

ORIGINAL ARTICLE

Health literacy and awareness of cardiovascular disease risk factors in kidney transplant recipients

Böbrek nakli alıcılarında sağlık okuryazarlığı ve kardiyovasküler hastalık risk faktörleri hakkındaki farkındalık

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Abstract

Purpose: Cardiovascular disease (CVD) is a leading cause of mortality among kidney transplant recipients (KTRs), and is influenced by both traditional cardiovascular risk and transplant-specific factors. Health literacy and perceptions of exercise play a crucial role in effectively managing these risks. Therefore, this study aimed to compare health literacy, awareness of CVD risk factors, and perceptions of exercise-related benefits and barriers in KTRs and healthy individuals.

Methods: Fifty-nine KTRs and 60 healthy control were included. Participants' health literacy (Health Literacy Scale-Short Form), awareness of CVD risk factors (CVD Risk Factors Knowledge Level [CARRF-KL]), and perception of exercise (the Exercise Benefits/Barriers scale (EBBS)) were evaluated.

Results: KTRs demonstrated significantly lower health literacy levels than healthy individuals ($p<0.001$), and this difference remained significant after adjustment for educational level. In unadjusted analyses, KTRs showed lower awareness of CVD risk factors, perceived exercise benefits, and total EBBS scores ($p<0.05$). When educational level was controlled for, there was no significant difference between the two groups in awareness of CVD risk factors, perceived exercise benefits, and total EBBS scores ($p>0.05$). Health literacy was positively correlated with perceived exercise benefits in KTRs ($p=0.042$). No significant difference was observed between groups in perceived exercise barriers ($p>0.05$).

Conclusion: KTRs have lower health literacy levels compared with healthy individuals, regardless of educational attainment. The disparities in knowledge of CVD risk factors and perceptions of the benefits of exercise seem to be largely explained by educational differentials. These results emphasise the necessity for health literacy-aware educational approaches and personalised exercise guidance as key elements of post-transplant care to enhance self-management and decrease long-term cardiovascular risk.

Keywords: Health behavior, Kidney transplantation, Patient education, Self-management.

Öz

Amaç: Kardiyovasküler hastalık (KVH), böbrek nakli alıcıları (BNA) arasında önde gelen ölüm nedenlerinden biridir ve hem geleneksel kardiyovasküler risk faktörlerinden hem de nakle özgü faktörlerden etkilenir. Sağlık okuryazarlığı ve egzersize ilişkin algılar, bu risklerin etkili bir şekilde yönetilmesinde önemli rol oynamaktadır. Bu çalışmanın amacı BNA ve sağlıklı bireylerde sağlık okuryazarlığı, KVH risk faktörlerine ilişkin farkındalık ve egzersizin yarar ve engellerine yönelik algıların karşılaştırılmasıydı.

Yöntem: Çalışmaya 59 BNA ve 60 sağlıklı kontrol dahil edildi. Katılımcıların sağlık okuryazarlığı (Sağlık Okuryazarlığı Ölçeği-Kısa Form), KVH risk faktörlerine ilişkin farkındalığı (KVH Risk Faktörleri Bilgi Düzeyi [KARRF-BD]) ve egzersiz algıları (Egzersiz Faydaları/Engelleri Ölçeği [EFEÖ]) ile değerlendirildi.

Bulgular: BNA'ların sağlık okuryazarlığı düzeyleri sağlıklı bireylere göre anlamlı derecede daha düşüktü ($p<0,05$) ve bu fark eğitim düzeyi dikkate alındıktan sonra da anlamlılığını korudu. Düzeltilmemiş analizlerde BNA'ların KVH risk faktörlerine ilişkin farkındalıklarının, egzersizin algılanan yararlarının ve toplam EBBS puanlarının daha düşük olduğu görüldü ($p<0,05$). Eğitim düzeyi kontrol edildiğinde, iki grup arasında KVH risk faktörleri farkındalığı, egzersizin yararlarına ilişkin algı ve toplam EBBS puanları açısından anlamlı bir fark bulunmadı ($p>0,05$). BNA'larda sağlık okuryazarlığı ile egzersizin algılanan yararları arasında pozitif yönde ilişki bulundu ($p=0,042$). Gruplar arasında egzersizin algılanan engelleri açısından fark gözlemedi ($p>0,05$).

Sonuç: BNA'lar, eğitim düzeyinden bağımsız olarak sağlıklı bireylere kıyasla daha düşük sağlık okuryazarlığı düzeyine sahiptir. KVH risk faktörleri bilgisi ve egzersizin yararlarına ilişkin algılardaki farklılıkların büyük ölçüde eğitim düzeyindeki farklılıklardan kaynaklandığı görülmektedir. Bu bulgular, uzun dönem kardiyovasküler riski azaltmak ve öz-yönetimi güçlendirmek amacıyla nakil sonrası bakımda sağlık okuryazarlığına duyarlı eğitim yaklaşımlarının ve kişiselleştirilmiş egzersiz rehberliğinin önemini vurgulamaktadır.

Anahtar kelimeler: Sağlık tutumu, Böbrek transplantasyonu, Hasta eğitimi, Öz yönetim.

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INTRODUCTION

Patients with chronic kidney disease (CKD) are at significantly increased risk of cardiovascular disease (CVD), a risk that cannot be attributed solely to reduced renal function. This increased risk is driven by a combination of traditional and non-traditional mechanisms. Traditional risk factors, such as hypertension, diabetes mellitus, dyslipidemia and obesity, are highly prevalent in this population. In addition, factors specific to CKD, including inflammation, oxidative stress, vascular calcification and activation of the renin-angiotensin-aldosterone system, contribute to an increased risk of CVD.¹ Therefore, effective management of cardiovascular risk factors is crucial in patients with CKD to preserve both the cardiovascular and renal function. Lifestyle changes such as smoking cessation, weight management, regular physical activity, and adherence to a healthy diet are well-established strategies for reducing cardiovascular risk in patients with CKD.² However, the adoption and maintenance of these behaviors especially physical activity are often limited in clinical practice due to multiple physical, psychological, and behavioral barriers such as fatigue, dyspnea, depression, and low motivation.^{3,4} In this context, health literacy plays a central role in shaping health behaviors. Health literacy is not only about being able to read health information, but also about understanding, interpreting and applying it in real-life decisions.⁵ Patients with CKD adequate health literacy are more likely to understand the importance of preventive health behaviours, accurately perceive disease-related risks, make sustainable lifestyle changes and achieve better overall clinical outcomes.⁶⁻⁸ Accordingly, health literacy is a key factor in individuals' ability to translate health knowledge into consistent and effective health behaviours.

Effective treatment for patients with end-stage renal failure, kidney transplants greatly improve patients' survival rates and quality of life. Nevertheless, transplantation does not eliminate pre existing cardiovascular risk factors, and additional transplant specific risks—including immunosuppressive therapy and chronic inflammation—may further increase cardiovascular burden.^{9,10} Post-

transplant patients may underestimate these risks, believing themselves as fully recovered, and may not give due importance to healthy lifestyle behaviors.⁸ Although previous studies have separately examined health literacy, cardiovascular risk awareness, and exercise behaviors in patients with CKD and transplant recipients, there is limited evidence comparing these factors simultaneously between kidney transplant recipients (KTRs) and healthy individuals. Therefore, this study aimed to compare health literacy, awareness of cardiovascular risk factors, and perceptions of exercise between KTRs and healthy individuals, while also examining the role of educational level in these relationships.

METHODS

Study population

This study was a cross-sectional study approved by the Hacettepe University Health Sciences Research Ethics Committee with protocol number SBA 23/275, dated 05.12.2023. The study included KTRs followed within the Department of Nephrology, Hacettepe University Faculty of Medicine and healthy controls between November 2024 and October 2025. Inclusion and exclusion criteria were verified by a specialist physician. For the KTRs group, individuals were eligible if they had undergone kidney transplantation at least 6 months prior, were clinically stable, aged between 18 and 65 years, and volunteered to participate in the study.

Participants were excluded if they had cognitive and physical impairment or were illiterate. For the healthy control group, individuals were eligible to participate if they were between 18 and 65 years of age and volunteered to take part in the study. Participants with any known acute or chronic diseases, as well as those who were illiterate, were excluded. Participants were first given verbal information. Informed consent was obtained from participants via Google Forms before proceeding to the survey questions. Participants' age, gender, body mass index (BMI), smoking status, and education level (years) were evaluated.

Health literacy: The Turkish version of the Health Literacy Scale-Short Form was used to

assess participants' health literacy. The scale consists of 12 questions, each with a 4-point Likert-type answer choice. The scale can be scored from a minimum of 0 to a maximum of 50. Higher scores indicate a higher level of health literacy.¹¹

Knowledge of cardiovascular disease risk factors: The Turkish version of the CVD Risk Factors Knowledge Level (CARRF-KL) scale, consisting of 28 questions, was used to assess knowledge of CVD risk factors. The highest possible score on the scale is 28, and higher scores indicate better knowledge of CVD risk factors.¹²

Perception of benefits/ barriers to exercise: Perceived benefits/barriers to exercise were assessed using the Turkish version of the Exercise Benefits/Barriers Scale (EBBS). Each participant was asked to rate the perceived benefits and perceived barriers to exercise on a 4-point Likert scale. There are 29 questions to identify the benefits of exercise and 14 questions to explore the barriers to exercise. The total score ranges from 43 to 170 and is obtained by adding the scores from the benefit and barriers sections. A higher score indicates that the perceived benefits of exercise are greater than the perceived barriers to exercise.¹³

Statistical analysis

Statistical analysis was SPSS (version 29) software package. A prior power analysis was performed using G*Power (version 3.1) to determine the required sample size. Pilot data from the Health Literacy Scale-Short Form indicated that a minimum of 56 participants per group were needed to detect significant differences between two independent means, with an effect size of $d=0.57$, an α value of 0.05, and 85% power. Descriptive statistics were expressed as mean $\pm$ SD. Normality was evaluated with the Kolmogorov-Smirnov test. Normally and non-normally distributed data were compared with Student's *t*-test and Mann-Whitney U-test, respectively. Additionally, as a significant difference in educational levels (years) was observed between the groups ($p<0.001$), analysis of covariance (ANCOVA) was performed to compare health literacy, awareness of CVD risk factors and perceptions of exercise while controlling for years of education as a covariate. The significance level was set at $p<0.05$.

RESULTS

A total of 209 individuals (127 KTRs and 82 healthy controls) were initially assessed. However, 90 individuals did not complete the questionnaires and were excluded from the final analysis. The study was completed with 119 participants (59 KTRs and 60 healthy individuals). The demographic characteristics of the participants are given in Table 1. There was no statistically significant differences between the KTRs and the healthy control group in terms of age, gender distribution, BMI and smoking status (all $p>0.05$).

The etiological causes of CKD are also included in the Table 1. 66.1% of the patients had hypertension and 15.2% had diabetes mellitus. There was a statistically significant difference in education levels between KTRs and healthy individuals ($p<0.001$). KTRs demonstrated significantly lower health literacy levels compared with healthy individuals ($p<0.001$). Preliminary analyses showed significant disparities between KTRs and healthy controls in terms of awareness of CVD risk factors ($p=0.008$), perceived exercise benefits ($p=0.029$), and total EBBS scores ($p=0.040$) (Table 2).

However, when education years were included as a covariate in the ANCOVA model, the group differences in awareness of CVD risk factors ($p=0.228$), perceived exercise benefits ($p=0.557$), and total EBBS scores ($p=0.449$) were not statistically significant. These results suggest that the observed differences in awareness of CVD risk factors and perceptions of exercise were primarily driven by underlying differences in educational attainment, rather than transplant status itself. The difference in health literacy between groups remained significant after controlling for education level, suggesting that factors beyond formal education contribute to lower health literacy in KTRs ($p=0.009$). In addition, health literacy was correlated with perceived exercise benefits ($r=0.266$, $p=0.042$) in KTRs group. There was no association between time since transplantation and health literacy, awareness of CVD risk factors and total EBBS scores ($p>0.05$).

Table 1. Comparison of demographic characteristics between kidney transplant recipients and healthy individuals.

	Kidney transplant recipients (N=59)	Healthy individuals (N=60)	p
	Median (Min-Max)	Median (Min-Max)	
Age (years)	35 (19-64)	34 (19-62)	0.595
	Mean±SD	Mean±SD	
Body mass index (kg/m ²)	25.55±4.85	24.97±4.36	0.494
Estimated glomerular filtration rate (ml/min/1.73 m ²)	66.07±26.18	-	
Time since transplantation (years)	6.90±6.28	-	
	n (%)	n (%)	
Gender (Female/Male)	20/39 (34/66)	25/35 (42/58)	0.382
Etiology			
Glomerulonephritis	17 (28.8)	-	
Polycystic kidney disease	11 (18.6)	-	
Urological	10 (16.9)	-	
Unknown	14 (23.7)	-	
Other	7 (11.8)	-	
Hypertension	39 (66.1)	-	
Diabetes mellitus	9 (15.2)	-	
Smoking status			
Current smoker	10 (16.9)	9 (15)	
Non-smoker	39 (66.1)	40 (66.7)	0.949
Ex-smoker	10 (16.9)	11 (18.3)	

Table 2. Comparison of health literacy, knowledge of cardiovascular disease risk factors and perception of benefits/ barriers to exercise between kidney transplant recipients and healthy individuals.

	Kidney transplant recipients (N=59)	Healthy individuals (N=60)	p
	Median (Min-Max)	Median (Min-Max)	
Health Literacy Scale-Short Form score	33 (14-46)	36 (14-48)	<0.001
Cardiovascular Disease RFK Level Scale score	21 (8-26)	22 (7-28)	0.008*
Perceived Exercise Benefits Scale score	85 (32-116)	90 (29-116)	0.029*
Perceived Exercise Barriers Scale score	30 (16-39)	28 (15-51)	0.191
Perceived Exercise Benefits/ Barriers Scale score	115 (52-142)	121.50 (43-156)	0.040*

* p<0.05. RFKL: Risk Factors Knowledge.

DISCUSSION

This study evaluated health literacy, awareness of CVD risk factors, and perceptions of exercise benefits and barriers in KTRs compared with healthy individuals. The main findings of our study, after accounting for

differences in education level, are that KTRs have significantly lower health literacy levels compared to a healthy control group. Conversely, although KTRs initially demonstrated a lower awareness of CVD risk factors and held more negative perceptions of the benefits of exercise in unadjusted analyses, these differences became insignificant once

education level was taken into account. These findings together demonstrate that health literacy remains a significant and lasting challenge for this population, whereas disparities in cardiovascular knowledge and exercise perceptions are largely dependent on educational level.

In this study, despite accounting for differences in educational level, health literacy was significantly lower among KTRs compared to healthy individuals. This finding is clinically important as health literacy plays a central role in patients' ability to understand health-related information, actively participate in disease management, and effectively navigate complex healthcare systems. Although organ transplant recipients maintain continuous communication with healthcare professionals, they may still face challenges related to long-term disease self-management.^{5,14} Previous studies have shown that limited health literacy is common among patients with CKD and is associated with poorer self-management and adverse clinical outcomes.⁵ KTRs constitute a population with especially complex care requirements, including the need to understand immunosuppressive therapies, manage cardiovascular risk factors, prevent infections, and implement lifestyle modifications, all of which may pose significant challenges for individuals with low health literacy. After transplantation, patients may believe that they are fully recovered and disregard long-term risks such as cardiovascular disease. Furthermore, post-transplant education often focuses on the medical adherence, which can inadvertently diminish the importance of health literacy regarding preventative strategies and healthy lifestyle behaviors.⁸ Previous research has consistently demonstrated that low health literacy is associated with reduced adherence to recommended health behaviors and poorer clinical outcomes. These findings underscore the importance of addressing health literacy as a key component of post-transplant care.⁶⁻⁸

In the present study, a significant difference in education level was observed between the groups. This finding is consistent with existing literature showing that individuals with lower educational attainment are at increased risk of developing CKD and experience poorer outcomes after kidney transplantation.¹⁵ Leonforte et al. reported that

low socioeconomic status and education level negatively affect outcomes in KTRs. However, the fact that health literacy remains low even after considering education level in our study indicates that factors beyond formal education also contribute to this inequality. Therefore, improving access to education and providing targeted educational support to enhance health literacy can improve treatment adherence and reduce disparities in organ transplant-related outcomes.¹⁶

Initially observed differences in knowledge of CVD risk factors and perceptions of the benefits of exercise between groups were no longer significant after accounting for educational levels. This result supports the idea that educational level plays a central role in shaping knowledge about disease and perceptions of health. Leonforte et al. stated that a low socioeconomic status and a low level of education adversely impacts the results of kidney transplants. The study concluded that improving access to education and enhancing health literacy by providing educational support can improve adherence to treatment and outcomes.¹⁶ Huang et al. also stated in their study that living donor KTRs with higher levels of education have a better prognosis.¹⁷ On the other hand, education level has been shown to be significantly associated with knowledge about CVD factors. Individuals with higher education levels demonstrate greater awareness of healthy lifestyle behaviors.^{18,19} These results demonstrate the importance of distinguishing between knowledge gaps that depend on education and health literacy deficits that persist beyond formal education.

The benefits of renal replacement therapy are well known, CVD remains the leading cause of morbidity and mortality among KTRs. The persistence of traditional risk factors—such as hypertension, diabetes mellitus, dyslipidemia, and obesity—forms a baseline of risk that continues to challenge the cardiovascular health of the recipient. However, the clinical status of KTRs is further complicated by transplant-specific stressors. Immunosuppressive, systemic inflammation and associated metabolic disorders increase the overall cardiovascular burden.^{9,10} Although statistical significance was lost after correction, the high prevalence of conventional cardiovascular risk factors (particularly hypertension and diabetes

mellitus) among KTRs in this study indicates the importance of raising awareness of cardiovascular risk and health education in this group. This supports previous research demonstrating that educational attainment is an important factor of cardiovascular knowledge, risk perception and traditional risk factor control.^{20,21} However, our findings suggest that although differences in knowledge decrease after adjusting for education, disparities related to health literacy remain, indicating that knowledge alone may not be enough to support effective health behaviors. A recent review highlights the positive effects of educational interventions on improving health literacy, promoting healthier lifestyle behaviors such as diet and physical activity, and enhancing overall health outcomes.²²

Previous studies have reported limited awareness of cardiovascular risk factors among patients with CKD and KTRs, even among those with frequent healthcare contact. Post-transplant education programs often focus primarily on graft survival and medication management, potentially overshadowing long-term cardiovascular risk prevention.⁵ Ballesteros et al.'s²³ qualitative research findings has shown that KTRs often underestimate post-transplant cardiovascular risk and rarely consider cardiovascular disease prevention as a priority post-transplant. Furthermore, patients may assume they are fully recovered after organ transplantation, leading to an underestimation of existing cardiovascular risk. Our findings suggest that limited health literacy may contribute to this misperception, potentially reducing patients' ability to recognize and manage long-term cardiovascular risks. Increasing awareness of cardiovascular risk factors through counseling and education by a multidisciplinary team has been shown to improve organ transplant recipients and individuals with CKD' health knowledge and self-management outcomes.^{24,25}

In terms of perceptions of exercise, unadjusted analyses revealed that KTRs reported lower perceived benefits of exercise than healthy individuals, although perceived barriers to exercise were similar across the two groups. Although this difference did not remain significant after accounting for educational level. This finding is consistent with previous studies indicating that KTRs generally exhibit

lower levels of physical activity than the general population.^{26,27} Our findings suggest that reduced awareness of exercise benefits may play a greater role than perceived barriers among KTRs. Exercise interventions have been associated with improvements in cardiorespiratory fitness, muscle strength, functional capacity, and patient-reported outcomes, as well as potential reductions in cardiovascular risk.^{26,28} The reduced perception of exercise benefits among KTRs may be explained by uncertainty regarding the type, intensity, and safety of physical activity appropriate for their condition. Qualitative studies suggest that fear of graft damage, lack of individualized exercise guidance, and limited understanding of the long-term benefits of exercise may negatively influence motivation and confidence. These concerns may contribute to a diminished perception of exercise benefits despite comparable perceived barriers.^{29,30} Furthermore, our study suggests that differences in educational level are the reason why KTRs perceive the benefits of exercise to be lower than those experienced by healthy individuals. Additionally, health literacy was found to be correlated with the perceived benefits of exercise in KTRs in our study. Our study adds to the existing literature by showing that KTRs with higher health literacy tend to perceive greater benefits from exercise, reinforcing the role of health literacy in understanding and valuing physical activity. The results of our study support the conclusion that health literacy may be an important mechanism contributing to inequalities in physical activity across different education levels.³¹

The lack of differences in perceived exercise barriers between the groups in our study suggests that KTRs perceive exercise as less beneficial, not more difficult, compared to healthy individuals. This distinction is important as it suggests that interventions should focus not only on reducing barriers but also on improving patients' understanding of the benefits of exercise. Commonly reported barriers include physical limitations, fatigue, and fear of injury, whereas facilitators include motivation to return to normal life, positive exercise experiences, and social support.^{29,30} From a clinical perspective, the findings indicate that exercise counselling and structured

physical activity programs should be included post-transplant follow-up process. Motivational interviewing, identifying personalized goal setting and appropriate activities, exercise prescriptions, and supervised exercise programs can help increase exercise-related benefits and participation in this population.^{4,32}

In the present study, no significant association was found between time since transplantation and health literacy, awareness of CVD risk factors, or perceived exercise benefits and barriers. Dahl et al.³³ emphasized that health literacy may show a short-term increase in the early post-transplant period, particularly during intensive follow-up phases, but this improvement plateaus in the following months. This finding highlights aspects of health literacy in KTRs that warrant closer attention once patients return to their home environment. In parallel, awareness of cardiovascular risk factors remains suboptimal in this population regardless of the time elapsed since transplantation.²³ Furthermore, qualitative study results indicate that perceived barriers to exercise in KTRs (e.g., fear of damaging the transplanted organ, lack of guidance, and limited professional support) persist even months or years after transplantation; suggesting that these perceptions are not time-dependent.²⁹ Overall, these findings suggest that time since transplantation alone may not be sufficient to improve health literacy or related perceptions, underscoring the importance of continuous and structured educational and behavioral support during long-term follow-up.

Limitations

This study has several limitations. The study's single-center design and the exclusion of some individuals may limit the generalizability of the results. The sample size was reduced because more than half of the patients we contacted did not complete the survey. The lack of long-term follow-up studies prevents drawing conclusions about the lasting effects of educational interventions.

Conclusion

In conclusion, this study demonstrates that KTRs have significantly lower health literacy levels than healthy individuals, independent of educational level. It appears that differences in knowledge of CVD factors and perceptions of exercise are largely driven by educational

disparities rather than transplant status alone. Although the perceived barriers to exercise were similar between the groups, the KTRs had less favourable perceptions of the benefits of exercise due to educational status and health literacy. Our findings suggest that clinical need for educational interventions after organ transplantation that take into account differences in health literacy levels. Health literacy-sensitive educational strategies and individualized exercise counseling as integral components of post-transplant care to improve self-management and reduce long-term cardiovascular risk. Future studies should investigate whether improving health literacy leads to long-term improvements in both self-management behaviours and patient outcomes in KTRs.

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