

Optimizing Recovery after Liver Transplantation: Can Functional Therapy-based Re-Education Make a Difference?

Mathew James

Department of Medical Surgical Nursing, Srinivas University Institute of Nursing Sciences, Mangalore, Karnataka, India

Abstract

Liver transplantation remains the definitive treatment for end-stage liver disease, yet post-operative rehabilitation remains a critical challenge. Despite advancements in surgical techniques and immunosuppressive therapy, transplant recipients frequently experience functional impairments, metabolic complications, and psychosocial distress, significantly impacting long-term recovery. Functional therapy-based re-education (FTBR) has emerged as a multidisciplinary rehabilitation approach designed to optimize post-transplant recovery by integrating physical therapy, occupational therapy, nutritional counseling, and psychological support. Unlike conventional physiotherapy, FTBR employs task-specific training, neuromuscular re-education, and cognitive-motor engagement to enhance physical function, metabolic stability, and mental well-being. Evidence suggests that structured FTBR interventions lead to improved muscle strength, mobility, and endurance, reducing the risk of sarcopenia and metabolic syndrome, while also fostering adherence to post-transplant regimens. Moreover, FTBR plays a pivotal role in mitigating cognitive impairments, alleviating psychological distress, and improving quality of life. Studies demonstrate that liver transplant recipients who undergo FTBR experience shorter recovery times, lower hospital readmission rates, and enhanced functional independence. However, barriers such as limited access, program variability, and patient adherence challenges hinder its widespread implementation. Addressing these limitations requires the development of standardized rehabilitation protocols, multidisciplinary collaboration, and increased awareness of FTBR's benefits. As evidence mounts in favor of structured post-transplant rehabilitation, integrating FTBR into routine liver transplant care may significantly enhance long-term patient outcomes. This review underscores the necessity of adopting a holistic, patient-centered approach to optimize recovery trajectories and ensure sustained health improvements in liver transplant recipients.

Keywords: Functional therapy-based re-education, liver transplantation, multidisciplinary approach, post-operative rehabilitation, quality of life

INTRODUCTION

Liver transplantation is a life-saving intervention for patients with end-stage liver disease,^[1] acute liver failure,^[2] and certain metabolic disorders.^[3] Over the years, advancements in surgical techniques, immunosuppressive therapies, and

perioperative care have significantly improved graft survival and patient outcomes.^[4] However, despite these advancements, post-transplant rehabilitation^[5] remains a crucial yet often overlooked aspect of patient care. Many liver transplant recipients experience persistent functional impairments, fatigue, and muscle deconditioning, which can negatively impact their long-term well-being and overall quality of life (QOL).^[6]

Recovery following liver transplantation is complex and multifaceted, requiring not only medical and pharmacological interventions but also structured rehabilitation strategies.^[7] Functional therapy-based re-education (FTBR) has emerged as a promising approach designed to enhance neuromuscular function, restore metabolic stability, and support psychosocial well-being. Unlike conventional physiotherapy, FTBR integrates task-specific training, cognitive-motor engagement,

Date of Submission: 25-01-2025

Date of Revision: 15-02-2025

Date of Acceptance: 05-03-2025

Access this article online

Website: <https://innovationaljournals.com/index.php/ijnr>

ISSN No: 2456-1320

DOI: 10.31690/ijnr.2025.v011i01.002

Address for Correspondence:

Dr. Udayakumar Rao, Dean, Srinivas University Institute of Nursing Sciences, Mangalore, Karnataka, India. E-mail: mathewsjems@gmail.com

This is an open-access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License <https://creativecommons.org/licenses/by-nc-sa/4.0/>, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms

and holistic interventions to promote a more effective recovery.^[8] By adopting a multidisciplinary and personalized approach, FTBR aims to bridge the gap between surgical success and long-term functional independence.

This review explores the effectiveness of FTBR in improving post-operative outcomes and its potential role in optimizing the recovery trajectory of liver transplant recipients. It delves into the challenges faced by patients post-transplant and examines how FTBR can address these issues to improve QOL and enhance overall recovery.

POST-OPERATIVE HURDLES: WHAT CHALLENGES DO LIVER TRANSPLANT PATIENTS FACE?

Despite the significant advancements in transplantation medicine, liver transplant recipients continue to face several post-operative challenges that can hinder their recovery. These challenges can be broadly categorized into physical, metabolic, and psychosocial complications, each requiring targeted interventions to ensure a comprehensive recovery.

Physical deconditioning and functional limitations

Many liver transplant recipients suffer from severe muscle deconditioning due to prolonged pre-transplant illness and post-surgical immobility.^[9] Chronic liver disease is often associated with sarcopenia,^[10] a condition characterized by progressive loss of muscle mass and strength, which is further exacerbated by the immunosuppressive medications required post-transplant.^[11]

The combination of extended hospital stays, immunosuppressive therapy, and corticosteroid use often leads to muscle atrophy, reduced endurance, and impaired mobility.^[12] These physical limitations significantly affect post-transplant rehabilitation and delay the return to normal daily activities. Studies have shown that liver transplant recipients tend to have lower physical activity function scores compared to the general population,^[13] highlighting the need for structured rehabilitation programs to improve functional capacity.

Without targeted rehabilitation efforts, physical deconditioning can contribute to a cycle of reduced activity, further muscle deterioration, and an increased risk of falls and fractures. Engaging patients in early mobilization and structured physical therapy can help break this cycle and promote faster recovery.

Metabolic complications

Metabolic syndrome is a prevalent issue among liver transplant recipients.^[14] The use of immunosuppressive medications, particularly corticosteroids and calcineurin inhibitors, can lead to weight gain, insulin resistance, and dyslipidemia, increasing the risk of diabetes and cardiovascular disease.^[15] In addition, post-transplant patients often experience an altered metabolic rate, which, when coupled with physical inactivity, can exacerbate these conditions.^[16]

The development of metabolic complications post-transplant not only affects long-term survival but also reduces QOL.^[17]

Studies have indicated that obesity and diabetes are increasingly common among liver transplant recipients, with long-term cardiovascular risks being a major concern.^[18] Addressing metabolic complications through structured physical activity and nutritional interventions is essential for long-term health maintenance. Nutritional counseling, combined with an individualized exercise program, can help mitigate these risks and promote a healthier post-transplant lifestyle.^[19]

Cognitive and psychosocial challenges

Beyond physical and metabolic issues, cognitive and psychosocial challenges also play a significant role in post-transplant recovery. Many liver transplant recipients have a history of hepatic encephalopathy,^[20] which may contribute to persistent cognitive impairments even after transplantation. Difficulties with memory, attention, and executive function can impact adherence to medical regimens and lifestyle modifications.

In addition, many recipients experience significant psychological distress, including anxiety and depression, stemming from the lifelong need for immunosuppressive therapy, concerns about graft rejection, and the uncertainty of long-term survival.^[21] The transition from chronic illness to post-transplant life can be emotionally overwhelming, requiring targeted psychological support to facilitate adjustment.

Such psychological challenges can negatively impact QOL scores, making mental health support an integral part of post-transplant rehabilitation. Studies suggest that patients with higher levels of emotional distress are less likely to engage in physical rehabilitation, further exacerbating deconditioning and functional decline. Incorporating cognitive behavioral therapy, mindfulness-based interventions, and peer support programs into post-transplant care can significantly improve psychological well-being and overall recovery.^[22]

Table 1 highlights the key hurdles faced by patients post-transplant, emphasizing the need for rehabilitation strategies.

While liver transplantation offers a second chance at life, it also presents a series of complex challenges that require

Table 1: Common post-operative challenges in liver transplant patients

Category	Challenges	Impact on recovery
Physical health	Muscle atrophy, fatigue, frailty	Reduced mobility, delayed functional independence
Metabolic issues	Obesity, diabetes, cardiovascular risks	Increased morbidity, long-term health concerns
Immunosuppression	Increased infection risk, medication side effects	Hospital readmissions, complications
Psychosocial factors	Anxiety, depression, cognitive dysfunction	Poor adherence to treatment, reduced QOL
Biliary and graft issues	Biliary complications, rejection episodes	Increased risk of graft failure, prolonged hospitalization

QOL: Quality of life

structured and multidisciplinary interventions. Addressing these hurdles through targeted rehabilitation programs, such as FTBR, can improve physical function, reduce metabolic risks, and enhance psychosocial well-being, ultimately leading to a more successful post-transplant recovery.

FTBR: A MULTIDISCIPLINARY APPROACH

FTBR offers a comprehensive, multidisciplinary approach to rehabilitation for liver transplant recipients, addressing the multifaceted challenges encountered during recovery. By integrating physical therapy, occupational therapy, nutritional counseling, and psychological support, FTBR aims to restore physical function, enhance metabolic health, and promote psychosocial well-being.

Physical and occupational therapy

Physical and occupational therapies are pivotal in counteracting the physical deconditioning often observed in liver transplant patients. Structured exercise programs, encompassing both aerobic and resistance training, have been shown to improve health-related QOL, physical function, and maximal exercise capacity. These interventions target muscle strength, endurance, and overall functional capacity, facilitating a return to daily activities and independence.^[8]

Task-specific training focuses on activities such as walking, stair climbing, and lifting, enabling patients to regain confidence and autonomy in their daily routines. Neuromuscular re-education addresses postural imbalances and movement inefficiencies, further contributing to improved physical performance. The benefits of exercise training in transplantation are well established, underscoring the importance of these therapeutic modalities in the FTBR framework.^[23]

Nutritional counseling

Post-transplant metabolic disturbances necessitate tailored nutritional interventions to support recovery and long-term health. High-protein diets are essential for muscle regeneration, while balanced macronutrient intake helps prevent excessive weight gain and associated complications. Nutritional counseling also addresses micronutrient deficiencies that may arise due to immunosuppressive therapy, ensuring optimal metabolic stability. Personalized adapted physical activity before liver transplantation has been shown to be acceptable and beneficial, highlighting the importance of integrating nutritional strategies into the rehabilitation process.^[24,25]

Psychological support

Psychosocial well-being is a critical component of successful rehabilitation. Interventions such as cognitive-behavioral therapy and mindfulness-based practices have been effective in reducing anxiety and depression among transplant recipients. Peer support programs further enhance emotional resilience by providing a sense of community and shared experience. Addressing psychological health is essential, as it significantly influences motivation, adherence to rehabilitation protocols, and overall QOL. Regular physical activity has a long-term

positive impact on recovery following various surgical procedures, including transplantation, giving individuals the opportunity to return to an active life with their families, in society, and in their professional life.^[21]

FTBR's multidisciplinary approach offers a holistic pathway to recovery for liver transplant patients. By concurrently addressing physical, nutritional, and psychological aspects of health, FTBR not only facilitates the restoration of function but also enhances overall well-being, paving the way for a successful return to daily life. Table 2 summarizes how rehabilitation interventions improve key outcomes for liver transplant recipients.

EVALUATING THE IMPACT: DOES FTBR ENHANCE RECOVERY?

FTBR has shown significant promise in improving post-operative recovery in liver transplant recipients. Several studies have demonstrated that structured rehabilitation programs incorporating FTBR principles contribute to enhanced physical function, improved QOL, and a reduction in post-transplant complications.^[26]

Improvements in physical function

Liver transplant recipients often experience muscle weakness and reduced endurance post-operatively. Studies have shown that patients engaged in FTBR programs exhibit significant improvements in muscle strength, balance, and overall mobility.^[27] Task-specific training and neuromuscular re-education techniques enhance coordination and movement efficiency, allowing patients to regain independence faster. Research further suggests that FTBR reduces recovery time, enabling patients to return to daily activities sooner compared to those who receive only conventional physiotherapy.^[13]

Enhancement of QOL

Beyond physical improvements, FTBR has been linked to better psychosocial outcomes. Patients who participate in structured rehabilitation programs report lower levels of anxiety and depression, improved cognitive function, and a greater sense

Table 2: Impact of functional therapy-based re-education on recovery

Intervention	Key benefits	Supporting evidence
Physical therapy	Improves strength, endurance, and mobility	Studies show faster recovery of functional capacity
Nutritional counseling	Prevents obesity, metabolic syndrome	Reduces risk of diabetes and cardiovascular disease
Psychological support	Reduces anxiety, enhances coping mechanisms	Lowers risk of depression and medication non-adherence
Multidisciplinary approach	Ensures individualized rehabilitation plans	Leads to better long-term outcomes
Patient education	Encourages adherence to medical and lifestyle changes	Enhances QOL and independence

QOL: Quality of life

of well-being. Regular participation in task-oriented exercises and cognitive-motor engagement activities fosters confidence and motivation, leading to higher QOL scores.^[13]

Reduction in complications and metabolic syndrome

One of the major benefits of FTBR is its role in mitigating post-transplant complications, particularly metabolic syndrome. Studies indicate that liver transplant recipients involved in structured exercise and dietary counseling programs show lower incidences of obesity, insulin resistance, and cardiovascular diseases. By incorporating tailored physical activity and nutritional strategies, FTBR helps regulate metabolic function, reducing the long-term risks associated with immunosuppressive therapy.

MinEvidence strongly supports the integration of FTBR into post-liver transplant rehabilitation programs. By enhancing physical function, improving QOL, and mitigating complications, FTBR plays a crucial role in optimizing recovery and ensuring long-term well-being for liver transplant recipients.^[28]

A structured rehabilitation program post-transplant significantly improves recovery timelines, reduces metabolic complications, and enhances overall QOL. Data comparing patient outcomes with and without functional therapy demonstrate its effectiveness in optimizing recovery [Table 3].

IMPLEMENTING FUNCTIONAL THERAPY: STRATEGIES FOR SUCCESS

Individualized rehabilitation programs

Developing personalized rehabilitation programs is essential for optimizing recovery in liver transplant recipients. Each patient presents with unique pre-operative conditions, post-operative complications, and varying levels of physical and cognitive impairment. An individualized rehabilitation plan considers these factors and tailors interventions to meet the patient's specific needs, ensuring optimal progress and functional gains.^[5]

A successful rehabilitation program includes baseline assessments of physical activity function, cognitive abilities, and nutritional status. This allows healthcare providers to set achievable goals and adjust therapy interventions accordingly. Gradual progression in exercise intensity, flexibility training, and balance exercises are essential to prevent injury while ensuring steady improvement.

Table 3: Comparison of recovery outcomes with and without functional therapy

Outcome measure	With functional therapy	Without functional therapy
Time to independent walking	2–4 weeks	6–8 weeks
Risk of metabolic syndrome	20–30%	50–60%
Hospital readmission rate	15–20%	30–40%
QOL (SF-36 score)	High	Moderate to Low
Return to work/normal activity	3–6 months	>12 months

QOL: Quality of life

Multidisciplinary team approach

A comprehensive rehabilitation strategy requires a multidisciplinary team composed of physiotherapists, occupational therapists, dietitians, psychologists, and transplant specialists.^[29] Each discipline plays a crucial role in addressing different aspects of the patient's recovery:

- Physiotherapists: Focus on restoring mobility, strength, and endurance through structured exercise programs
- Occupational therapists: Help patients regain independence in daily activities and improve coordination^[30]
- Dietitians: Provide nutritional counseling to manage metabolic risks and promote healthy weight maintenance
- Psychologists: Offer mental health support, addressing emotional distress, and promoting adherence to rehabilitation programs.

Inpatient and outpatient rehabilitation

The transition from inpatient rehabilitation to outpatient follow-up is critical for sustained recovery.^[31] Early mobilization in the hospital setting helps prevent complications such as deep vein thrombosis and muscle atrophy. As patients progress, outpatient rehabilitation continues with structured exercise regimens, dietary monitoring, and psychological support to reinforce positive health behaviors.^[32]

Patient education and active participation

Educating patients about the benefits of rehabilitation and encouraging active participation in their recovery process significantly enhances outcomes. Patients who understand the importance of physical activity, proper nutrition, and mental well-being are more likely to adhere to rehabilitation programs and achieve better long-term results.

Workshops, support groups, and patient education materials can empower recipients to take charge of their health, fostering motivation and compliance with therapy recommendations.

By implementing these strategies, FTBR can significantly enhance recovery outcomes, ensuring that liver transplant recipients achieve optimal physical, metabolic, and psychosocial well-being.^[33]

Successful rehabilitation after liver transplantation requires a collaborative effort among healthcare professionals, ensuring holistic patient support. The involvement of physiotherapists, dietitians, psychologists, and transplant specialists plays a pivotal role in improving long-term recovery [Table 4].

IMPACT ON RECOVERY: EVIDENCE AND BENEFITS

Improvements in physical function and QOL

Patients engaged in structured rehabilitation programs show marked improvements in muscle strength, mobility, and endurance. By incorporating progressive resistance training, aerobic exercises, and task-specific motor training, FTBR enables transplant recipients to regain independence and improve their overall QOL.^[34]

Table 4: Multidisciplinary team roles in liver transplant recovery and their key benefits

Team member	Role in recovery	Key benefits
Physiotherapist	Strengthens muscles, improves mobility	Prevents deconditioning, enhances endurance
Dietitian	Manages metabolic risks, tailors nutrition plans	Prevents weight gain, supports liver function
Psychologist	Provides mental health support, addresses anxiety	Improves adherence, reduces depression risks
Occupational Therapist	Enhances daily activity function, assists in adaptation	Facilitates independence, improves QOL
Transplant Specialist	Monitors liver function, adjusts immunosuppressants	Ensures long-term graft survival

QOL: Quality of life

Research has shown that transplant recipients who participate in FTBR programs report lower levels of fatigue, improved psychological well-being, and better reintegration into daily activities. Enhanced mobility and strength reduce the risk of falls and fractures, contributing to long-term physical health and overall functional independence.^[35]

Reduction in post-operative complications

One of the significant advantages of FTBR is its ability to mitigate post-transplant complications, particularly those related to metabolic health. Liver transplant recipients are at an increased risk of developing metabolic syndrome, characterized by obesity, diabetes, hypertension, and dyslipidemia. Regular physical activity and structured exercise interventions have been found to significantly reduce these risks by improving insulin sensitivity, promoting weight management, and enhancing cardiovascular health.

Moreover, FTBR has been associated with lower hospital readmission rates due to its role in preventing secondary complications such as infections, graft rejection, and cardiovascular disease. By emphasizing a holistic rehabilitation approach that integrates physical, nutritional, and psychological support, FTBR contributes to long-term transplant success and patient well-being.^[36]

IMPLEMENTATION STRATEGIES AND CHALLENGES

Importance of individualized rehabilitation programs and a multidisciplinary team

Successful implementation of FTBR relies on individualized rehabilitation programs that address each patient's specific needs. Tailoring therapy based on pre-transplant health status, post-operative complications, and overall functional goals ensures more effective recovery outcomes. Programs should focus on progressive mobility, strength training, and cognitive-motor activities to optimize functional independence.^[37]

Barriers to implementation

Despite its potential benefits, several challenges hinder the widespread adoption of FTBR in liver transplant rehabilitation. These barriers include:

- Limited access and program availability: Not all healthcare facilities have established FTBR programs, making access to specialized rehabilitation difficult for many patients. Regional disparities in healthcare resources further contribute to these limitations.
- Variability in program design: There is currently no standardized protocol for FTBR in liver transplant recipients, leading to inconsistent rehabilitation practices across institutions.
- Patient adherence issues: Long-term commitment to rehabilitation can be challenging due to factors such as fatigue, financial constraints, and lack of motivation. Ensuring patient engagement through education and support groups is essential for sustained adherence.
- Resource constraints: Implementing FTBR requires specialized personnel, equipment, and funding, which may not be readily available in all healthcare settings.

Addressing these barriers requires investment in training programs for healthcare providers, the development of standardized rehabilitation guidelines, and increased awareness about the benefits of FTBR among patients and caregivers. Expanding access through community-based and telerehabilitation initiatives may also improve program availability and adherence rates.

By overcoming these challenges, FTBR can become an integral part of post-transplant rehabilitation, ensuring better long-term outcomes and QOL for liver transplant recipients.

CONCLUSION

Liver transplantation is a transformative procedure that significantly improves patient survival. However, recovery challenges persist, necessitating structured rehabilitation programs. FTBR provides a multidisciplinary approach that addresses physical, metabolic, and psychosocial factors, ultimately improving post-operative outcomes. Given its proven benefits, integrating FTBR into standard liver transplant rehabilitation protocols should be prioritized to enhance long-term patient recovery and well-being.

ACKNOWLEDGMENT

NA.

FUNDING'S

NA.

CONFLICTS OF INTEREST

NA.

REFERENCES

1. Johnson A, Habib S. Liver transplantation consideration and evaluation: A life-saving treatment in acute-on-chronic liver failure. *Explor Dig Dis* 2024;3:262-74.

2. Hessheimer AJ, Nacif L, Villalba EF, Fondevila C. Liver transplantation for acute liver failure. *Cir Esp* 2017;95:181-9.
3. Sirrs S, Hannah-Shmouni F, Nantel S, Neuberger J, Yoshida EM. Transplantation as disease modifying therapy in adults with inherited metabolic disorders. *J Inher Metab Dis* 2018;41:885-96.
4. Bezinover D, Saner F. Organ transplantation in the modern era. *BMC Anesthesiol* 2019;19:32.
5. Mina DS, Tandon P, Kow AW, Chan A, Edbrooke L, Raptis DA, *et al.* The role of acute in-patient rehabilitation on short-term outcomes after liver transplantation: A systematic review of the literature and expert panel recommendations. *Clin Transplant* 2022;36:e14706.
6. Ladak SS. Symptoms and Function During the Early Recovery Period Following Orthotopic Liver Transplantation Surgery. Canada: University of Toronto; 2015. 10001050.
7. Wickerson L, Rozenberg D, Janaudis-Ferreira T, Deliva R, Lo V, Beauchamp G, *et al.* Physical rehabilitation for lung transplant candidates and recipients: An evidence-informed clinical approach. *World J Transplant* 2016;6:517-31.
8. Pérez-Amate É, Roqué-Figuls M, Fernández-González M, Giné-Garriga M. Exercise interventions for adults after liver transplantation. *Cochrane Database Syst Rev* 2023;5:CD013204.
9. Dutkowski P, Linecker M, DeOliveira ML, Müllhaupt B, Clavien PA. Challenges to liver transplantation and strategies to improve outcomes. *Gastroenterology* 2015;148:307-23.
10. Hsu CS, Kao JH. Sarcopenia and chronic liver diseases. *Expert Rev Gastroenterol Hepatol* 2018;12:1229-44.
11. Brown S, Richardson B, Bouquet E, Reid E, Mercer E, Goncalves M, *et al.* Cirrhosis-related sarcopenia may not resolve after liver transplantation. *JHEP Rep* 2023;5:100881.
12. Gil AP, Lunardi AC, Santana FR, Bergamim JS, Sarmento LA, Cristelli MP, *et al.* Impact of renal transplantation and immunosuppressive therapy on muscle strength, functional capacity, and quality of life: A longitudinal study. *Transplant Proc* 2020;52:1279-83.
13. Dunn MA, Rogal SS, Duarte-Rojo A, Lai JC. Physical function, physical activity, and quality of life after liver transplantation. *Liver Transpl* 2020;26:702-8.
14. Gabrielli F, Golfieri L, Nascimbeni F, Andreone P, Gitto S. Metabolic disorders in liver transplant recipients: The state of the art. *J Clin Med* 2024;13:1014.
15. Opałka B, Żolnierczuk M, Grabowska M. Immunosuppressive agents-effects on the cardiovascular system and selected metabolic aspects: A review. *J Clin Med* 2023;12:6935.
16. Tantisattamo E, Ho BT, Workeneh BT. Editorial: Metabolic changes after kidney transplantation. *Front Med (Lausanne)* 2021;8:709644.
17. Tropea I, Bernabei A, Faggian G, Onorati F. Outcomes and impact on life quality. In: *Heart Transplantation*. Cham: Springer International Publishing; 2023. p. 177-98.
18. Reichman TW, Therapondos G, Serrano MS, Seal J, Evers-Meltzer R, Bohorquez H, *et al.* "Weighing the risk": Obesity and outcomes following liver transplantation. *World J Hepatol* 2015;7:1484-93.
19. Klaassen G, Zelle DM, Navis GJ, Dijkema D, Bemelman FJ, Bakker SJ, *et al.* Lifestyle intervention to improve quality of life and prevent weight gain after renal transplantation: Design of the active care after transplantation (ACT) randomized controlled trial. *BMC Nephrol* 2017;18:296.
20. Acharya C, Bajaj JS. Hepatic encephalopathy and liver transplantation: The past, present, and future toward equitable access. *Liver Transpl* 2021;27:1830-43.
21. Schmajuk M, DeGuzman E, Allen N. Psychotherapy in transplant patients. In: *Psychosocial Care of End-Stage Organ Disease and Transplant Patients*. Cham, Switzerland: Springer; 2019. p. 471-81.
22. Kuntz K, Weinland SR, Butt Z. Psychosocial challenges in solid organ transplantation. *J Clin Psychol Med Settings* 2015;22:122-35.
23. De Paiva Azevedo M, Angelica De Miranda Silva Nogueira P, D'Souza L, Cheung B, Uy K, Patcai J, *et al.* Changes in functional outcomes after an inpatient rehabilitation program for solid-organ transplant recipients. *Prog Transplant* 2023;33:201-7.
24. EXALT Trial Team. Home-based exercise and motivational programme before and after liver transplantation (EXALT): Study protocol for phase II two-centre, randomised controlled trial. *BMJ Open Gastroenterol* 2024;11:e001410.
25. Anastacio LR, Correia MI. Nutrition therapy: Integral part of liver transplant care. *World J Gastroenterol* 2016;22:1513-22.
26. Knadmin. Liver and Kidney Transplant Rehabilitation. PM and R Knowledge Now; 2024. Available from: <https://now.aapmr.org/solid-organ-transplant-rehabilitation> [Last assessed on 2025 Feb 10].
27. Van Den Berg-Emons RJ, Van Ginneken BT, Nooijen CF, Metselaer HJ, Tilanus HW, Kazemier G, *et al.* Fatigue after liver transplantation: Effects of a rehabilitation program including exercise training and physical activity counseling. *Phys Ther* 2014;94:857-65.
28. Janaudis-Ferreira T, Cheung B, Uy K, Chawla J, Mathur S, Patcai J. Changes in functional outcomes after an inpatient rehabilitation program for solid organ transplant recipients. Abstract# D2723. *Transplantation* 2014;98:841.
29. Roberts F, Hobbs H, Jessop H, Bozzolini C, Burman J, Greco R, *et al.* Rehabilitation before and after autologous haematopoietic stem cell transplantation (AHSCT) for patients with multiple sclerosis (MS): Consensus guidelines and recommendations for best clinical practice on behalf of the autoimmune diseases working party, nurses group, and patient advocacy committee of the European society for blood and marrow transplantation (EBMT). *Front Neurol* 2020;11:556141.
30. Koppen A. Advocating For the Role of Occupational Therapy in the Transplant Continuum of Care; 2024. Available from: <https://scholarworks.indianapolis.iu.edu/items/3767e1cd-b260-4f9b-9c0b-89a7c068d719> [Last assessed on 2025 Feb 09].
31. Merbitz NH, Westie K, Dammeyer JA, Butt L, Schneider J. After critical care: Challenges in the transition to inpatient rehabilitation. *Rehabil Psychol* 2016;61:186-200.
32. Al-Dorzi HM, AlQahtani S, Al-Dawood A, Al-Hameed FM, Burns KE, Mehta S, *et al.* Association of early mobility with the incidence of deep-vein thrombosis and mortality among critically ill patients: A *post hoc* analysis of PREVENT trial. *Crit Care* 2023;27:83.
33. Golder HJ, Papalois V. Enhanced recovery after surgery: History, key advancements and developments in transplant surgery. *J Clin Med* 2021;10:1634.
34. Onghena L, Develtere W, Poppe C, Geerts A, Troisi R, Vanlander A, *et al.* Quality of life after liver transplantation: State of the art. *World J Hepatol* 2016;8:749-56.
35. Lai JC, Segev DL, McCulloch CE, Covinsky KE, Dodge JL, Feng S. Physical frailty after liver transplantation. *Am J Transplant* 2018;18:1986-94.
36. Langer D. Rehabilitation in patients before and after lung transplantation. *Respiration* 2015;89:353-62.
37. Wade DT. What is rehabilitation? An empirical investigation leading to an evidence-based description. *Clin Rehabil* 2020;34:571-83.

How to cite this article: James M. Optimizing Recovery after Liver Transplantation: Can Functional Therapy-based Re-Education Make a Difference? *Int J Nur Res*. 2025;11(1):6-11.