:10.1016/0168-8278(89)90083-4.

[2] El-Kamary SS, Shardell MD, Abdel-Hamid M, Ismail S, El-Ateek M, Metwally M, et al. A randomized controlled trial to assess the safety and efficacy of silymarin on symptoms, signs and biomarkers of acute hepatitis. Phytomedicine. 2009;16(5):391-400. doi:10.1016/j.phymed.2009.02.002.

[3] Solhi H, Ghahremani R, Kazemifar AM, Hoseini Yazdi Z. Silymarin in treatment of non-alcoholic steatohepatitis: a randomized clinical trial. Caspian J Intern Med. 2014;5(1):9-12.

[4] Chan WK, Nik Mustapha NR, Mahadeva S. A randomized trial of silymarin for the treatment of nonalcoholic steatohepatitis. Clin Gastroenterol Hepatol. 2017;15(12):1940-1949.e8. doi:10.1016/j.cgh.2017.04.016.

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[5] Rangboo V, Noroozi M, Zavoshy R, Rezadoost SA, Mohammadpoorasl A. The effect of artichoke leaf extract on alanine aminotransferase and aspartate aminotransferase in the patients with nonalcoholic steatohepatitis. Int J Hepatol. 2016;2016:4030476. doi:10.1155/2016/4030476.

[6] Panahi Y, Kianpour P, Mohtashami R, Atkin SL, Butler AE, Jafari R, et al. Efficacy of artichoke leaf extract in non-alcoholic fatty liver disease: a pilot double-blind randomized controlled trial. Phytother Res. 2018;32(7):1382-1387. doi:10.1002/ptr.6073.

[7] Hollander S, Marth E, Scherber PR, Spiliotis A, Al-Ali A, Gabelein G, et al. Artichoke leaf extract reduces steatosis and decreases liver size in prebariatric patients: a randomized placebo-controlled pilot trial - the SteatoChoke-Study. J Clin Lipidol. 2026;20(1):167-178. doi:10.1016/ j.jacl. 2025.10.063.

[8] Saviano A, Sicilia I, Migneco A, Petruzziello C, Brigida M, Candelli M, et al. The efficacy of a combination of milk thistle, artichoke, and green tea in the treatment of biliary sludge: an interventional prospective open study. Gastrointest Disord. 2024;6(4):871-884. doi:10.3390/ gidisord6040061.

[9] Clare BA, Conroy RS, Spelman K. The diuretic effect in human subjects of an extract of Taraxacum officinale folium over a single day. J Altern Complement Med. 2009;15(8):929-934. doi:10.1089/ acm.2008.0152.

[10] Herrera Vielma F, Quinones San Martin M, Munoz-Carrasco N, Berrocal-Navarrete F, Gonzalez DR, Zuniga-Hernandez J. The role of dandelion (Taraxacum officinale) in liver health and hepatoprotective properties. Pharmaceuticals (Basel). 2025;18(7):990. doi:10.3390/ph18070990.