Journal of Postgraduate Institute of Indigenous Medicine (JPGIIM) Vol. 1, No.1, December 2025, ISSN: 3051-522X (Online)

Efficacy of *Phalatrikadi Kwatha* and *Triphala Guggulu* in Patients with Non-Alcoholic Fatty Liver Disease: A Pilot Single-Arm Interventional Study

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ABSTRACT

Non-alcoholic fatty liver disease (NAFLD), closely associated with metabolic syndrome, is characterized by fat accumulation in the liver independent of alcohol consumption. Although Ayurvedic formulations such as *Phalatrikadi Kwatha* and *Triphala Guggulu* are traditionally recommended for liver disorders, their specific role in NAFLD remains underexplored. This pilot single-arm interventional study aimed to evaluate their efficacy in the management of NAFLD. Five patients (n = 5) with ultrasonography-confirmed NAFLD were recruited from two Ayurveda hospitals in Sri Lanka and treated with *Phalatrikadi Kwatha* (120 ml twice daily) and *Triphala Guggulu* (500 mg twice daily) for 60 days, with follow-up every 15 days. Clinical symptoms, biochemical and haematological parameters, anthropometric measures, and ultrasonography findings were assessed before and after treatment. Marked symptomatic relief, with fatigue, abdominal pain, and nausea improving by up to 97%. Liver enzymes showed notable reductions, with AST decreasing by 10.2 U/L and ALT by 20 U/L, indicating improved hepatic function. Lipid profiles improved with reductions in total cholesterol, LDL, and triglycerides, and a concomitant increase in HDL. Renal function showed mild enhancement without adverse effects. However, ultrasonography findings revealed no significant change in fatty liver grades, suggesting that structural improvement may require a longer treatment duration. As a pilot feasibility study, these results are preliminary and larger controlled trials of longer duration are needed to validate the findings and determine long-term effects. Overall, *Phalatrikadi Kwatha* and *Triphala Guggulu* appear promising in alleviating symptoms and improving biochemical markers in NAFLD.

Keywords: Liver diseases, Non-Alcoholic Fatty Liver Diseases, Ayurveda, *Phalatrikadi Kwatha*, *Triphala Guggulu*

Recommended Citation: Perera, K. P. D. C., & Kulatunga, R. D. H. (2025). Efficacy of *Phalatrikadi Kwatha* and *Triphala Guggulu* in patients with non-alcoholic fatty liver disease: A pilot single-arm interventional study. *Journal of Postgraduate Institute of Indigenous Medicine*, 1(1), 35–53. Postgraduate Institute of Indigenous Medicine.

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Introduction

Ayurveda, the ancient system of medicine, highlights the crucial role of the liver (*yakrit*) in maintaining overall health, as detailed in classical texts like the Charaka Samhita. The liver, along with the spleen (*pleeha*), is considered the primary site for the origin of *raktavahasrotas*, the channels responsible for blood circulation (Sharma & Dash, 2022). Furthermore, the liver is identified as the seat of *ranjaka pitta*, a subtype of *pitta dosha* (Murthy, 2015) (Murthy, 2007) (Murthy, 2011), which is instrumental in transforming nutrient plasma (*apya rasa dhatu*) into blood tissue (*rakta dhatu*) (Deva, 2002). This underscores the liver's essential role in metabolic processes and blood formation in the body.

In the allopathic medical framework, the liver is similarly recognized as a vital organ, being the largest gland and a key player in numerous physiological functions (Vernon *et al,* 2022). It is in the right upper quadrant of the abdomen. The prominence of liver diseases on a global scale, in 2016, liver diseases became a significant global health concern, ranking as the 11th leading cause of death and the 15th leading cause of morbidity worldwide (Sumeet *et al,* 2019). The data also highlighted a gender disparity in mortality, with about two-thirds of deaths occurring in men and one-third in women. These findings emphasize the widespread impact of liver diseases and the necessity for increased awareness, early detection, and targeted public health strategies to tackle this major health issue globally (NOMIS, 2022). This health burden is exacerbated by chronic liver diseases (CLD), which lead to progressive liver damage and conditions like fibrosis and cirrhosis (Chalasni *et al,* 2019).

Among liver diseases, Fatty Liver Disease (FLD), also known as hepatic steatosis (HS), is notably prevalent. It encompasses Alcoholic Fatty Liver Disease (AFLD) and Non-Alcoholic Fatty Liver Disease (NAFLD). AFLD results from excessive alcohol consumption, while NAFLD affects those who consume little to no alcohol (Enjoji *et al,* 2013). NAFLD is associated with metabolic syndrome components, such as obesity and insulin resistance (Chalasni *et al,* 2019) and can encompass a spectrum of liver conditions characterized by the accumulation of fat in the liver ranging from simple steatosis to more severe forms such as Non-Alcoholic Steatohepatitis (NASH), and if the untreated more severe form that can lead to significant health risks such as cirrhosis and hepatocellular carcinoma (Brown & Kleiner, 2016). With rising prevalence worldwide, NAFLD places a considerable burden on healthcare systems, necessitating effective

strategies for prevention, early detection, and management to mitigate its adverse impacts on public health.

Ayurveda literature correlates the symptoms and progression of NAFLD with various liver diseases, emphasizing conditions like *pandu*, *kamala*, *raktapitta*, and *udara roga.* The end stage specially corelates with *yakriddalyudara* (Remya & Mandip, 2017). Considering the symptoms of Non-Alcoholic Fatty Liver Disease it is more specific with *kaphaja Udara* (Perera & Kulathunga, 2021). Additionally, *udara roga* including other Ayurveda emphasizes the causes especially due to *mandagni* (Murthy, 2003). Oxidative stress is identified as a significant factor in the development and progression of NAFLD, and it necessitates antioxidant therapy (Andrea *et al,* 2020). According to Ayurveda, it can be correlated to the *ama* produced by the *mandagni*, and *ama pachana* is the best treatment modality for it. Ayurvedic interventions, with their holistic approach and emphasis on lifestyle modifications, may offer complementary and sustainable solutions for managing NAFLD, addressing root causes, and promoting overall well-being. The implications of such health conditions extend beyond personal health, as managing these complications incurs significant healthcare costs. Therefore, the integration of specialized Ayurvedic treatments is crucial for addressing NAFLD effectively.

Ayurvedic herbal remedies are renowned for their minimal side effects and their capacity to support liver function, balance Pitta, and alleviate liver congestion. These remedies can enhance bile flow, aid in enzymatic detoxification, nourish the liver, and stabilize liver health. Evaluating the effectiveness of specific Ayurvedic formulations in treating NAFLD is therefore essential. By integrating Ayurvedic management principles, a more comprehensive approach to managing liver conditions can be achieved. This involves the use of herbal and mineral formulations known for their antioxidant and anti-inflammatory properties (Li et al., 2014). Notable treatments for NAFLD in Ayurveda include *Phalatrikadi Kwatha* (Tripathi, 2002; Srivastava, 2015; Shastri, 2004, 2010) and *Triphala Guggulu* (Nagodavithana, 2001; Shastri, 2004; Tripathi, 2002), both recognized for their efficacy in promoting liver health.

Phalatrikadi Kwatha is a classical formulation containing eight key ingredients, *Amalaki* (dried peri cap of *Phyllanthus emblica*), *Haritaki* (dried peri cap of *Terminalia chebula*), *Vibhitaka* (dried fruits of *Terminalia belerica*), *Amrita* (stems of *Tinospora cordifolia*), *Vasa* (roots of *Adhatoda vasica* L.), *Tikta/Katuka* (plants of *Picrorhiza kurroa*), *Bhunimba* (plants of *Andrographis paniculata*), and

Nimba tvak (bark of *Azadirachta indica*) (Shastri, 2010). In Ayurveda, these ingredients are recognized for their *kamalahara* properties, including *Pitta-Kapha shamaka, Yakriduttejaka, Shothahara, Pandurogahara, Rechana*, and *Deepana*.

Table 1: summarizes the ingredients and their pharmacological properties (Shetty & Babu, 2012).

S. No	**Ingredients**	**Botanical Names**	**Parts Used**	**Properties**
1	*Haritaki*	*Terminalia chebula*	Dried peri cap	*Pittahar, Pittarechak, Yakriduttejak, Deepan, Rechan, Pachak, Shothhara, Jwarahara, Kamala and Panduhara, Yakrit and Raktvikarhara, Tridoshhar, Rashayan, Mutrajanana, Pittasarak, Anulomak, Shwedak, Dahaprashaman and Raktapittahara*
2	*Vibhitaka*	*Terminalia belerica*	Dried peri cap	
3	*Amalaki*	*Phyllanthus emblica*	Dried fruit	
4	*Amrita*	*Tinospora cordifolia*	Stem	
5	*Vasa*	*Adhatoda vasica L.*	Stem	
6	*Tikta (Katuka)*	*Picrorhiza kurroa*	Rhizome	
7	*Bhunimba*	*Andrographis paniculata*	Whole plant	
8	*Nimba tvak*	*Azadirachta indica*	Bark	

Triphala Guggulu (TG) comprises *Haritaki* (*Terminalia chebula*), *Vibhitaki* (*Terminalia belerica*), *Amalaki* (*Phyllanthus emblica*), *Pippali* (*Piper longum*), and *Guggulu* (*Commiphora mukul*) (Nagodavithana, 2001). This formulation is commonly used for *Medoroga* and is known for its *Pitta-Kapha shamaka, Shothahara, Yakriduttejaka, Rechana*, and *Deepana* properties.

Table 2: elaborates the pharmacological properties of these ingredients (Shetty & Babu, 2012).

S. No	***Ingredients***	***Botanical Names***	**Parts Used**	***Properties***
1	*Haritaki*	*Terminalia chebula*	Dried peri cap	*Deepana, Pachana, Rechana, Amahara, Medohara, Vatahara, Arsha, Hridya, Trutahara, Kustha, Varnya, Rasayani, Swara, Balya, Dahahara, Mehahara, Kamala hara, Pramehagna*
2	*Vibhitaka*	*Terminalia belerica*	Dried peri cap	
3	*Amalaki*	*Phyllanthus emblica*	Fruits	
4	*Pippali*	*Piper longum*	Fruits	
5	*Guggulu*	*Commiphora mukul*	Resin	

With the diverse pharmacological properties of these two formulations, they play a significant role in supporting liver function, improving digestion and metabolism, reducing inflammation, and promoting overall well-being. Their use in the present study is therefore justified for addressing both the primary and secondary outcomes in the management of NAFLD.

Objective of the study

This pilot single-arm interventional study aimed to investigate the impact of *Phalatrikadi Kwatha* and *Triphala Guggulu* on five patients with Non-Alcoholic Fatty Liver Disease (NAFLD). Specifically, it focused to assess the effectiveness of these Ayurvedic formulations in improving both the subjective and objective parameters of NAFLD patients.

Methodology

Sample Selection

This study focused on five (n = 5) patients diagnosed with Non-Alcoholic Fatty Liver Disease (NAFLD). Participants were recruited from the outpatient departments of the Provincial Ayurveda Hospital, Meegoda, and the National

Ayurveda Teaching Hospital, Borella. A purposive sampling method was employed to ensure that enrolled patients met the inclusion criteria relevant to the study objectives and were available for close follow-up as this was a pilot single-arm interventional study, purposive sampling was used for preliminary assessment. Being a non-probability method, it limits the external generalizability of the findings, which should therefore be interpreted as exploratory and hypothesis-generating.

Inclusion Criteria

Diagnosed patients with NAFLD via clinical evaluation and relevant diagnostic tests, age between 18 to 65 years, willingness to participate and provide informed consent, and availability of follow-up visits as required by the study protocol were the inclusion criteria.

Exclusion Criteria

Patients with a history of significant alcohol consumption, presence of other chronic liver diseases (e.g., viral hepatitis, autoimmune liver disease), patients currently undergoing treatment with hepatotoxic drugs, pregnant or lactating women, and individuals with severe comorbid conditions that could interfere with the study outcomes were the exclusion criteria.

Study Design

The study was designed as a pilot single-arm interventional investigation to evaluate the efficacy of two Ayurvedic formulations, *Phalatrikadi Kwatha* and *Triphala Guggulu*, in the management of Non-Alcoholic Fatty Liver Disease (NAFLD).

Treatment Protocol

Patients received a two-month treatment regimen consisting of *Phalatrikadi Kwatha* and *Triphala Guggulu*, administered orally and treatment schedule with prescribed dosages shown in table 3.

Table 3: Treatment schedule

Drug	Dose	Time	Duration
Phalatrikadi Kwatha	120 ml (1/2 *patha*)	6:00 a.m. and 6:00 p.m.	08 weeks
Triphala Guggulu	1 g (2 *vati*)	6:00 a.m. and 6:00 p.m.	08 weeks

Participants were provided with pre-measured packets containing 60 g of *Phalatrikadi Kwatha* and 56 tablets of *Triphala Guggulu*. They were instructed to prepare the *Kwatha* by boiling one packet in 960 ml of water, reducing it to 240 ml, and consuming 120 ml twice daily. *Triphala Guggulu* were taken with lukewarm water after meals. As this was a single-arm study, all five participants received the combined treatment regimen, and no separate grouping or randomization was applied.

Data Collection

Data collection was conducted using a specially designed proforma, structured to gather comprehensive information on each participant. This proforma included demographic details, medical history, and both subjective and objective clinical parameters. Assessments were performed before and after the treatment, with biweekly evaluations of subjective parameters at each follow-up.

Demographic Information

The demographic section of the proforma captured essential participant information such as age, gender, occupation, socioeconomic status, and lifestyle factors. This data was essential for understanding the population characteristics and the correlations between demographic factors and the progression or management of NAFLD.

Medical History

A detailed medical history was obtained for each participant, focusing on aspects relevant to NAFLD. This included: history of liver diseases or related conditions, details of any current or past treatments for liver-related issues, information on comorbid conditions, such as diabetes, hypertension, and cardiovascular diseases, and documentation of alcohol consumption, smoking habits, and other lifestyle factors that could impact liver health.

Clinical Parameters

Clinical parameters were recorded in before and after the treatments for evaluating treatment efficacy, covering both subjective and objective parameters.

Subjective Parameters

Subjective parameters including fatigue, abdominal discomfort, appetite status, nausea, and liver-related symptoms such as right upper quadrant pain, were assessed. Quality of Life of the participants were considered according to their overall well-being and daily functioning using standardized quality of life scales (Burckhardt & Anderson, 2003). This included aspects such as physical, mental, as well as social.

Objective Parameters

Objective parameters were Liver Function Tests (LFTs), Lipid Profile- Initial assessment of Total cholesterol, HDL-Cholesterol, LDL-Cholesterol and triglycerides, Kidney Function Tests- baseline serum creatinine assessed to ensure renal health and rule out pre-existing kidney issues, Ultrasonography Findings- initial imaging of the liver to document liver size, fatty infiltration, and any structural abnormalities, and anthropometric Measurements- recording of height, weight, body mass index (BMI), and waist circumference to assess the physical status and risk factors associated with metabolic syndrome.

Assessment

Assessments were conducted both pre-treatment and post-treatments to evaluate the effectiveness of the Ayurvedic formulations, *Phalatrikadi Kwatha* and *Triphala Guggulu*, in managing NAFLD. The assessments included symptom

assessments to track improvements in fatigue, abdominal pain, and other liver-related symptoms, evaluation of the quality of life using validated scales, liver function tests, lipid profiles to assess changes in cholesterol and triglyceride levels, kidney function tests to ensure no adverse effects on renal health to monitor biochemical changes, and ultrasonography to observe changes in liver size and condition.

Follow up monitoring

Participants were followed up bi-weekly for the two months and assessments were performed at the beginning and end of the treatment period based on the criteria mentioned above. During the follow-up period identified the experiences of symptoms and any adverse effects or new symptoms related to the disease. And a reinforcement of treatment adherence and lifestyle modification advice.

Data analysis

Due to the small sample size of five patients in this observational study, visual analysis methods were employed to evaluate the impact of the Ayurvedic formulations on NAFLD.

Results and Discussion

Demographic Profile and Clinical Profile

Age group and gender distribution

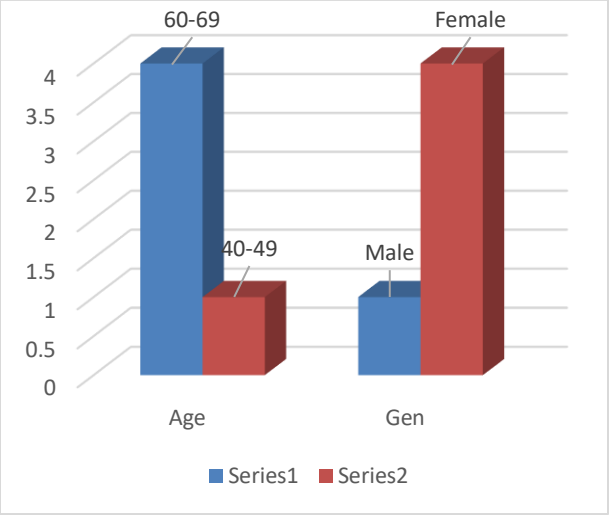

Figure 1: Shows the age and gender distribution of the patients

The study enrolled five patients with ultrasonography confirmed NAFLD. The age group and gender distribution shows in figure 1 and it identified the concentration of patients in the older age category. Four out of the five patients fell within the 60-69 age group, highlighting a predominance of older individuals in the study sample. The remaining participants belonged to the 40-49 age group.

***Prakruti* distribution**

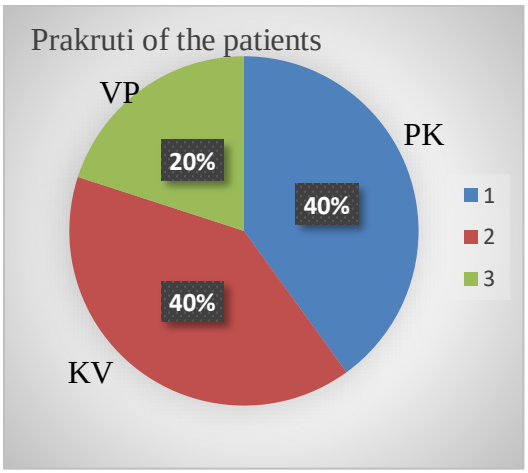

Figure 2: shows the *prakruti* involvement of the patients

The analysis of the *Prakruti* (constitution) involvement shows in figure 2 and among the five patients participating in this observational study revealed that, *Vata-Pitta prakruti* one patient (20%), *Pitta-Kapha prakruti* two patients (40%) and *Kapha-Vata prakruti* two patients (40%). This distribution highlights the variability in the constitutional types of the patients affected by Non-Alcoholic Fatty Liver Disease (NAFLD). The dominance of *Kapha dosha* in these combinations suggests that imbalances associated with *Kapha*, such as sluggish metabolism, accumulation of fat, and impaired digestion, could be contributing factors to the development and progression of NAFLD.

BMI (Body Mass Index) involvement

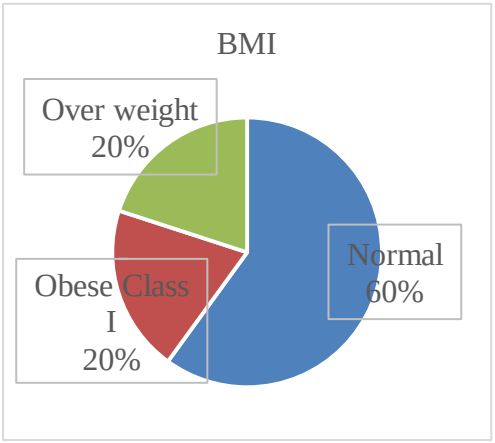

Figure 3: BMI involvement of the patients

BMI involvement among the five patients is shown in figure 3 and within this observational study participants BMI identified in three distinct groups including normal BMI, overweight, and obese class 1. Normal BMI identified within three out of five patients (60%), Overweight- one patient (20%), and Obese Class 1- one patient (20%). This distribution indicates a significant presence of patients with normal BMI (60%), suggesting that Non-Alcoholic Fatty Liver Disease (NAFLD) can affect individuals across different weight categories, not just those who are overweight or obese.

Genetic Predisposition (*Kulapravrutta*) and Family History

The genetic predisposition analysis showed that no direct link to NAFLD was identified among the patients. However, 60% of the patients had family histories of obesity and hypertension, suggesting a hereditary component related to metabolic conditions. Additionally, 40% of the patients had a family history of diabetes mellitus, further highlighting the relevance of genetic and familial factors in the overall metabolic profile. No heart diseases were reported in the family history of the patients, indicating variability in the genetic and environmental influences among this small group.

Lifestyle and Dietary Factors

Among the five patients, all were identified as following a mixed diet pattern. Notably, three patients reported excessive intake of starchy and oily foods, while two patients consumed excessive amounts of protein. All patients consistently ate rice and curry for their three meals, typically allocating only 20 to 30 minutes for dinner. None of the patients frequently consumed outside or sugary foods. Additionally, all five patients were documented as not engaging in regular exercise, highlighting a sedentary lifestyle (*avara*). This dietary and lifestyle profile underscores the significant role of poor dietary habits and lack of physical activity in the development and progression of NAFLD.

Subjective parameters of the patients

During the assessment of subjective parameters, symptoms were categorized into seven categories, general weakness or fatigue, appetite, abdominal discomfort, nausea or vomiting, vague right upper quadrant abdominal pain, gastrointestinal nonspecific symptoms, and pruritus. These categories represent common presentations of fatty liver disease and other liver ailments. The findings, illustrated in figure 4, provide a visual representation of the prevalence and severity of these symptoms among the five patients.

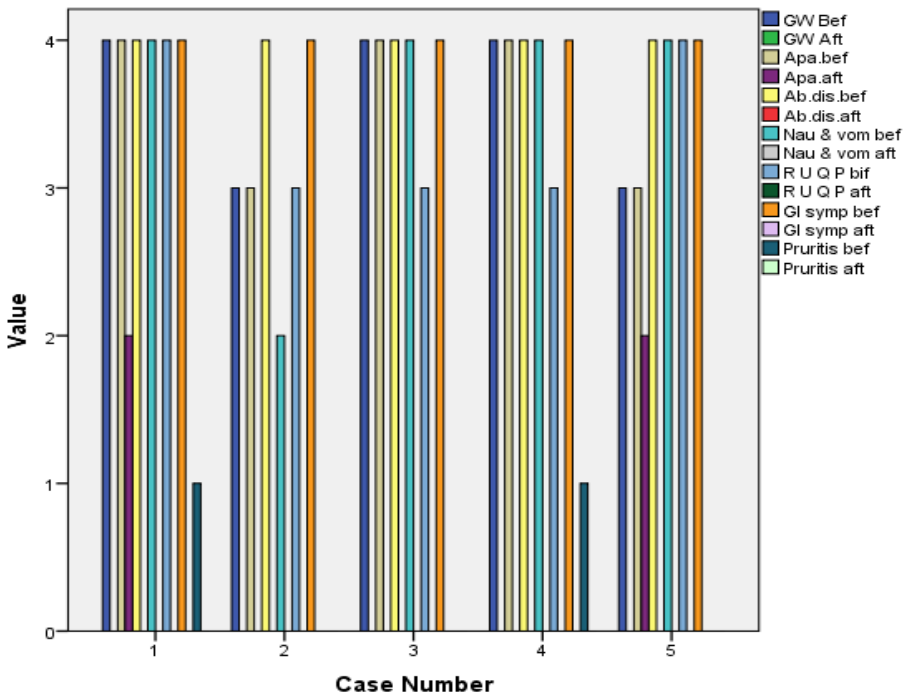

Figure 4: shows the prevalence and severity of the symptoms among the five patients before and after the treatments

This result illustrates significant improvements in the subjective parameters following treatment with *phalatrikadi kwatha* and *triphala guggulu*. All assessed parameters showed marked improvement, demonstrating that these medications were highly effective in alleviating the subjective symptoms associated with Non-Alcoholic Fatty Liver Disease (NAFLD) as well as improving quality of life.

Clinical examination findings

The examination of hepatomegaly, splenomegaly, spider angioma, palmar erythema, caput medusa, jaundice, and NASH-related cirrhosis among the five patients revealed that two patients exhibited mild hepatomegaly, while the remaining three patients did not show any signs of hepatomegaly. No instances of splenomegaly, spider angioma, palmar erythema, caput medusa, jaundice, or NASH-related cirrhosis were observed in any of the patients. These findings indicate that, aside from the mild hepatomegaly in two patients, there were no significant physical manifestations of advanced liver disease in this small sample group.

Anthropometric measurements

The study assessed changes in body weight, body mass index (BMI), and waist circumference before and after the treatment. The results demonstrated a mild overall improvement in these parameters. The average reduction in body weight was 1.3 kg, and **t**he mean reduction in waist circumference was 1.6 cm. There was an average reduction in BMI of 0.4, suggesting a slight decrease in the overall body mass relative to height. These findings suggest that the treatment had a positive, albeit modest, impact on weight and body composition. The reductions in body weight, BMI, and waist circumference, though minor, indicate that the intervention may contribute to improving metabolic health and potentially reducing the risk factors associated with conditions like NAFLD.

Liver function parameters - Serum Aminotransferase levels

The study mainly investigated liver function indicators, specifically Serum Aminotransferase levels, including Aspartate Aminotransferase (AST/SGOT) and Alanine Aminotransferase (ALT/SGPT), to evaluate the impact of the treatment on liver health. The average reduction in AST/SGOT levels was 10.2

U/L. This decrease suggests a positive impact on liver enzyme levels, indicating potential improvements in liver function or a reduction in liver stress. The average reduction in ALT/SGPT levels was 20 I/U. This significant reduction also points to an improvement in liver function, as ALT/SGPT is a key marker for liver health, and it is shown in table 4.

Table 4. Liver function test values of patients

S. No	ALT Before (U/L)	ALT After (U/L)	ALT Difference (U/L)	AST Before (U/L)	AST After (U/L)	AST Difference (U/L)
1	41.2	18.8	22.4	33.0	22.5	10.5
2	50.4	32.3	18.1	41.7	30.5	11.2
3	43.0	26.5	16.5	54.9	42.5	12.4
4	54.2	31.0	23.2	29.0	20.9	8.1
5	43.0	23.2	19.8	31.4	22.6	8.8
Mean Change			20.0	Mean Change		10.2

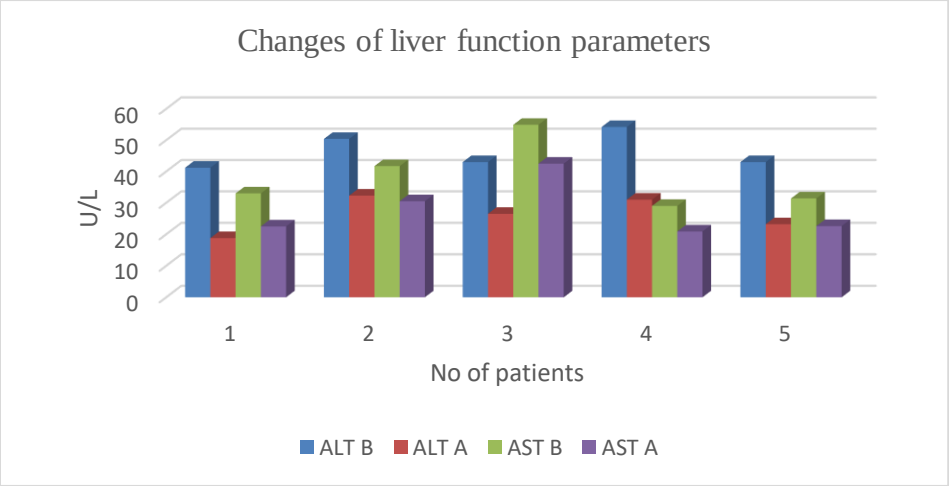

Figure 5. Changes in liver function parameters (AST and ALT levels) for five patients.

Ultrasonography Findings – regarding the Liver

While considering the changes of echogenicity and parenchymal thickness, no significant changes were observed in liver ultrasonography results within the specified period. However, two patients showed mild changes in echogenicity. Diagnoses based on ultrasonography revealed that two patients had fatty liver grade 2, two patients had fatty liver grade 1, and one patient had fatty liver grade 3. Among the patients diagnosed with fatty liver grade 1, one showed normal echogenicity of the liver cells, while the other exhibited mild changes in echogenicity compared to previous scans. The other three patients, diagnosed with fatty liver grades 2 and 3, did not show significant changes in echogenicity over the observation period. Within this short duration of the study period, major histological changes in fatty liver disease are difficult to be expected. Especially in its more advanced stages, typically requires a longer period for significant histological improvements to become evident.

Lipid Profile Changes

Positive changes were noted in the lipid profile of the participants. Specifically, there were improvements in parameters such as total cholesterol, low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, and triglycerides and the values show in table no. 05. These changes suggest a potential benefit for cardiovascular health, as improved lipid profiles are associated with a reduced risk of cardiovascular diseases.

Table 05: Changes of Lipid Profile Parameters

S.No.	Tot. Cho Before	Tot. Cho After	HDL Before	HDL After	LDL Before	LDL After	Trigly Before	Trigly After
1	250	232	38	40	160	142	220	210
2	230	240	45	47	140	138	180	179
3	260	251	40	52	170	157	240	213
4	220	208	45	47	130	121	180	153
5	210	200	50	49	125	116	170	161
Mean Change	7.8		-3.4		10.2		14.8	

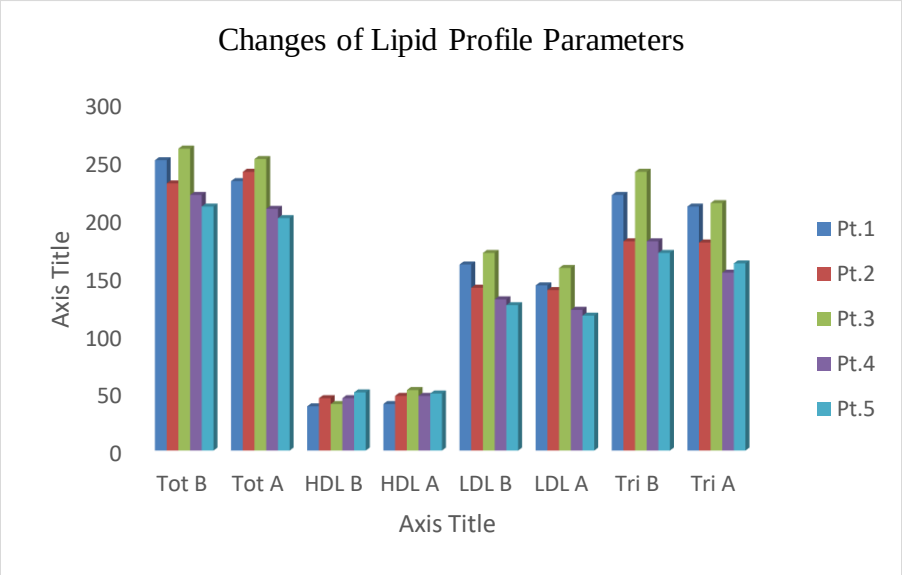

Figure 6: Shows the changes in lipid profile parameters of five patients

Kidney Function Enhancement

A mild improvement in kidney functions was observed in the study participants. This enhancement indicates that the intervention might have a positive impact on kidney health. The lack of adverse effects further suggests that the treatment is safe for kidney function.

Limitations

This study's small sample size (n = 5) and purposive sampling limit external validity and statistical power. Results should be interpreted as preliminary and hypothesis-generating. Future studies will use a formal sample-size calculation and probability (or consecutive) sampling to permit inferential conclusions.

Conclusion

The pilot single-arm interventional study evaluating the efficacy of the Ayurvedic formulations *Phalatrikadi Kwatha* and *Triphala Guggulu* in managing Non-Alcoholic Fatty Liver Disease (NAFLD) yielded encouraging results. Over the two-month treatment period, patients experienced substantial improvements in subjective symptoms, with a notable 97% reduction in discomforts such as fatigue, abdominal pain, and nausea. Biochemical markers

of liver function, including serum aminotransferase levels (AST/SGOT and ALT/SGPT), showed significant reductions, reflecting enhanced hepatic function and decreased liver stress, with AST/SGOT levels decreasing by an average of 10.2 U/L and ALT/SGPT levels by 20 U/L. Improvements were also observed in lipid profiles, including total cholesterol, LDL, HDL, and triglycerides, indicating potential cardiovascular benefits. Mild enhancements in kidney function, with no adverse effects reported, further underscore the safety of the interventions. However, despite these favourable outcomes in symptoms and biochemical parameters, liver ultrasonography did not demonstrate significant changes in fatty liver grades over the study period, suggesting that structural improvements in the liver may require a longer duration of treatment. Overall, these findings highlight the potential of *Phalatrikadi Kwatha* and *Triphala Guggulu* as effective Ayurvedic interventions for symptom relief and biochemical improvement in patients with NAFLD, warranting further investigation in larger, longer-term studies.

Recommendations for Future Studies

Future studies should focus on a few key areas. First, using a larger sample size will make the results more reliable and applicable to a broader population. Additionally, extending the treatment period is important to detect more changes in liver health and metabolism over time.

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