Journal of Research in Clinical Medicine

J Res Clin Med. 2025;13:35012
doi: 10.34172/jrcm.025.35012
https://jrcm.tbzmed.ac.ir

TUOMS PRESS

Original Article

Comparative analysis of functional status in kidney and liver transplant recipients: A descriptive-analytical study

Bakhtiar Amini[1], Ahmadmirza Aghazade Atari[2], Akram Ghahramanian[3], Farzad Kakaei[4], Mohammad Reza Ardalan[5], Ali Sharifi[6], Zahra Sheikhalipour[7*]

[1]Department of Nursing, School of Nursing and Midwifery, Tabriz University of Medical Sciences, Tabriz, Iran
[2]Department of Basic Sciences, School of Allied Medical Sciences, Tabriz University of Medical Sciences, Tabriz, Iran
[3]Department of Medical-Surgical Nursing, School of Nursing and Midwifery, Tabriz University of Medical Sciences, Tabriz, Iran
[4]Hepatopancreaticobiliary and Organ Transplantation Surgery Group, Department of General and Vascular Surgery, school of Medicine,Imam Reza Hospital, Tabriz University of Medical Sciences, Tabriz, Iran
[5]Kidney Research Center, Tabriz University of Medical Sciences, Tabriz, Iran
[6]Hepatopancreaticobiliary and Organ Transplantation Surgery Group, Department of General and Vascular Surgery, School of Medicine, Imam Reza Hospital, Tabriz University of Medical Sciences, Tabriz, Iran
[7]Department of Medical-Surgical Nursing, School of Nursing and Midwifery, Imam Reza Medical Research & Training Hospital, Tabriz University of Medical Sciences, Tabriz, Iran

Article info

Article History:
Received: August 5, 2024
Revised: September 25, 2024
Accepted: October 13, 2024
ePublished: July 2, 2025

Keywords:
Functional status, Kidney transplantation, Karnofsky performance status, Liver transplantation, Physical activity, Social support, Transplant recipients

Abstract

Introduction: This study aimed to assess the functional status of kidney and liver transplant patients and identify factors associated with improvement in their condition.

Methods: A descriptive-analytical study was conducted involving 375 patients, 195 kidney and 180 liver transplant recipients, from Imam Reza Medical Training Center and transplant specialists' offices in Tabriz. Data were collected using the "Personal-social factors of patients" questionnaire and "Karnofsky Performance Scale Index", and analyzed using SPSS version 24. Descriptive (mean, standard deviation) and inferential statistical tests (independent t-test, ANOVA, Pearson correlation), with significance set at $P<0.05$.

Results: Liver transplant patients had an average functional status score of 80.06 ± 9.54, while kidney transplant patients scored 77.64 ± 8.53, a significant difference. Among kidney recipients, men demonstrated better functional status, while among liver recipients, women performed better. Poor economic status, unemployment, and low education was associated with lower functional levels. In contrast, patients reporting strong social support and physical activity exhibited higher functional status scores. An inverse relationship was found between age and functional status, while time since transplantation showed a direct relationship.

Conclusion: Employment status, income level, social support, and housing conditions significantly influence post-transplant functional status. These findings highlight the need for targeted interventions to improve patient outcomes.

Introduction

Organ transplantation is one of the most effective treatment options for patients in the final stages of organ failure.[1,2] It involves removing a damaged or defective organ from the body and replacing it with a transplanted organ.[3] Patients in the post-transplant period need to take medication and adhere to restrictions such as limitations on communication, work, and social activities.[4,5] These restrictions vary depending on the type of transplant, and failure to follow these recommendations could lead to transplant rejection.[6] Based on existing literature, including the theory of adaptation, role-playing is determined by the functional status of the individual.[4,7] Functional status is a crucial concept in patient care, used to evaluate the impact of the disease on activity levels, self-care ability, and daily activities. Disruptions in functional status lead to loss of independence and a decline in patients' quality of life.[5,6] Functional status encompasses matters related to home, family, society, personal care, and social activities; reflecting the patient's understanding of how the disease and related treatments affect daily functioning. Loss of functional status is linked to reduced survival rates, compromised quality of life, depression, and financial challenges for patients and caregivers.[5-7] Since performance status reflects the patient's needs, it should be considered during treatment. Functional status comprises several dimensions but appears to center on physical ability.[8,9] If a patient doesn't feel well, they

***Corresponding Author:** Zahra Sheikhalipour, Email: sheikhalipourz@gmail.com

won't have the physical capacity to engage in effective and powerful activities, resulting in an overall decline in functional status.[10] After transplantation, individuals' functional status does not return to normal levels, and impaired functional status is increasingly recognized as a risk factor for post-transplant complications.[6,11] Numerous studies have indicated that the functional status of transplant recipients varies and is linked to patient mortality.[12,13] However, there has been limited research on the functional status of patients following liver and kidney transplants. It is believed that studying these factors can offer healthcare providers valuable insights into the condition of organ transplant recipients. Moreover in this study, we aimed to assess the functional status of kidney and liver transplant recipients using the Karnofsky Performance Status (KPS) scale and to evaluate the impact of personal-social factors on their functional outcomes.

The study aimed to answer the following questions:

1. What is the functional status of kidney transplant recipients as measured by the KPS scale?
2. What is the functional status of liver transplant recipients as measured by the KPS scale?
3. Is there a significant difference in functional status between kidney and liver transplant recipients?
4. How do socioeconomic status, social support, and physical activity influence the functional status of kidney transplant recipients?
5. How do socioeconomic status, social support, and physical activity influence the functional status of liver transplant recipients?

Methods

Study design

This research was part of a descriptive study involving 195 kidney transplant and 180 liver transplant patients who were referred to medical centers affiliated with Tabriz University of Medical Sciences and who met the inclusion criteria. The inclusion criteria required participants to be over 18 years of age and to have had their transplant for at least six months. Patients whose questionnaires were more than ten percent incomplete were excluded from the study.

The minimum sample size required to estimate the role percentage in organ transplant recipients, with 95% confidence and a precision of E = 0.05 from the actual population size of N = 740, using the formula below:

$$n \geq \frac{N^2 Z^2 Pq}{(N-1)^2 E^2 + (P)(q)Z^2}$$

The obtained formula indicates that the role ratio (p) in organ transplant recipients, from a preliminary study involving 20 individuals, was estimated at p = 0.45. The required sample size for this study was determined to be 375 transplant recipients. The sample size was calculated relative to the actual population in different groups of organ transplant recipients, and the respective numbers for each group are presented in Table 1. It is important to note that the same number of caregivers who accompany these transplant patients to the center or clinic are also participating in the research.

Data collection scales

In this study, the data collection questionnaire consisted of two parts:

1. The first part was the personal and social characteristics questionnaire, which collected information about the patient including age, gender, marital status, occupation, education level, daily mobility, underlying diseases, type of housing, head of the family status, type of transplant, date of transplant, and reason for organ transplant.
2. The second part was the KPS, comprising 11 items designed to assess the functional status of patients undergoing chemotherapy for lung carcinoma. The KPS scores range from 0 (worst) to 100 (best), with higher scores indicating better functional status. Patients are categorized into two groups based on their scores: those with a score of 80-100 are considered to have a favorable functional status, while those with lower scores are classified as having an unfavorable functional status. Within the unfavorable functional status group, patients with scores of 50-70 are unable to work and require varying degrees of assistance, while scores of 10-40 indicate that the patients are unable to care for themselves and need medical equipment due to rapid disease progression. A score of 0 indicates the patient has passed away.[14]

The validity and reliability of the KPS were assessed in studies conducted in Iran, including one by Hasanvand et al, where the reliability was found to be 0.83.[14] In this study, the sociodemographic questionnaire and KPS were sent to 10 academic faculty members of the Midwifery and Nursing school at Tabriz University of Medical Sciences to check their face validity. According to their comments, the questionnaires had face validity. The reliability of

Table 1. Distribution of sample size among kidney and liver transplant recipients based on population proportion

Type of organ transplant recipients	Total number (population size) of organ transplant recipients (ni)	Ratio of organ transplant recipients to the total relevant population (pi)	Sample size in each group of organ transplant recipients (n = ni × pi)
Kidney transplant (n_1)	373	0.51	195
Liver transplant (n_2)	367	0.49	180
$n_1 + n_1$	740	1	375

the scale in this study was also determined to be 0.80 according to Cronbach's alpha.

Data collection

After obtaining permission from the Faculty of Nursing and Midwifery at Tabriz University of Medical Sciences and receiving the ethics code from the university's ethics committee, we conducted sampling of patients who met the inclusion criteria using a convenience sampling method. The research objectives were explained to the participants, who were then asked to read and sign the informed consent form. Subsequently, demographic information was collected directly from the patients. Additionally, the functional status questionnaire was completed through interviews with the participants.

Data analysis

The data were analyzed using analysis of variance (ANOVA) with the statistical software SPSS version 24. In the univariate analysis, the relationship between functional status and personal as well as social variables was investigated. Initially, the normality of the data distribution was assessed using the Kolmogorov-Smirnov test, which confirmed that the functional status scores followed a normal distribution. Subsequently, to compare the mean functional status scores across two qualitative personal and social variables of the patient, independent t-tests, one-way ANOVA, and post hoc tests were employed. Furthermore, to examine the relationship between functional status scores and quantitative variables, given the normality of the data, the Pearson correlation coefficient was utilized.

Results

In the group of kidney transplant patients, male patients were the most frequent, accounting for 53.8%. The mean age of kidney transplant was 41.07 ± 9.02 years, and their age ranged from 20 to 70 years. The results showed that the majority of kidney transplant patients were married (74.9%), and 41.0% had received primary to bachelor's education. Additionally, approximately 68% of the patients in this group were employed. Regarding income, approximately 40% of patients reported insufficient income. For kidney transplant patients, the majority of patients had a history of kidney diseases (35.4%), followed by high blood pressure (14.4%) and diabetes (9.7%). Most patients (56.4%) lacked sufficient social support, and 54.9% did not have a daily exercise plan. Some demographic characteristics of kidney transplant patients are provided in Table 2.

In a study of liver transplant patients, 52.2% were men, and 57.2% were married. Additionally, 50.0% had completed primary to bachelor's education, and approximately 39.4% were housewives. The average age of the patients was 44.06 ± 10.17 years, with ages ranging from 20 to 62 years. The study also revealed that approximately

Table 2. Demographic characteristics in kidney transplant patient

Variables	N (%)	Mean ± SD	*P*
Gender			
Male	105 (53.8)	80.19 ± 7.46	0.001
Female	90 (46.2)	74.67 ± 8.76	
Age (x = year)			
x<35	51 (26.2)	80.39 ± 7.20	*P* = 0.001, r = -0.445**[1]
35 ≤ x<50	111 (56.9)	79.10 ± 7.07	
x ≥ 50	33 (16.9)	68.48 ± 9.05	
Marital status			
Married	146 (74.9)	74.69 ± 8.92	0.008
Single	49 (25.1)	78.63 ± 8.19	
Education level			
Illiterate	25 (12.8)	74.40 ± 9.60	0.01
High school	80 (41.0)	76.13 ± 8.34	
Bachelor	42 (21.5)	77.14 ± 9.18	
Master	39 (20.0)	80.65 ± 6.04	
PhD	9 (4.6)	82.82 ± 6.38	
Occupation			
Employee	47 (24.1)	79.79 ± 7.06	0.001
Freelancer	85 (43.6)	79.18 ± 8.62	
Unemployed/temporary worker	63 (32.3)	73.97 ± 8.33	
Elapsed time since transplant (x) (m = Month/y = Year)			
6m ≤ x<1y	27 (13.8)	69.63 ± 9.79	*P* = 0.001, r = -0.230**[2]
1y ≤ x<5y	68 (34.9)	78.97 ± 6.49	
5y ≤ x<10y	72 (36.9)	78.61 ± 7.74	
x ≥ 10y	28 (14.4)	79.64 ± 9.61	
Underlying diseases			
No	14 (7.2)	77.14 ± 9.94	0.253
Kidney diseases	88 (35.4)	78.64 ± 7.90	
Liver diseases	10 (8.7)	82.00 ± 7.88	
Cardiovascular diseases	5 (2.6)	80.00 ± 12.24	
Autoimmune diseases	22 (12.8)	77.73 ± 8.69	
Diabetes	19 (9.7)	75.26 ± 8.41	
Pressure blood	28 (14.4)	75.36 ± 8.53	
Other disease	9 (9.2)	74.44 ± 8.81	
Cause of transplantation			
Diabetes	54 (27.7)	75.74 ± 9.23	0.001
Pressure blood	70 (35.9)	79.43 ± 7.78	
Autoimmune diseases	11 (5.6)	82.73 ± 11.00	
Other disease	60 (30.8)	76.33 ± 7.58	
Income level			
Not enough	127 (65.2)	76.97 ± 6.84	0.066
Enough	59 (30.3)	78.25 ± 8.14	
More than enough	9 (4.5)	79.13 ± 8.48	
Social support			
Yes	85 (43.6)	80.94 ± 6.65	0.001

Table 2. Continued.

Variables	N (%)	Mean ± SD	*P*
No	110 (56.4)	75.09 ± 8.95	
Physical activity			
Yes	88 (45.1)	80.23 ± 6.60	0.001
No	107 (54.9)	75.51 ± 7.58	
House situation			
Own house	114 (58.5)	78.92 ± 8.98	0.016
Rental house	81 (41.5)	75.95 ± 7.62	

**P value of 0.001 indicates strong statistical significance.
[1]Correlation between age and funcctional status in kidney transplant patient is significant at the 0.01 level (2 tailed).
[2]Correlation between elapsed time since transplant and funcctional status in kidney transplant patient is significant at the 0.01 level (2-tailed).

68.3% of the patients had a history of underlying liver or genetic diseases. The primary cause of the transplant was non-alcoholic fatty liver disease, reported by 40.6% of the patients, while 37.2% attributed it to other factors such as excessive alcohol consumption and self-administration of drugs. Moreover, 56% of the patients lacked sufficient social support, and 58.3% did not engage in daily exercise. The demographics of the liver transplant patients are detailed in Table 3.

When examining the functional status of liver and kidney transplant recipients, the results revealed that the average KPS score for kidney transplant patients was 77.64 ± 8.53, and for liver transplant patients, it was 80.06 ± 9.54. This indicates that liver transplant recipients generally had a better functional status than kidney recipients, and this difference was found to be statistically significant. The majority of kidney (68.7%) and liver (69.4%) transplant patients achieved a favorable KPS score (80-100) (Table 4).

The analysis of demographic characteristics and functional status revealed significant differences based on gender and marital status among kidney and liver transplant patients. In kidney transplant patients, men had a higher functional status than women ($P = 0.001$), while in liver transplant patients, women showed a better functional status ($P = 0.003$). Additionally, married patients in both groups had better functional status compared to single individuals ($P < 0.05$).

The research results indicate that the average KPS score of patients without housing and those lacking a social support system was lower than that of transplant patients who had housing and adequate social support in both the kidney and liver transplant groups. This difference was found to be statistically significant ($P < 0.05$). Additionally, the average KPS in both groups of transplant patients was higher for patients who engaged in daily exercise and physical activity, compared to patients who did not. This difference was also found to be statistically significant ($P < 0.05$).

Pearson's correlation coefficient test revealed a significant inverse relationship between the KPS and the

Table 3. Demographic characteristics in liver transplant patient

Variables	N (%)	Mean ± SD	*P*
Gender			
Male	94 (52.2)	78.09 ± 9.97	0.003
Female	86 (47.8)	82.21 ± 8.59	
Age (x = Year)			
x < 35	40 (22.2)	86.25 ± 5.40	*P* = 0.001 r = - 0.528**[1]
35 ≤ x < 50	85 (47.2)	80.82 ± 8.62	
x ≥ 50	55 (30.6)	74.36 ± 10.1	
Marital status			
Married	103 (42.8)	77.79 ± 9.81	0.006
Single	77 (57.2)	81.75 ± 9.01	
Education level			
Illiterate	34 (18.9)	78.24 ± 10.2	0.004
High school	90 (50.0)	77.89 ± 9.53	
Bachelor	32 (17.8)	85.63 ± 7.15	
Master	23 (12.8)	83.48 ± 7.75	
PhD	1 (0.6)	80.00 ± 6.38	
Occupation			
Employee	44 (24.4)	84.09 ± 7.25	0.001
Freelancer	65 (36.1)	82.31 ± 8.43	
Unemployed/temporary worker	71 (39.4)	75.49 ± 9.97	
Elapsed time since transplant (x) (m = Month/y = Year)			
6m ≤ x < 1y	47 (26.1)	75.74 ± 9.94	*P* = 0.001 r = 0.241**[2]
1y ≤ x < 5y	76 (42.2)	81.05 ± 9.17	
5y ≤ x < 10y	36 (20.0)	82.50 ± 8.06	
x ≥ 10y	21 (11.7)	81.90 ± 9.80	
Underlying diseases			
No	13 (7.2)	80.0 ± 9.12	0.159
Kidney diseases	4 (2.2)	85.0 ± 10.0	
Liver diseases	75 (41.7)	81.20 ± 8.37	
Cardiovascular diseases	3 (1.7)	73.33 ± 5.77	
Autoimmune diseases	28 (15.6)	76.43 ± 10.9	
Diabetes	4 (2.2)	80.0 ± 8.16	
Pressure blood	9 (5.0)	75.56 ± 8.81	
Other disease	44 (24.4)	81.36 ± 10.4	
Cause of transplantation			
Hepatitis B, V	28 (15.6)	81.07 ± 7.37	0.001
Non-alcoholic fatty liver disease	73 (40.6)	81.10 ± 9.51	
Autoimmune diseases	12 (6.7)	80.83 ± 9.00	
Other disease	67 (37.2)	78.36 ± 10.3	
Income level			
Not enough	93 (51.7)	80.40 ± 8.07	0.005
Enough	81 (45.0)	82.11 ± 8.43	
More than enough	6 (3.3)	85.0 ± 8.36	
Social support			
Yes	80 (44.4)	84.13 ± 7.23	0.001

Table 3. Continued.

Variables	N (%)	Mean ± SD	*P*
No	100 (55.6)	76.80 ± 9.93	
Physical activity			
Yes	75 (41.7)	82.67 ± 7.94	0.001
No	105 (58.3)	78.19 ± 10.1	
House situation			
Own house	100 (55.6)	82.0 ± 8.87	0.02
Rental house	80 (44.4)	77.63 ± 9.84	

**P value of 0.001 indicates strong statistical significance.
[1]Correlation between age and funcctional status in liver transplant patient is significant at the 0.01 level (2-tailed).
[2]Correlation between Elapsed time since Transplant and funcctional status in liver transplant patient is significant at the 0.01 level (2-tailed).

age of transplanted patients in both groups. This means that the functional status of patients decreases as their age increases ($P < 0.05$). Specifically, liver transplant patients aged 55 and older and kidney transplant patients aged 60 and older exhibited a worse functional status compared to other age groups.

An important statistical relationship was observed between the KPS score and the educational level of liver and kidney transplant patients using a one-way analysis of variance. In the supplementary analysis (Post hoc Tukey's test), it was discovered that the KPS score increased significantly with higher levels of education ($P < 0.05$).

Using a one-way analysis of variance test, a significant statistical relationship was found between the KPS and average monthly income in patients from both transplant groups. In the supplementary analysis, Tukey's post hoc test indicated that individuals with no or low income had a lower average KPS compared to those with high income ($P < 0.05$).

The study's results indicated a clear statistical connection between the average KPS and the patients' occupations in both transplant groups. Further analysis using Tukey's post hoc test revealed that the KPS score of employed patients significantly differed from that of unemployed and housebound patients ($P < 0.05$). This suggests that patients who were unemployed or homemakers had a weaker functional status compared to those with stable employment.

The Spearman's correlation coefficient test demonstrated a direct and statistically significant relationship between the average KPS of the participants and the time elapsed since transplantation for both groups of transplanted patients ($P < 0.05$). This means that as time elapsed since the transplant increased, the KPS score also increased for both groups of transplanted patients. Additionally, there were no significant differences between the transplant patient groups with a history of underlying disease ($P > 0.05$).

Discussion

The concept of functional status is crucial for evaluating the performance, self-care ability, and quality of life in patients.[5] This study aimed to investigate functional status during the post-transplantation period in liver and kidney transplant patients. The study found that the functional status score in liver transplant recipients was higher than in kidney recipients. According to the results, most participants in both groups demonstrated a favorable performance status.

No studies have investigated and compared the functional status of kidney and liver transplant patients; however, Ali et al found that functional status significantly improved after transplantation, consistent with the current study.[8] In this study, men had a better functional status among kidney transplant patients, aligning with Grant and colleagues' findings. Grant et al found that men had higher quality of life and functional status than women in their study examining functional status and quality of life among allogeneic transplant patients.[15] The findings indicate that transplant patients who were employed, had a high income, and possessed a university education level tended to have higher functional status. This is likely due to their increased energy, physical strength, financial resources, and knowledge, which enable them to adapt and perform better. Physical self-care played a significant role in this improvement. Transplant recipients must consistently monitor their bodies and symptoms, pay attention to their body postures, observe any changes, watch for signs of infection and edema, and monitor vital signs daily. Additionally, they pay attention to preventing long-term side effects of immune system-suppressing medications.[16-18] A study by Legendre et al. also supports these findings, emphasizing the importance of continuous symptom monitoring, test result follow-ups, and controlling drug side effects for successful kidney transplant survival.[19]

One effective factor in improving the performance status of transplant recipients is self-management. This includes improving literacy about the disease, developing problem-solving skills, and fostering self-empowerment. Self-management also impacts motivation - the stronger the belief, the more active and persistent a person is in pursuing a specific goal.[20] Khezerloo et al revealed that having adequate knowledge about transplantation and its long-term consequences increases the self-efficacy of transplant recipients.[21]

The study revealed that transplant patients suffering from multiple diseases had a significant and inverse relationship with their overall functional status score. Developing additional diseases appears to be linked to greater medications use, more side effects, decreased physical capability, and an inability to fulfill their roles, all of which can negatively affect functional status. In a study by Reese et al, which focused on functional status and survival rates following kidney transplantation, similar to our findings, younger individuals exhibited better functional status than older individuals.[6] Tandon et al,

Table 4. Baseline clinical of the analytic cohort (N = 375) overall and stratified by functional status at kidney and liver transplant

Variables	Total N = 375 (%)	No assistance (KPS 80%-100%) N = 259 (%)	Minimal assistance (KPS 50%-70%) N = 116 (%)	Full assistance (KPS 10%-40%) N = 0	Mean ± SD	*P*
kidney transplant patient	195 (100)	134 (68.7)	61 (31.3)	-	77.64 ± 8.53	<0.001
liver transplant patient	180 (100)	125 (69.5)	(30.5) 55	-	80.06 ± 9.54	

in a study examining the functional status of 954 patients with liver cirrhosis after hospital discharge, found that increasing age was significantly and inversely related to the functional status score, aligning with our findings.[22] Wedding and colleagues' study also demonstrated a significant decline in functional status with advancing age among elderly cancer patients.[23]

The present study found that married patients had a higher functional status score compared to single patients, which aligns with Ghanbari and colleagues' study, which showed a correlation between functional and marital status.[24] In this study, a high level of education was suggested as a key factor in improving functional status, in line with Akkuzu and colleagues' research on the functional status of women with gynecological cancers.[7]

Based on the findings, patients who engaged in daily exercise and activity showed higher functional status scores compared to those who did not. Orlandi et al, conducted a 12-month study on kidney transplant recipients and found that exercise had positive effects on various aspects of health, including reducing cardiovascular events.[25] Unfortunately, most patients in both groups lacked a regular physical activity plan. Many believed that exercise could harm their health post-transplantation, although numerous doctors emphasized its benefits.[26,27]

The study revealed a strong association between social support and functional status. Patients who had social support from family, others, and transplant associations had higher functional status scores compared to those without sufficient support. Taher et al. conducted a study on 130 patients with high blood pressure and found that those with moderate to good social support had better adherence to medication regimens compared to those with poor social support.[28,29] This suggests that social support can improve functional status by providing a sense of pleasure and satisfaction with life, and by improving the overall quality of life and physical health.[30]

Limitations of the study

One limitation of this study is that the results should be generalized cautiously. The study was conducted in a single specialized medical training center, serving as a reference center for transplant patients. Therefore, caution should be exercised when generalizing the results. Future studies are recommended to investigate the functional status of patients in different transplant groups through multi-center and multi-group research. Additionally, the effects of psychological interventions on the functional status of transplant patients should be explored.

Conclusion

The study found that liver transplant patients had a higher functional status score compared to kidney transplant patients. Although the reasons for this difference were not identified in other studies, further investigation is needed. The study also identified social support as a key factor affecting functional status. It is suggested that measures should be taken to improve social support, including support from family and friends, as well as from organ transplant associations. Additionally, the study revealed that exercise positively effect affects the functional status of transplant patients. Therefore, it is recommended to encourage transplant patients to exercise by providing appropriate support and solutions.

Acknowledgments

We would like to express our appreciation to the Research Deputy of Tabriz University.

Authors' Contribution

Conceptualization: Bakhtiar Amini, Zahra Sheikhalipour.
Data curation: Akram Ghahramanian, Mohammad Reza Ardalan.
Formal analysis: Bakhtiar Amini, Ahmadmirza Aghazade Atari.
Investigation: Bakhtiar Amini, Ahmadmirza Aghazade Atari, Zahra Sheikhalipour, Akram Ghahramanian, Mohammad Reza Ardalan.
Methodology: Bakhtiar Amini, Ahmadmirza Aghazade Atari, Zahra Sheikhalipour.
Project administration: Bakhtiar Amini, Zahra Sheikhalipour.
Resources: Bakhtiar Amini, Farzad Kakaei, Mohammad Reza Ardalan, Ali Sharifi.
Software: Bakhtiar Amini, Ahmadmirza Aghazade Atari.
Supervision: Bakhtiar Amini, Zahra Sheikhalipour, Farzad Kakaei.
Validation: Mohammad Reza Ardalan, Ali Sharifi.
Visualization: Bakhtiar Amini, Ahmadmirza Aghazade Atari, Zahra Sheikhalipour, Akram Ghahramanian.
Writing–original draft: Bakhtiar Amini, Farzad Kakaei, Mohammad Reza Ardalan, Ali Sharifi.
Writing–review & editing: Bakhtiar Amini, Ahmadmirza Aghazade Atari, Zahra Sheikhalipour, Akram Ghahramanian, Farzad Kakaei.

Competing Interests

The authors declare that they have no conflict of interest.

Ethical Approval

The present study was conducted by the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all the patients or their parents/legal guardians and was approved by the Ethics Review Committee of Tabriz University of Medical Sciences (TBZMED.REC.2020.423).

Funding

This study was funded by Vice-chancellor for Research of Tabriz University of Medical Sciences. Funding source has not any role in the design of the study and collection, analysis and interpretation of data.

Study Highlights

What is current knowledge?

- Functional status is a crucial concept in patient care, used to evaluate the impact of the disease on activity levels, self-care ability, and daily activities. Disruptions in functional status lead to loss of independence and a decline in patients' quality of life.

What is new here?

- The current studies on functional status in transplant patients are very limited. In this study, in addition to assessing the functional status in kidney and liver transplant patients, we also compared the functional status between these two groups.
- Liver transplant patients exhibited a better functional status compared to kidney transplant patients.
- Age, physical activity, economic status, education level, and social support are factors influencing the functional status of patients in the post-transplant period.

References

1. Bezinover D, Saner F. Organ transplantation in the modern era. BMC Anesthesiol. 2019;19(1):32. doi: 10.1186/s12871-019-0704-z.
2. Anthony SJ, Lin J, Pol SJ, Wright L, Dhanani S. Family veto in organ donation: the experiences of organ and tissue donation coordinators in Ontario. Can J Anaesth. 2021;68(5):611-21. doi: 10.1007/s12630-021-01928-0.
3. Klaassen G, Zelle DM, Navis GJ, Dijkema D, Bemelman FJ, Bakker SJL, 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(1):296. doi: 10.1186/s12882-017-0709-0.
4. Tulman L, Fawcett J. Development of the comprehensive inventory of functioning-cancer. Cancer Nurs. 2007;30(3):205-12. doi: 10.1097/01.Ncc.0000270713.18156.95.
5. Serper M, Bittermann T, Rossi M, Goldberg DS, Thomasson AM, Olthoff KM, et al. Functional status, healthcare utilization, and the costs of liver transplantation. Am J Transplant. 2018;18(5):1187-96. doi: 10.1111/ajt.14576.
6. Reese PP, Bloom RD, Shults J, Thomasson A, Mussell A, Rosas SE, et al. Functional status and survival after kidney transplantation. Transplantation. 2014;97(2):189-95. doi: 10.1097/TP.0b013e3182a89338.
7. Akkuzu G, Talas MS, Ortac F. Functional status in Turkish women with gynecological cancer. Asian Pac J Cancer Prev. 2014;15(5):2045-9. doi: 10.7314/apjcp.2014.15.5.2045.
8. Ali H, Soliman K, Mohamed MM, Rahman M, Herberth J, Fülöp T, et al. Impact of kidney transplantation on functional status. Ann Med. 2021;53(1):1302-8. doi: 10.1080/07853890.2021.1962963.
9. Bui K, Kilambi V, Rodrigue JR, Mehrotra S. Patient Functional Status at Transplant and Its Impact on Posttransplant Survival of Adult Deceased-donor Kidney Recipients. Transplantation. 2019;103(5):1051-63. doi: 10.1097/tp.0000000000002397.
10. Jalowiec A, Grady KL, White-Williams C. Functional status one year after heart transplant. J Cardiopulm Rehabil Prev. 2007;27(1):24-32. doi: 10.1097/01.hcr.0000265029.25392.6e.
11. Kok B, Duarte-Rojo A, Tandon P. Predicting functional status after transplantation in patients with acute-on-chronic liver failure. Clin Gastroenterol Hepatol. 2020;18(1):54-6. doi: 10.1016/j.cgh.2019.05.048.
12. Phillips AL, Walker EL, Martin JE, First MR, Hanto DW, Whiting JF. Quality of life as a predictor of morbidity, mortality, and resource utilization after solid organ transplant. Transplant Proc. 2001;33(1-2):1922. doi: 10.1016/s0041-1345(00)02713-5.
13. Jafari-Rouhi AH, Shams Vahdati S, Jafari-Rouhi A, Khameneh A, Vahedi L, Azadi R, et al. Association of end-tidal and venous carbon dioxide in intubated and ventilated children. J Res Clin Med. 2023;11(1):32. doi: 10.34172/jrcm.2023.33335.
14. Hasanvand S, Ashktorab T, Jafari Z, Salmani N, Safariyan Z. Cancer-related fatigue and its association with health-related quality of. Adv Nurs Midwifery. 2015;24(85):21-30. doi: 10.22037/anm.v24i85.8109.
15. Grant M, Cooke L, Williams AC, Bhatia S, Popplewell L, Uman G, et al. Functional status and health-related quality of life among allogeneic transplant patients at hospital discharge: a comparison of sociodemographic, disease, and treatment characteristics. Support Care Cancer. 2012;20(11):2697-704. doi: 10.1007/s00520-012-1389-8.
16. Sheikhalipour Z, Zamanzadeh V, Borimnejad L, Valizadeh L, Shahbazi M, Zomorrodi A, et al. Recipients' experiences after organ transplantation. Int J Organ Transplant Med. 2018;9(2):88-96.
17. Çınar Tanrıverdi E, Bayraktar M. The effect of practice with the simulated patient on the professionalism attitudes of medical students: an intervention study. J Res Clin Med. 2023;11:25. doi: 10.34172/jrcm.2023.33433.
18. Rijhwani P, Jain SS, Goel P. Prediction of mortality in sepsis with biomarkers and qSOFA score combination: an observational study in a tertiary care centre of western India. J Res Clin Med. 2023;11(1):21. doi: 10.34172/jrcm.2023.33404.
19. Legendre C, Canaud G, Martinez F. Factors influencing long-term outcome after kidney transplantation. Transpl Int. 2014;27(1):19-27. doi: 10.1111/tri.12217.
20. Guo L, Li L, Lu Y, Li T, Chen L, Jiang L, et al. Effects of empowerment education on the self-management and self-efficacy of liver transplant patients: a randomized controlled trial. BMC Nurs. 2023;22(1):146. doi: 10.1186/s12912-023-01298-6.
21. Khezerloo S, Mahmoudi H, Sharif Nia H, Vafadar Z. Predictors of self-management among kidney transplant recipients. Urol J. 2019;16(4):366-70. doi: 10.22037/uj.v0i0.5061.
22. Tandon P, Reddy KR, O'Leary JG, Garcia-Tsao G, Abraldes JG, Wong F, et al. A Karnofsky performance status-based score predicts death after hospital discharge in patients with cirrhosis. Hepatology. 2017;65(1):217-24. doi: 10.1002/hep.28900.
23. Wedding U, Röhrig B, Klippstein A, Brix C, Pientka L, Höffken K. Co-morbidity and functional deficits independently contribute to quality of life before chemotherapy in elderly cancer patients. Support Care Cancer. 2007;15(9):1097-104. doi: 10.1007/s00520-007-0228-9.
24. Ghanbari A, Momeni M, Rahimi A. Predictors of performance status in patients with colorectal cancer. J Guilan Univ Med Sci. 2012;20(80):1-9. [Persian].
25. Orlandi G, Sofi F, Moscarelli L, Cirami L, Mancini S, Stefani L. Exercise prescription in renal transplant recipients: from sports medicine toward multidisciplinary aspects: a pilot study. J Funct Morphol Kinesiol. 2020;5(1):10. doi: 10.3390/jfmk5010010.
26. Neale J, Smith AC, Bishop NC. Effects of exercise and sport in solid organ transplant recipients: a review. Am

J Phys Med Rehabil. 2017;96(4):273-88. doi: 10.1097/phm.0000000000000599.
27. Paknezhad S, Vand Rajabpour Z. Investigation of the ability of final-year medical students to deliver bad news. J Res Clin Med. 2023;11(1):37. doi: 10.34172/jrcm.2023.33391.
28. Taher M, Abredari H, Karimy M, Abedi A, Shamsizadeh M. The relation between social support and adherence to the treatment of hypertension. J Educ Community Health. 2014;1(3):63-9. [Persian].
29. Caglar O, Karadeniz E, Ates I, Ozmen S, Aydin MD. Vagosympathetic imbalance induced thyroiditis following subarachnoid hemorrhage: a preliminary study. J Res Clin Med. 2020;8(1):17. doi: 10.34172/jrcm.2020.017.
30. Sanne B, Mykletun A, Dahl AA, Moen BE, Tell GS. Testing the job demand-control-support model with anxiety and depression as outcomes: the Hordaland Health Study. Occup Med (Lond). 2005;55(6):463-73. doi: 10.1093/occmed/kqi071.