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## Research Article

# The effect of immunosuppressive therapy after liver transplantation on activities of daily living and fear of death during the COVID-19 pandemic

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## ABSTRACT

**Background:** In our study, we aimed to investigate the effect of immunosuppressive therapy after liver transplantation on activities of daily living and fear of death during the COVID-19 pandemic.

**Methods:** This study was conducted as a cross-sectional study with the participation of 213 liver transplant patients hospitalized in the liver transplant center of a university hospital. The data analysis was performed with IBM SPSS (Statistical Package for the Social Sciences) Statistics 25.

**Results:** Katz's Activities of Daily Living (ADL) were semi-independent and the total score was  $11.07 \pm 1.59$ , and the Death Attitude Profile-Revised (DAP-R) total score was  $152.23 \pm 5.34$ . It was determined that the DAP-R score was around 150 points in the minimum and maximum score ranges of Katz ADL after liver transplantation. **Conclusions:** High fear of death threatens resilience and can make patients feel lonely, helpless, sad, abandoned and stressed. Clinicians should spend more time with their patients.

## 1. Introduction

Solid organ transplantation is one of the most remarkable and groundbreaking therapeutic developments in the last decade [1]. The success of solid organ transplantation is related to practices including donor selection, organ procurement, preservation and transplantation of the organ with appropriate techniques, recipient selection, and medical and surgical improvement [2,3]. However, the major constraining factors, when it comes to the success of organ transplantation, are the inadequacy of transplant organs and the difficulties in managing the immune system's response to the transplanted graft [4]. When a foreign object, such as a transplanted graft, enters the recipient's body, the immune system recognizes it as foreign and mounts a detailed immune response to attack and destroy it. This protective mechanism plays an active role in the rejection of transplanted organs. Immunosuppressive therapy aims to disrupt the immune response process by weakening the recipient's innate immune response to the transplanted graft, promoting and inducing foreign body tolerance, thereby preventing its rejection and destruction. Effective immunosuppression is one of the most important requirements of post-transplant care. The purpose of clinical immunosuppression is to ensure the organ transplant process and to reduce the recipient's immune response to prevent its rejection [5].

Since immunosuppressive therapy suppresses the immune system, an increase in the risk and rate of infection is expected [6]. In addition, immunosuppressive drugs are prone to malignancies due to their oncogenic effects [7] and require high compliance with the treatment protocol [8]. Toxicity affecting almost every organ may develop due to immunosuppressive therapy [9]. Complications related to immunosuppression can be listed as increased morbidity and mortality, longer hospital stay, lower quality of life, and higher healthcare costs [10]. Patients undergoing liver transplantation and receiving immunosuppressive therapy are at risk for mortality due to weak immune systems, increased catabolism and high stress, and the course of possible infections can be fatal. In addition, experiencing high levels of fear and stress is a negative experience making the patients think the possibility of death [11].

Fear is a universal response to a perceived threat in people with various problems and dangers [12]. It disrupts the individual's well-being and causes emotional, physiological, and physical reactions [13]. Fear brings about depression, anxiety and delay in wound healing in individuals and requires additional medication use [14]. The most severe form of fear is called the fear of death [12,14].

The physiological balance of liver transplant patients receiving immunosuppressive therapy is prone to deterioration and are at high

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risk of contracting COVID-19. Unfortunately, COVID-19 can be fatal for this patient population. COVID-19 is a fatal disease appearing in Wuhan, China towards the end of 2019, and it has resulted a global pandemic and pursues to have its devastating effects [15–17]. These patients can be damaged by the effect of fear even before emerging infectious agents, and this can affect their activities of daily living. Therefore, studies evaluating fear of death and activities of daily living in liver transplant patients receiving immunosuppressive therapy are needed to guide clinicians and to provide more comprehensive and better practices for patients during the COVID-19 pandemic.

### 1.1. Objective

In this study, we aimed to investigate the effect of immunosuppressive therapy after liver transplantation on activities of daily living and fear of death during the COVID-19 pandemic.

## 2. Methods

This study was carried out as a descriptive and cross-sectional study to investigate the effect of adherence with immunosuppressive therapy after liver transplantation on activities of daily living and fear of death.

### 2.1. Research design and participants

This research was carried out with the participation of liver transplant patients at the liver transplant institute of a research and application hospital after ethical approval. The universe was formed by the patients hospitalized in the Liver Transplant Institute affiliated to a university hospital in Turkey. After the power analysis, 213 patients were involved in the study in a range of 95% confidence interval with a 0.05 margin of error, and the study was carried out using the purposeful sampling method. Data collection was performed by both researchers between June 1 and 30, 2021 with face-to-face interviews. The data collection form was read to the patients, and the answers given were marked and recorded on the form by the researcher.

#### Inclusion criteria

- i. Receiving a liver transplant,
- ii. Receiving immunosuppressive therapy,
- iii. Being 18 years or older,
- iv. Not having any communication barriers,
- v. Agreeing to participate in the study.

#### Exclusion criteria

- i. Not receiving a liver transplant,
- ii. Not receiving immunosuppressive therapy,
- iii. Patients under the age of 18,
- iv. Non-Turkish speakers, having a communication barrier,
- v. Not willing to participate in the study.

### 2.2. Data collection tools

“Personal Information Form”, “Death Attitude Profile-Revised (DAP-R)” and “Katz Activities of Daily Living (ADL) Scale” were used as data collection tools. Information about the scales is presented below.

### 2.3. Death attitude profile-revised (DAP-R)

The Death Attitude Profile-Revised (DAP-R) was developed by Wong et al. (1994) to assess individuals' attitudes towards death [18]. Its Turkish validity and reliability were performed by Işık Abalı [19]. The scale is 32-item, multi-dimensional and Likert-type and is scored as strongly disagree (1) and strongly agree (7). There are 5 sub-scales in the scale. These are fear of death, death avoidance, neutral acceptance,

approach acceptance and escape acceptance. The internal consistency reliability coefficient was 0.81 for the sum scale, 0.86 for neutral acceptance and approach acceptance subscales, 0.74 for escape acceptance, and 0.76 for fear of death and death avoidance. In this study, the Cronbach's alpha value for the sum scale was found to be 0.90.

### 2.4. Katz activities of daily living (ADL) scale

The ADL index, developed by Katz et al. in 1963, determines the activities aimed at meeting the basic needs necessary for survival. The ADL index consists of six questions including bathing, dressing, going to toilet, transfer, continence, and feeding activities. According to the ADL index, 0–6 points are evaluated as dependent, 7–12 points as semi-independent, 13–18 points as independent [20]. It was adapted to the Turkish study in 2001 by Diker et al. [21].

### 2.5. Statistical analysis

After the data were coded by the researchers, data analysis was performed by using IBM SPSS (Statistical Package for the Social Sciences) Statistics 25. Before starting the statistical analysis, skewness and kurtosis values were checked and it was determined that they showed a normal distribution. Descriptive statistics were used in the analysis of the data. *t*-test, independent samples *t*-test, Kruskal-Wallis, PostHoc test were performed to determine the relationship between scales and descriptive characteristics. The scale reliability coefficient was determined in Cronbach's Alpha.

### 2.6. Ethical considerations

Prior to the study, the ethical approvals were obtained from Turgut Ozal Medical Center Liver Transplant Institute and Gaziosmanpasa University Ethics Committee (Decision No:83116987, Number:543). Participants were informed about the study in accordance with the Declaration of Helsinki, and their approval for the Voluntary Information Form was obtained. Volunteer participants were included in the study after their verbal and written consent.

## 3. Results

The characteristics of the patients and information on immunosuppressive therapy are presented in Table 1.

### 3.1. Descriptive characteristics of liver transplant patients

In our study, according to the descriptive characteristics of liver transplant patients, it was determined that 26.8% of the patients were over 58 years old, 22.5% of them were between 48 and 57 years old and 21.1% were between 38 and 47 years old. 79.8% of the patients were male and 91.5% of them were married. It was determined that 30.5% of the patients were high school graduates and 24.9% of them were primary school graduates. It was found that 56.5% of the patients were between the 11th and 21st days after transplantation, and compliance with immunosuppressive therapy was 95.8%. It was determined that 75.6% of the patients had chronic diseases, and the top three were listed as follows; high blood pressure as 24.8%, coronary artery disease as 20.1%, and diabetes as 18.7%. It was found that 16.9% of the patients had previous surgical experience. When the immunosuppressive drugs used were examined, it was found that all of the patients used antimebolites and corticosteroids, 64.4% of them used calcineurin inhibitors, 16% of them used proliferation inhibitor, and 8.5% of them used biological agents. When the side effects of immunosuppressive drugs were examined, it was found as follows; neuropsychiatric as 4.7%, renal as 10.8%, endocrine as 13.1%, blood disorders as 14.6% and GIS issues as 13.6% (Table 1).

**Table 1**  
Comparison of liver transplant patients' descriptive characteristics and health information with Katz ADL scale and DAP-R scores (n = 213).

Descriptive characteristics	n	%	KATZ ADL		DAP-R	
			Mean ± SD	Test	Mean ± SD	Test
<b>Age</b>	28	13.1				
18–27 years (1)	35	16.4	10.60 ± 1.44		152.8 ± 6.12	
28–37 years (2)	45	21.1	11.05 ± 1.86	t* = 48,160	152.3 ± 5.37	t* = 101,052
38–47 years (3)	48	22.5	11.38 ± 1.21	<b>p = 0.000**</b>	152.3 ± 5.71	<b>p = 0.000**</b>
48–57 years (4)	57	26.8	11.10 ± 1.60	<b>Post hoc=</b>	152.3 ± 4.12	<b>Post hoc=</b>
58 and over (5)	28	13.1	11.04 ± 1.75	<b>1 &lt; 2,3,4,5</b>	151.6 ± 5.64	<b>1 &gt; 2,3,4 &gt; 5</b>
<b>Gender</b>						
Female	43	20.2	10.86 ± 1.30	t = -0.964	153.30 ± 5.04	t = 1452
Male	170	79.8	11.12 ± 1.66	<b>p = 0.018*</b>	151.96 ± 5.4	p = 0.64
<b>Marital status</b>						
Married	195	91.5	10.88 ± 1.64	KW = -0.503	152.35 ± 5.31	KW = 1064
Single	18	8.5	11.08 ± 1.59	p = 0.851	150.95 ± 5.62	p = 0.716
<b>Educational level</b>						
Primary School (1)	53	24.9	11.07 ± 1.50	t* = 101.052	152.42 ± 5.39	t* = 416.045
Secondary School (2)	46	21.6	11.36 ± 1.53	<b>p = 0.000**</b>	151.54 ± 5.65	<b>p = 0.000**</b>
High School (3)	65	30.5	10.84 ± 1.83	<b>Post hoc=</b> <b>1,2,4 &gt; 3</b>	152.9 ± 5.16	<b>Post hoc=</b> <b>3,1 &gt; 2,4</b>
University (4)	49	20.3	11.08 ± 1.41		151.7 ± 5.24	
<b>The days after the transplant</b>						
1–10 (1)	47	22.2	11.43 ± 1.54	t* = 101.052	152.15 ± 6	t* = 416.045
11–21 (2)	120	56.5	11 ± 1.61	<b>p = 0.000**</b>	152.43 ± 5.37	<b>p = 0.000**</b>
22–32 (3)	21	10	11.76 ± 1.71	<b>Post hoc=</b>	151.29 ± 3.83	<b>Post hoc=</b>
33 and above (4)	24	11.3	11.23 ± 1.44	<b>3 &gt; 1,2,4</b>	151.66 ± 5.28	<b>1,2 &gt; 3,4</b>
<b>Adherence to immunosuppressive therapy</b>						
Moderate	9	4.2	10.06 ± 1.36	t = 1452	151.68 ± 3.76	t = 1115
High degree	204	95.8	11.12 ± 1.21	<b>p = 0.005*</b>	152.18 ± 4.43	p = 0.71
<b>Presence of chronic diseases</b>						
Yes	52	24.4	11 ± 1.72	t = 0.354	152.55 ± 5.47	t = -0.827
No	161	75.6	11.09 ± 1.56	p = 0.88	152.15 ± 5.32	p = 0.85
<b>Concomitant chronic disease</b>						
Diabetes (1)	52	18.7	10.92 ± 1.60	KW = 101.052	152.47 ± 4.68	KW = 16.640
High Blood Pressure (2)	69	24.8	11.14 ± 1.39	<b>p = 0.000**</b>	152.73 ± 5.87	<b>p = 0.000**</b>
Coronary artery disease (3)	56	20.1	11.11 ± 1.84	<b>Post hoc=5 &gt; 2,3 &gt; 1,4</b>	151.55 ± 6.87	<b>Post hoc =5 &gt; 1,2 &gt; 3,4</b>
Goiter (4)	18	6.5	10.75 ± 0.88		150.50 ± 3.96	
Chronic kidney disease (5)	8	2.9	12.20 ± 1.81		153 ± 5.96	
Others (6)	10	3.6	11 ± 1.72		151.69 ± 5.13	
<b>Surgical experience</b>						
Yes	36	16.9	11.16 ± 1.69	t = 0.395	152.55 ± 5.47	t = 0.406
No	177	83.1	11.05 ± 1.58	p = 0.307	152.15 ± 5.32	p = 0.685

Duration of immunosuppressive drug use

(continued on next page)

Table 1 (continued)

Descriptive characteristics	n	%	KATZ ADL		DAP-R	
			Mean $\pm$ SD	Test	Mean $\pm$ SD	Test
1–10 days (1)	54	25.4	11.22 $\pm$ 1.68	KW = 15.014	152.4 $\pm$ 5.45	KW = 41.314
11–21 days (2)	124	58.2	10.99 $\pm$ 1.56	<b>p = 0.000**</b>	152.38 $\pm$ 5.49	<b>p = 0.000**</b>
22–32 days (3)	12	8.5	10.94 $\pm$ 1.76	<b>Post hoc=1,4 &gt; 2,3</b>	151.55 $\pm$ 4.71	<b>Post hoc=1,2 &gt; 3,4</b>
33 days and above (4)	23	8	11.29 $\pm$ 1.44		151.17 $\pm$ 4.65	
<i>Immunosuppressive drug used<sup>a</sup></i>						
Biological agent (1)	18	8.5	10.66 $\pm$ 2.05	KW = 1.213	152.55 $\pm$ 4.39	
Proliferation inhibitor (2)	34	16	11.11 $\pm$ 1.78	<b>p = 0.012*</b>	151.79 $\pm$ 5.01	KW = 1.967
Calcineurin inhibitor (3)	179	64.4	11.07 $\pm$ 1.55	<b>Post hoc=1 &lt; 2,3,4,5</b>	152.33 $\pm$ 5.38	<i>p</i> = 0.111
Antimetabolite (4)	213	100	11.07 $\pm$ 1.59		152.22 $\pm$ 5.33	
Corticosteroid (5)	213	100	11.07 $\pm$ 1.59		152.22 $\pm$ 5.33	
<i>Side effect of immunosuppressant drugs<sup>a</sup></i>						
Neuropsychiatric (1)	10	4.7	11 $\pm$ 1.63		155.70 $\pm$ 5.69	
Renal (2)	23	10.8	11.30 $\pm$ 1.63		154 $\pm$ 5.65	KW = 1.052
Endocrine (3)	28	13.1	11 $\pm$ 1.49	KW = 6.033	152.10 $\pm$ 4.45	<b>p = 0.000**</b>
Blood disorders (4)	31	14.6	11.32 $\pm$ 1.42	<i>p</i> = 0.165	152.16 $\pm$ 4.93	<b>Post hoc=8 &gt; 1,2 &gt; 3,4,5,6,7</b>
GIS Issues (5)	29	13.6	11.65 $\pm$ 1.54		152.86 $\pm$ 4.43	
Edema (6)	15	7	11.60 $\pm$ 1.63		152.66 $\pm$ 4.68	
Malignancy (7)	11	5.2	10.90 $\pm$ 0.83		152.36 $\pm$ 7.72	
At least three side effects (infection, neuropsychiatric, nephrotoxicity) (8)	66	31	10.56 $\pm$ 1.71		156.75 $\pm$ 5.51	

t = Independent samples t-test, t\* = t testi, \**p* < 0.05, \*\**p* < 0.01.

<sup>a</sup> The same patient may have more than 1 option. KW:Kruskal-Wallis Test,

### 3.2. Comparison of KATZ ADL and DAP-R scores of liver transplant patients

In our study, the mean Katz ADL score was the lowest in the age group of 18–27 years (10.60  $\pm$  1.44, *p* = 0.000). Katz ADL scores were lower for women than for men (*p* = 0.018) and for married people compared to singles. In addition, the Katz ADL scores of high school graduates were found to be the lowest. Katz ADL scores were found to be higher in those with strong adherence to immunosuppressive treatment than those with moderate adherence (*p* = 0.005). Katz ADL scores were found to be higher in patients between 22nd and 32nd days after liver transplantation (*p* = 0.000). Among individuals with concomitant chronic diseases, those with diabetes and goiter had the lowest Katz ADL score, and those with chronic kidney disease had the highest Katz ADL score (*p* = 0.000). The Katz ADL score was found to be the lowest in those using biologic agents compared to those using other drugs (*p* = 0.012) (Table 1).

In our study, it was determined that the highest mean score of DAP-R was in the 18–27 age group, and the lowest was in the patients who were 58 and above (*p* = 0.000). It was determined that there was no statistically significant difference between women and men, married and single, in terms of the mean score of DAP-R. It was found that primary and high school graduates had higher DAP-R scores than secondary school and university graduates (*p* = 0.000). Patients in the first 21 days after liver transplantation had a higher DAP-R score than those in the other post-op days (*p* = 0.000). Similarly, it was found that patients using immunosuppressive drugs in the first 21 days had a higher DAP-R score than those on other post-op days (*p* = 0.000). It was determined

that patients developing at least 3 side effects due to immunosuppressive drugs had the highest DAP-R score, and those who experienced neuropsychiatric and renal side effects had the second highest DAP-R score (Table 1).

### 3.3. Katz ADL and DAP-R mean scores of liver transplant patients

When the Katz ADL and DAP-R score averages were examined, it was determined that the total Katz ADL score was 11.07  $\pm$  1.59 (min 7, max 16) and the total DAP-R score was 152.23  $\pm$  5.34 (min 135, max 165). When the sub-scales of DAP-R were examined, it was determined that 46.13  $\pm$  3.22 (min 36, max 53) points were obtained in the Fear of Death and Death Avoidance sub-scale. In addition, it was determined that 55.84  $\pm$  2.93 (min 50, max 64) points were obtained in the sub-scale of Neutral Acceptance and Approach Acceptance, and 22.43  $\pm$  2.36 (min. 16, max. 28) points in the Escape Acceptance sub-scale (Table 2).

The relationship between the mean scores of Katz ADL and DAP-R is shown in Fig. 1. After liver transplantation, it was determined that the DAP-R score was around 150 points in all the minimum and maximum score ranges of Katz ADL (7–16). In Fig. 1, it is seen that the Katz ADL has the highest level in the range of 9 and 14 points (Table 2).

## 4. Discussion

It has been considered that all medical and conservative management strategies are unsuccessful in chronic organ failure, and solid organ transplantation has been determined as the “gold standard” [22,23]. According to 2018 data, 76,382 liver transplants have been performed in

**Table 2**  
Katz activities of daily living and death attitude profile-revised scale scores (n = 213).

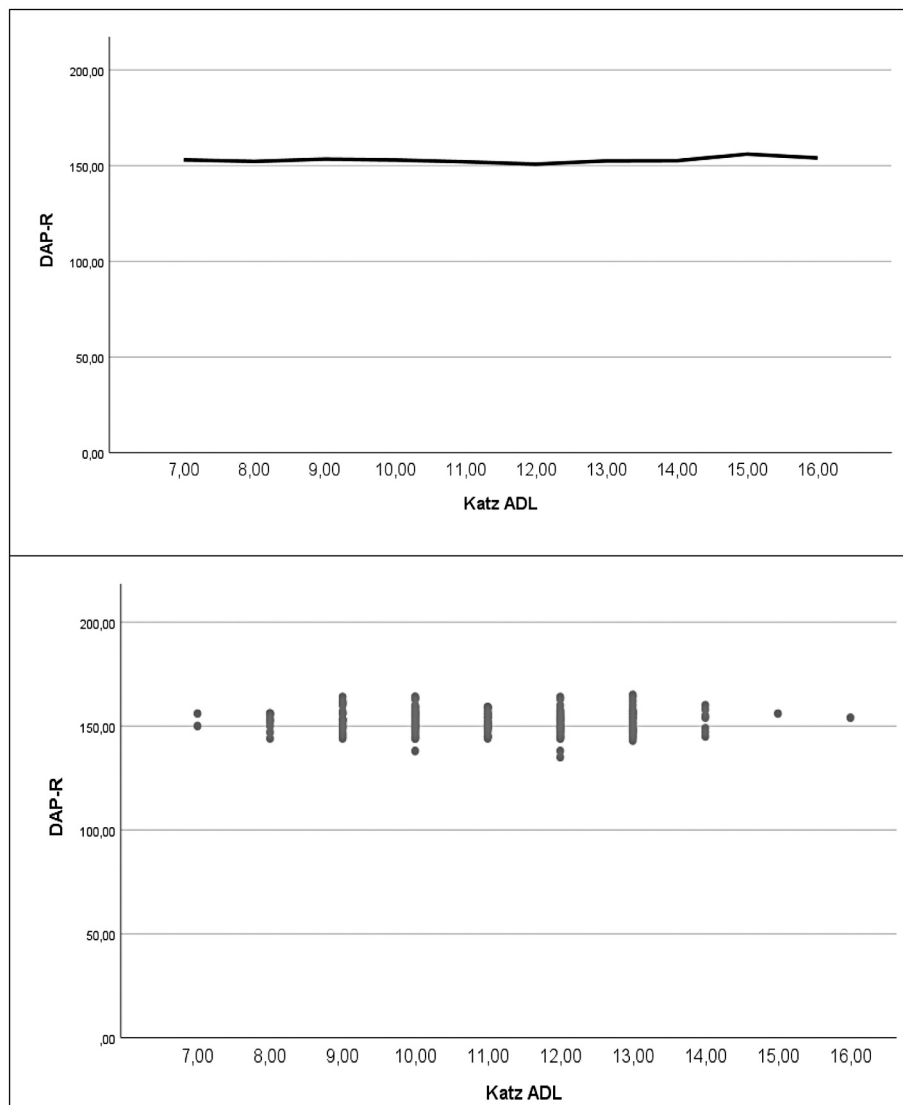
Scales	Item number	Items	Score range	Mean ± SD	Min-Max
Katz ADL total score	6	(Item 1–6)	0–18	11.07 ± 1.59	7–16
Death attitude profile-revised (DAP-R) total	26	(Item 1–26)	26–182	152.23 ± 5.34	135–165
Fear of death and death avoidance	9	(1–3, 7, 10, 16–18, 26)	9–63	46.13 ± 3.22	36–53
Neutral acceptance and approach acceptance	12	(4, 6, 8, 12–15, 19, 21–23, 25)	12–84	55.84 ± 2.93	50–64
Escape acceptance	5	(5, 9, 11, 20, 24)	5–35	22.43 ± 2.36	16–28

the world and 4058 in Turkey in the last 3 years [24]. In addition, according to an annual report published by the National Health Unit in 2017, a total of 5090 transplants (kidney, liver, lung and heart) were performed in England [25]. The number of patients waiting and

performing organ transplants is expected to increase in Turkey and around the world [22,26].

In our study, according to the descriptive characteristics of liver transplant patients, it was determined that 26.8% of the patients were over 58 years old, and 22.5% of them were between 48 and 57 years old. 79.8% of the patients were male and 91.5% of them were married. It was determined that 30.5% of the patients were high school graduates and 24.9% of them were primary school graduates. It was found that 56.5% of the patients were between the 11th and 21st days after transplantation, and compliance with immunosuppressive therapy was 95.8%. Compliance with the drug treatment protocol is affected by various factors such as the patient's lifestyle, sociodemographic and psychosocial characteristics, type of transplant, and the nature of the treatment protocol [27]. Immunosuppressive therapy takes a long time in most transplant patients. In the later stages, lifelong immunosuppression is required, albeit at low doses, and discontinuation of therapy predisposes to the risk of severe graft rejection [1].

In this study, it was found that all of the patients used antimetabolites and corticosteroids, 64.4% of them used calcineurin inhibitors, 16% of them used proliferation inhibitors, and 8.5% of them used biological agents. When the side effects of immunosuppressive drugs were examined, it was found as follows; neuropsychiatric as 4.7%, renal as 10.8%, endocrine as 13.1%, blood disorders as 14.6% and GIS issues as 13.6%.



**Fig. 1.** Comparison of Katz ADL and DAP-R score averages.

In addition, Katz ADL scores were found to be higher in those with strong adherence to immunosuppressive treatment than those with moderate adherence ( $p = 0.005$ ). Katz ADL scores were found to be higher in patients between 22nd and 32nd days after liver transplantation ( $p = 0.000$ ). In the literature reviews, it was found that the quality of life was low in the early period after liver transplantation, but it was noted that it started to increase afterwards [28,29]. In our study, the Katz ADL score being low in the first two weeks and high in the following week supports the results of the literature. However, the low Katz ADL score after the 32nd week draws attention to the fact that the patients could not achieve their ADLs at an ideal level in the following periods. Thus, it can be deduced that patients' long-term habits, comfort and quality of life are related to their individual abilities [28].

It was found that 18.7% ( $n = 50$ ) of the liver transplantation patients in our study had diabetes mellitus, 6.5% ( $n = 18$ ) of them had goiter, and 2.9% ( $n = 8$ ) had chronic kidney disease. Among individuals with concomitant chronic diseases, those with diabetes and goiter had the lowest Katz ADL score, and those with chronic kidney disease had the highest Katz ADL score ( $p = 0.000$ ). Diabetes and impaired glycemic balance are common side effects of corticosteroids. It has also been proven that its use with tacrolimus and cyclosporine enhances the overall diabetogenic effect [30]. Calcineurin Inhibitors (CNIs) cause vasoconstriction of glomerular arterioles, thus decreasing renal blood flow and glomerular filtration rate, causing acute nephrotoxicity [31]. The findings of our study support the results of the literature.

Katz ADL score was found to be lowest in those using biologic agents containing polyclonal and monoclonal antibodies compared to those using other drugs ( $p = 0.012$ ). Polyclonal antibodies also stimulate the expansion of regulatory T cell populations, which are responsible for preventing activation of the immune system, eliminating the possibility of self-reactivation in recognizing that the transplanted graft is not foreign [32]. In the literature, it has been stated that secondary autoimmune diseases (thyroid disease) may develop as a result of suppression of lymphocyte and regulatory T cell populations due to alemtuzumab therapy [33]. Basiliximab and daclizumab group biological agents have been associated with acute allergic reactions, electrolyte imbalances, tremors, headaches, hypertension, high risk of infection and some types of cancer [1]. This may be associated with the lowest Katz ADL in liver transplant patients using biologic agents in our study compared to those using other drugs ( $p = 0.012$ ).

In our study, when the Katz ADL and DAP-R score averages were examined, it was determined that the total Katz ADL score was  $11.07 \pm 1.59$  (min 7, max 16), and the total DAP-R score was  $152.23 \pm 5.34$ .

After liver transplantation, it was found that the DAP-R score was around 150 points in the minimum and maximum score ranges of Katz ADL (min 7, max 16). In the literature review, it was determined that the DAP-R score was  $122.13 \pm 4.65$  in patients with diabetes [34] and  $121.28 \pm 5.06$  in patients with chronic obstructive pulmonary disease (COPD) [13] during the COVID-19 pandemic. The fact that the fear of death of liver transplant patients was found to be significantly higher than patients with diabetes and COPD is an important proof that the patient group receiving immunosuppressive therapy needs more psychological support. When Katz ADL was between 9 and 14 points, it was determined that the DAP-R score was the highest. This means that there is a high level of fear of death in liver transplant patients with both semi-independent and independent ADLs.

In conclusion, this study is an important source of information examining ADL and fear of death in patients receiving immunosuppressive therapy after liver transplantation during the COVID-19 pandemic. In addition to the social isolation applied to liver transplant patients who have increased vulnerability to infections due to immunosuppressive therapy, the negative effects of medications and the complications and adverse effects they cause are important stressors and extremely wearisome. In this process, liver transplant patients were found to have a high fear of death even if they were independent and semi-independent in terms of ADL index. High fear of death threatens

resilience and can make patients feel lonely, helpless, sad, abandoned and stressed. As a result, major depression, noncompliance with immunosuppressive drug therapy and suicidal behavior may increase. In addition, patients may not be able to adapt to their home life after the hospital stay is completed. The first two years after transplantation is exhausting and tiring, and it requires the highest level of attention and adaptation.

Clinicians should question patients' fear of death and levels of ADLs in detail. When the psychological state of the patients is poor, this can reduce adherence to therapy and adversely affect post-transplant care. Clinicians should spend more time with patients after liver transplantation and allow them to express themselves.

#### Authors' contributions

All the authors took part in the formulation of the concept, data collection, data analysis and interpretation of results. All the authors reviewed and edited the manuscript and approved the final version of the manuscript.

#### Availability of data and materials

The data sets generated and/or analysed during the current study are available from the corresponding author.

#### Informed consent

Not applicable.

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#### Declaration of Competing Interest

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