



One-year Body Mass Index Change in Adult Renal Transplant Recipients and Its Relationship with Glomerular Filtration Rate and Creatinine Level: A Retrospective Study

Yetişkin Böbrek Nakli Alıcılarında Bir Yıllık Vücut Kitle İndeksi Değişimi ve Bu Değişimin Glomerüler Filtrasyon Hızı, Kreatinin Değerleri ile İlişkisi: Retrospektif Bir Çalışma

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ABSTRACT

Objective: Renal transplantation is a challenging process for the recipients. One of the important problems in this process is unwanted weight gain. This study aimed to determine the change in body mass index (BMI) and to evaluate the effect of recipient characteristics on BMI during one-year period after renal transplantation.

Methods: The article was conducted in a retrospective design. In the study, files of 170 patients who underwent renal transplantation between 2015 and 2016 were reviewed retrospectively. T-test, ANOVA, and correlation analysis were used in the analysis of data.

Results: It was determined that the patients had a tendency to have increased BMI after transplantation, with a higher rate in the first three months. The increase in BMI was higher in singles than in married participants ($p=0.01$ and $p<0.05$), and in men than in women ($p=0.01$ and $p<0.05$). It was determined that there was no significant relationship between BMI values and glomerular filtration rate, and creatinine levels of adult renal transplant recipients ($p>0.05$).

Conclusion: In the study, it was determined that the increase in BMI was higher especially in the first three months after renal transplantation. For this reason, it is an important requirement to address the counseling and support to patients and their relatives regarding weight management in the early period.

Keywords: Body mass index, kidney transplantation, obesity, transplant recipients, weight gain

ÖZ

Amaç: Renal transplantasyon, alıcılar için zorlu bir süreçtir. Bu süreçteki önemli sorunlardan biri de istenmeyen kilo alımıdır. Bu çalışmada, böbrek nakli sonrası bir yıllık süreçte vücut kitle indeksindeki (VKİ) değişimin belirlenmesi ve alıcı özelliklerinin VKİ'ye etkisinin değerlendirilmesi amaçlanmıştır.

Yöntemler: Makale retrospektif olarak yürütülmüştür. Çalışmada 2015-2016 yılları arasında böbrek nakli yapılan 170 hastanın dosyaları retrospektif olarak incelenmiştir. Verilerin analizinde t-testi, ANOVA ve korelasyon analizi kullanılmıştır.

Bulgular: Hastaların nakil sonrası VKİ'de ilk üç ayda daha fazla artış eğilimi olduğu belirlenmiştir. VKİ artışı bekarlarda evlilere göre ($p=0,01$, $p<0,05$), erkeklerde kadınlara göre ($p=0,01$, $p<0,05$) daha yüksektir. Glomerüler filtrasyon hızındaki VKİ değişiklikleri ile kreatinin ölçümleri arasında anlamlı bir ilişki olmadığı saptanmıştır ($p>0,05$).

Sonuç: Çalışmada böbrek nakli sonrası özellikle ilk üç ayda VKİ artışının daha fazla olduğu belirlenmiştir. Bu nedenle kilo yönetimi konusunda hasta ve yakınlarına danışmanlık ve desteğin erken dönemde verilmesi önemli bir gerekliliktir.

Anahtar Sözcükler: Vücut kitle indeksi, böbrek nakli, obezite, nakil alıcıları, kilo alımı

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Cite this article as: Cebeci F, Seçkin D, Erdem Ç, Dizlek Bayraktar D, Çetinkaya R. One-year Body Mass Index Change in Adult Renal Transplant Recipients and Its Relationship with Glomerular Filtration Rate and Creatinine Level: A Retrospective Study. Bezmialem Science 2024;12(1):78-83



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Received: 02.06.2023

Accepted: 14.10.2023

Introduction

Renal transplantation constitutes 12.97% of the treatment options in end-stage renal disease (1). According to the United States Renal Data System, approximately more than a quarter (25.7%) of patients who have been waiting for a kidney transplant for 1 year have received a kidney transplant (2). It is reported that renal transplantation has increased in Turkey over the years, and 3,621 individuals were transplanted in 2022 (3).

Renal transplantation is a challenging process for patients and their relatives. One of the encountered problems in this process is weight gain. It is known that there is a three-fold increase in the risk of obesity and a two-fold increase in the risk of morbid obesity in the post-transplant period. Therefore, determining the weight gain status in renal transplant recipients is important to support weight management. Maintaining a normal weight by regulating the lifestyles of patients is of great importance in terms of the functions of the transplanted organ, and it is important in increasing the success of treatment (4). In a study by Kim et al. (5), renal functions decreased as body mass index (BMI) increased, especially in the first three months after transplantation. It was reported that death and graft defects were more common in patients with a BMI above 30 kg/m² one year after transplantation (6). In another conducted research, it was observed that the risk of short-term complications in the 90-day period after transplantation was higher in obese individuals (7).

Graft failure and morbidity in the first three years after transplantation may not be associated with morbid obesity (8). But, it is stated that obesity is a serious problem in renal transplant recipients, and there is an important relationship between increased BMI and decreased graft functions (9). In addition, the pre-transplant weight status of patients also affects post-transplantation (10). There were no studies in the literature that were similar to our study when it was being prepared. Considering the data in the literature, the purpose of this study was to determine the BMI changes of patients after renal transplantation in one-year period.

Research Questions

1. What are the changes in BMI of adult renal transplant recipients over one-year period?
2. Do the demographic characteristics of adult renal transplant recipients affect BMI changes in the first one year?.
3. Is there a relationship between BMI values, glomerular filtration rate (GFR), and creatinine levels of adult renal transplant recipients?

Methods

Study Population and Design

The Organ Transplantation Center at a University Hospital's patient files from January 2015 to 2016 were retrospectively analyzed. When renal transplant recipients came for control,

their height, weight, blood pressure, liver, and renal functions were recorded in their files. Study data were obtained from patient files. The records of adult renal transplant recipients followed up in the Organ Transplantation Center constituted the population of the study. A purposeful sampling method was used. The file data of the patients who underwent transplantation in the center for the years 2015-2016 constituted the sample. One hundred eighty eight patient records were included in one year, with missing data on study size. Adults (aged ≥ 18 years old) and patients who died at least one year after renal transplantation were included. However, patients who died within one year and patients with files with missing data were excluded. Eighteen files were excluded due to insufficient medical records in terms of authorization bias.

In this study, dependent variables were BMI, creatinine level, and GFR. The independent variables of the research were defining features (age, gender, educational status, marital status, donor type, transplantation time). Research data were collected through the data collection form, which was created by using the literature (4,6,8). The data collection form consisted of questions measuring the degree of the relation of the living donor, age, gender, educational status, marital status, donor type, BMI, transplantation time, creatinine level, and GFR. The form was planned in such a way that all data about the patient could be taken from the patients' files. Research data were collected after obtaining institutional permissions and ethics committee approval and continued until all patient records within the specified date range were reached. The Clinical Research Ethics Committee's approval and the hospital's institutional permission were obtained in order to carry out the study (dated 20.02.2016, issue no: 70904504/77, decision no: 101).

Statistical Analysis

Data were evaluated with the IBM SPSS 23 program in an electronic environment for analysis of data. Descriptive statistics were displayed as frequency, percentage, mean, standard deviation, maximum and minimum values. Missing data were not included in the analyses. Patients' BMI changes in 1st, 3rd, 6th, 9th and 12th months were calculated based on pre-transplant BMI levels [Δ BMI (BMI x. month-BMI baseline/BMI baseline)]. Independent t-test analyzes between patients' BMI change, gender, age, marital status and transplant type were performed. ANOVA test was used to compare patients' BMI changes according to education level. Repeated analysis of variance was performed to examine whether BMI levels differed between 1st, 3rd, 6th, 9th and 12th months and pre-transplantation period. Sidak pairwise comparison test was applied to examine the different measurement times. Correlation analysis was applied to examine the relationship between BMI changes, GFR, and creatinine level. P values less than 0.05 were considered statistically significant in the study.

Results

The data obtained as a result of the retrospective study were analyzed with the statistical methods mentioned above. The

findings obtained as a result of the analysis of the data are explained below.

Our study consisted of 170 (48 female and 122 male) patient data. 85.3% of the recipients were transplanted from a living donor. Before transplantation, 53% of patients were normal weighted. The mean BMI of the patients before transplantation was found to be $23.05 \pm 4.74 \text{ kg/m}^2$ (Table 1).

While the mean BMI was $24.29 \pm 4.81 \text{ kg/m}^2$ in the first month, it was determined as $27.04 \pm 5.33 \text{ kg/m}^2$ at the end of the 12th month and it was found gradually increased. It was found that the increase in BMI was higher in males than in female patients (Figure 1).

Table 1. Sociodemographic characteristics of the patients (n=170)

Donor type	n	%
Living donor	145	85.3
Deceased donor	25	14.7
Living donor	n	%
First degree relative	68	40.0
Second degree relative	34	20.0
Fourth degree relative	60	35.3
Cross	8	4.7
Education	n	%
Primary	94	55.3
High school	48	28.2
Bachelors	28	16.5
Marital status	n	%
Married	116	68.2
Single	54	31.8
Age	Mean ± SD	Min-max
	41.45±12.75	20-77
Sex	n	%
Female	48	28.2
Male	122	71.8
BMI before transplantation	n	%
Underweight	29	17.1
Normal weight	90	52.9
Pre-obesity	32	18.8
Obese	19	11.2
BMI	Mean ± SD	Min-max
Before transplantation	23.05±4.74	13.36-36.21
First month after transplantation	24.29±4.81	13.25-42.53
12 th month after transplantation	27.04±5.33	14.49-44.41

Min: Minimum, Max: Maximum, SD: Standard deviation, BMI: Body mass index

When the patients' BMI changes according to age were examined in the first year after transplantation, it was found that increase in BMI was $0.21 \pm 0.17 \text{ kg/m}^2$ in patients aged 40 and below, and increase in BMI was $0.16 \pm 0.15 \text{ kg/m}^2$ in patients aged 41 and above. These changes were determined to be statistically significant ($p=0.03$). A statistically significant difference was found between changes in patients' marital status and BMI at 1st, 3rd, 6th, 9th, and 12th months ($p=0.01$, $p<0.05$). BMI increases in single patients were higher than in married patients. There was no statistical difference between the education levels and donor types of the patients and the BMI changes in the 1st, 3rd, 6th, 9th, and 12th months ($p>0.05$). It was observed that BMI changes in the 1st, 3rd, 6th, 9th, and 12th months of the living and transplanted patients were similar ($p>0.05$).

GFR measurements of the patients were $15.60 \pm 20.54 \text{ mg/dL}$ before transplantation and $73.39 \pm 25.97 \text{ mg/dL}$ at 12 months. While the mean of creatinine levels before transplantation was $5.95 \pm 3.72 \text{ U/L}$, the average of creatinine level at the end of the 12th month was $1.34 \pm 0.97 \text{ U/L}$. It was determined by the correlation analysis that the BMI changes of the patients according to the months did not have a significant relationship with the GFR and creatinine level ($p>0.05$). We found statistically different levels of change in patients in 1st, 3rd, 6th, 9th, and 12th months according to their pre-transplant BMI values, which were shown in Table 2 ($p=0.01$ and $p<0.05$). It was observed that there was no difference between the 9th and 12th month BMI changes of the patients, and there was an increasing trend between the other months. It was determined that the BMI changes of the patients in the 1st, 3rd, 6th, 9th, and 12th months were different according to their genders ($p=0.01$). It was observed that BMI changes in the 1st, 3rd, 6th, 9th, and 12th months of male patients were higher than those of female patients. It was determined that female patients' BMI increases between 1-12 months were lower than those of male patients (Figure 1). The patients' marital status and the changes in their BMI in the 1st, 3rd, 6th, 9th, and 12th months were found to differ statistically ($p=0.01$ and $p<0.05$). It was observed that the BMI changes of the single patients in the 1st, 3rd, 6th, 9th, and 12th months were higher than the married patients.

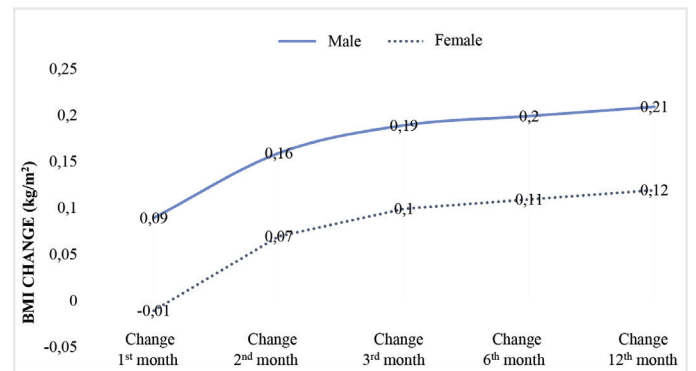


Figure 1. BMI changes by gender at 1st, 3rd, 6th, 9th, and 12th months

BMI: Body mass index

Table 2. BMI Changes in the 1st, 3rd, 6th, 9th, and 12th months (n=170)

BMI changes (n=170)	X ± SD	p**	Difference***
Δ 1 st month	0.06±0.13	0.01*	1<2<3<4=5
Δ 3 rd month	0.14±0.14		
Δ 6 th month	0.17±0.15		
Δ 9 th month	0.18±0.15		
Δ 12 th month	0.19±0.16		

Δ= (Month Measurement-Baseline)/Baseline x100,
 *Significant difference
 **Repeated analysis of variance was applied
 ***Sidak test was applied for pairwise comparison test
 BMI: Body mass index, SD: Standard deviation

Discussion

Weight gain in transplant recipients causes an adverse cardiovascular profile. Weight gain is becoming an important factor in the evaluation of graft dysfunction after transplantation. Weight increase following a transplant is linked to ischemic heart disease, hypertension, diabetes, and dyslipidemia (11-14). Regardless of their nutritional status prior to transplantation, about 50% of patients gain weight afterward. There are studies reporting weight gain in patients within one year after renal transplantation (4,5,10,15-18). Significant increases are observed in the weight of individuals after renal transplantation, especially in the 3rd and 12th months (11,16,19,20). In our study, the average BMI was 23.05±4.74 kg/m² before transplantation, 24.29±4.81 kg/m² in the 1st month after transplantation, and 27.04±5.33 kg/m² in the 12th month. In a study, the mean weight gains in the first 12 months after transplantation was 4.4±9.6 kg. It was stated that the weight gains of the group with a BMI of ≥35 kg/m² before transplantation was 9.8±7.02 kg in one year after transplantation [Liese et al. (21)]. However, there are also studies showing that the increase in the first years is not significant or that this increase is not statistically significant (10,18). In a two-year observational study by Wołoszyk et al. (22), in patients who were initially overweight and obese, their BMI did not significantly change after two years. In a study evaluating living donor transplantations, it was reported that 40 of 427 patients who were obese and normal weighted (BMI <30) before transplantation had post-transplant weight gain (11).

The mean BMI in our study was 23.05±4.74 kg/m² before transplantation and 27.04±5.33kg/m² in the 12th month after transplantation. According to the obtained data, the BMI levels of the transplant recipients increased by 19% at the end of the first year (Figure 1). This increase may be due to intensive immunosuppressive therapy after transplantation, it is important to carefully monitor weight, especially in the first months, and to handle weight management by a multidisciplinary team approach. In case of need, it is an important requirement to examine the cultural factors in detail that affect weight gain in patients.

In our study, it was determined that the BMI changes of the patients differed according to gender (p=0.01) and that the increase in BMI of male patients was higher in the one year after

transplantation. There are different results in studies on the effect of gender on BMI changes. In the literature, there were studies that found a statistically significant difference between BMI and gender (21,23) and there were also studies that showed no difference (11,24). Our study supports literature data showing significant differences between BMI and gender. It is thought that this situation is related to the eating habits and lifestyles of male and female patients, and cultural differences affect this situation.

In our study, it was determined that single renal transplant recipients gained more weight than married ones. In our country, married individuals lead a more regular life than singles (25). Our result was thought to be related to a regular life with marriage, the culture of preparing food at home, and the decrease in the consumption of ready-made/processed food.

Donor type and monthly variations in BMI did not differ from one another (p>0.05). In other words, BMI changes in the 1st, 3rd, 6th, 9th, and 12th months of living and deceased donor transplant recipients were similar. Liese et al. (21), reported no significant difference between BMI and donor type in a five-year retrospective study. Uysal et al. (26), reported no statistically significant difference between cadaver donor and living donor in terms of the BMI changes of the recipients in the 6th and 12th months. In this respect, our findings are similar to the literature.

In the study, it was found that patients younger than 40 years of age (n=81) had a higher BMI change in the first year after transplantation than those over 40 years of age (n=89) (p=0.03). In the study of Bardonnaud et al. (27), unlike our study, it was stated that the average age of obese patients was higher after transplantation. In a retrospective study, there was no significant difference between recipient age and BMI (BMI ≤29.9, BMI 30-34.9, BMI ≥35) (p=0.597) Liese et al. (21) evaluated five-year renal transplantation data. Different results in age and BMI comparison may be due to cultural habits and lifestyle.

A major risk factor that reduces the GFR value is obesity, which occurs between 3 and 6 months following renal transplantation (28). In our study, there was no statistically significant distinction between BMI changes and GFR changes in the 1st, 3rd, 6th, 9th, and 12th months before and after transplantation (p>0.05). In a study, obesity was not seen as a permanent risk factor in one year but became a risk factor again in two and three years (28). In the study of Kim et al. (5), a negative significant correlation was found between BMI and GFR. In this study, it was determined that the only independent factor explaining the decrease in GFR between the pre-transplantation and the first month after transplantation was the increase in BMI (5). In a five-year retrospective study by Liese et al. (21), 12 months after transplantation, the GFR value was found to be significantly lower in obese patients than in non-obese patients (32.76 mL/min), (p=0.005). Being overweight and obese was associated with annual GFR decline (29). Contrary to these studies, Forte et al. (15), revealed that post-transplant weight changes did not affect the GFR level.

In our study, the mean creatinine value of the patients at the end of the first year was 5.95 mg/dL and the mean BMI was 27.04±5.33 kg/m² at the end of the first year. Nevertheless, there was no statistically significant difference between BMI changes and creatinine levels over the first 12 months ($p>0.05$). Contrary to our study; in a study, the mean creatinine level of the groups with BMI ≤ 29.9 , 30-34.99, and ≥ 35 kg/m² in the 12 months after renal transplantation were determined as 1.76±0.81, 2.04±0.10 and 2.1±0.66 mg/dL, respectively, and a statistically significant difference was found between them ($p=0.036$) (23). In the study of Malgorzewicz et al. (24), a positive, moderately significant correlation was found between BMI and creatinine level ($r=0.38$, $p<0.05$) in the early post-transplant period (30-180 days).

Study Limitations

There were various limitations to our study. The limitations of the study were that it was a single-centered study, there were missing file data, and the data obtained were limited to the ones in the file.

Conclusion

In summary, as a result of the research, patients experienced weight gain, especially in the first six months after transplantation. Male patients had a higher tendency to have increased BMI than women and single patients compared to married ones. There was no effect of BMI changes on GFR and creatinine level in the one-year post-transplantation period. From this point of view, it may be recommended to focus especially on the first months in terms of weight gain, and to increase information, support and counseling during these months. In addition, socio-cultural factors affecting weight gain in the first months after transplantation may need to be addressed and investigated. It is the responsibility of the entire post-transplant team to evaluate the post-transplant habits of the patients in detail and to make attempts to improve them.

Ethics

Ethics Committee Approval: Akdeniz University Faculty of Medicine, Clinical Research Ethics Committee (number: 70904504/77).

Informed Consent: Retrospective study.

Peer-review: Externally peer reviewed.

Authorship Contributions

Surgical and Medical Practices: R.Ç., Concept: F.C., Design: D.S., Ç.E., D.D.B., Data Collection or Processing: D.S., Ç.E., D.D.B., Analysis or Interpretation: D.S., Ç.E., D.D.B., Literature Search: D.S., Ç.E., D.D.B., R.Ç., Writing: F.C., D.S., Ç.E., D.D.B.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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