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## The effect of hematopoietic stem cell transplantation awareness in university students on being a volunteer donor

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### Abstract

**Problem/aim** This study was planned in order to determine the effect of hematopoietic stem cell transplantation awareness in university students on being a volunteer donor.

**Method:** The research as a quasi-experimental single group study with a pretest-posttest design was completed with 1216 students who agreed to participate in the study. The data were collected through a questionnaire prepared by the researchers. The questionnaire consists of three parts and a total of 46 questions, which contains demographic attributes, knowledge about hematopoietic stem cell transplantation, and questions measuring participants' attitudes. Mean, standard deviation, median, frequency, Mann-Whitney U, Kruskal-Wallis, Pearson chi-square, Spearman's correlation tests were used to evaluate the data. The results were evaluated at a 95% confidence interval, and the significance level was  $p < 0.05$ .

**Results:** Participants was 41% studied in health sciences departments. While the pre-training awareness of the need for hematopoietic stem cell donors in Turkey was 51.9%, it increased to 92.1% after the training. Before the training, while 25.5% of the students stated that they definitely wanted to donate hematopoietic stem cells, this percentage increased to 45.9% after the training. The average increase of  $52.68 \pm 24.35$  units in the post-training hematopoietic stem cell transplant knowledge score of the students compared to the pre-training was found to be statistically significant ( $p=0.001$ ) After the training, a statistically significant difference was found between the HSCT knowledge scores of the students according to their sociodemographic characteristics (gender, department, duration of degree, grades) ( $p=0.001$ )

**Conclusion:** It was concluded in the study that the knowledge level of the students on hematopoietic stem cell transplantation was insufficient, and the training had a positive effect on their knowledge and attitude concerning hematopoietic stem cell donation.

**Keywords:** Stem cell transplantation, education, knowledge, attitude, awareness.

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## 1. Introduction

Hematopoietic stem cell transplantation (HSCT) has taken its place as a successful treatment option today in cases where bone marrow does not work enough or not at all, in malignant hematologic diseases, genetic disorders, and immunologic diseases (Bayraktar and Ciurea, 2013). Human Leukocyte Antigen (HLA) is an effective criterion for the success rate of the transplantation treatment and in determining the donor compatibility. In the studies conducted, while the compatibility within the family was 25%; the chance of compatibility among other members of the family has been stated as 30% (Boo *et al.*, 2011; Tiercy, 2016). However, looking for 9/10 or 10/10 compatibility and having a rare gene-phenotype of HLA in order for the treatment to take place decreases the possibility of a match (Tiercy, 2012). This process takes a long time due to the difficulty in HLA compatibility and the insufficient number of donors. Despite the increase in the number of donors day by day, the desired figures cannot be fully reached due to the increase in the demand amount. According to the data of TÜRKÖK (2018), the number of donors has reached up to 63,900 individuals.

The number of people who have had transplantation treatment with a compatible match from TÜRKÖK donors is 292 (Türkkök Statistics 2018). The young population is in the position of potential donors due to the rarity of chronic diseases and the longer stay in stem cell banks. Although many activities have been carried out to increase it; the donor rate of individuals in the 18-26 age group is not sufficient. In the donor analysis of the Global Trend Report 2017, it was stated that the donation made by the 18-25 age group constituted 14.3% of all donations (*WMDA Global Trend Report*, 2017).

When the studies on hematopoietic stem cell and organ donation are evaluated; although the willingness to be a donor is influenced by factors such as age, gender and educational background; the knowledge level about hematopoietic stem cell and organ donation is one of the main criteria for being a donor. While the willingness of the participants to be a donor was around 50% in the studies conducted; the percentage of actual registered individuals was quite low. However, it was determined that the willingness to be a donor increased when they were educated on this subject (Yılmaz, 2011; Kaya *et al.*, 2015; Sezek *et al.*, 2015; Kim and Shin, 2019).

The picture of chronic diseases is increasing day by day and it goes down to lower levels in age groups. The younger population is more likely to be a potential donor than other age groups due to the fact that chronic diseases are less common and they will stay in stem cell banks for a longer period of time. Although many national and international activities are carried out to increase the donor rate, the donor rates of active and healthy people in the 18-26 age group are not sufficient. There is a need for this group to be recruited to stem cell banks by analyzing the factors affecting being a donor.

## 2. Purpose

This study was conducted to determine the impact of university students' awareness of HSCT on volunteering as a donor.

### 2.1. Study hypothesis

H<sub>0</sub>: University students' awareness of HSCT on volunteering as a donor is the same before and after training.

H<sub>1</sub>: University students' awareness of HSCT on volunteering as a donor is different before and after training.

## 3. Method and material

### 3.1. The place and time of the study

The study population consists of 16,649 students between the ages of 18-25 who study at a university in the 2018-2019 academic year.

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### 3.2. Population and sample selection

The sample size was determined as 376 using the sample formula with a known population based on a 95% confidence level and  $\pm 5\%$  margin of error. The study was completed with 1216 students.

### 3.3. Type of the study

This study was planned as a quasi-experimental single group pre-test-post-test design.

### 3.4. The variables

- a-be a university student
- b-agree to participate in the study
- c-be between the ages of 18-25

### 3.5. Data collection

#### 3.5.1.Data collection method

The study was carried out in the lectures and classrooms without a lack of projection, allowed by the lecturers of the faculties and colleges whose necessary permissions were obtained. The study consists of three stages and in the first stage, a pretest form was distributed and 15 minutes were allowed to answer. The completed forms were collected from the participants. In the second stage, the training on HSCT prepared in the form of a slide was explained to the participants with a 15-minute presentation. The content of the training was prepared by the researchers and the opinions of a hematology expert were included. In the third stage, the final test was filled by the same participants. The questionnaire numbers were written on the forms to match the questionnaire forms belonging to the same individuals. In order to inform about the donation program to be organized at the end of the study; an extra form was distributed to the students who wanted to be a donor and share their contact information. The students who shared their contact information were supplied with the Turkish Red Crescent team's information report, who came to the university campus three months after the end of the study for blood and stem cell donation, and they were invited to donate hematopoietic stem cells.

#### 3.5.2 Data collection tools

The "Data Collection Form" prepared by the researchers was used in data collection. This form consists of three sections and a total of 46 questions. The form consists of demographic characteristics, knowledge questions about hematopoietic stem cell transplantation, questions measuring participants' attitudes, and multiple-choice questions on what affects donation motivation. In the first section, there are 14 questions with which we examined the sociodemographic characteristics of the students. In addition to demographic characteristics, information about family history of cancer and past blood donation were also included, which appear in the review of the literature as factors affecting being a hematopoietic stem cell donor. The second section in which the knowledge level of the participants about HSCT was evaluated consists of 19 items questioning the treatment, the donor criteria and the donation process. The answers were determined as Yes \ No \ I don't know. In the evaluation of the questions; they were scored as 1 for correct answers and 0 for incorrect answers / I don't know. The points obtained were converted to a scale-of-100 and the evaluation was made over 100 points. The Cronbach's alpha value of the knowledge questions in the questionnaire was calculated as 0.832. In the third section of the form, there are 13 questions about the attitude towards donation.

#### 3.5.3.Pre-testing of Data Collection Tools

The clarity of the data collection form and the training content was tested before the study by applying to 10 individuals between the ages of 18-25 who had no knowledge in the field of health sciences.

#### 3.5.4.Data collection time

2018-2019 academic year

### 3.6. Limitations of the study

Lack of projection and speakers in some classrooms of faculties and colleges, whose permissions were obtained for the study, constituted the physical limitations.

### 3.7. Research ethics

Ethical aspects of the study, written informed consents were obtained from the participants who accepted to participate in the study by explaining the purpose and the duration of the study and what was expected from them. Necessary institutional permissions and ethics committee approval were obtained in advance of the study. (Ethical Committee No: 2018.168.12.02)

### 3.8. Evaluation of data

NCSS (Number Cruncher Statistical System) 2007 (Kaysville, USA, Utah) program was used for statistical analyses. Mean, standard deviation, median, frequency, minimum maximum values were give. Since the data was not normally distributed, Mann-Whitney U, Kruskal-Wallis, Pearson chi-square, Spearman's correlation tests were used to evaluate the data. Results were evaluated at a 95% confidence interval and a significance level of  $p < 0.01$  and  $p < 0.05$ .

## 4. Results

When the sociodemographic characteristics of 1216 students who accepted to participate in the study were analyzed; the average age was  $20.34 \pm 1.62$  (min: 18-max: 25) while 67.8% were women and 41% studied in the field of health sciences. Considering the participant students' characteristics that affect being an HSC donor, 5.8% had a family history of blood cancer/ blood disease, and 13.3% had a family history of organ cancer. The rate of need for HSCT treatment within the family was 0.9%. 71.6% of the students stated that they had knowledge about HSC donation before the training, and 72% of them stated that they got this information from social media. (Table 1).

Table 1. Sociodemographic Distribution of the Participants and Variables that Affect Being a Donor (N= 1216)

Variable	Min-Max Mean $\pm$ SD	(Median)
<b>Age(years)</b>	18-25 (20)	20.34 $\pm$ 1.62
	n	%
<b>Gender</b>		
Male	392	32.2
Female	824	67.8
<b>Marital Status</b>		
Married	12	1.0
Single	1204	99.0
<b>Department*</b>		
Health Sciences	499	41.0
Other	717	59.0
<b>Degree Program</b>		
Associate Degree	213	17.5
Bachelor's Degree	1003	82.5
<b>Grades</b>		
First Year	413	34.0
Second Year	518	42.6
Third Year	185	15.2
Fourth Year	100	8.2
<b>Blood cancer/blood disease history in the family</b>		
Yes	71	5.8
No	1145	94.2
<b>Organ cancer history in the family</b>		
Yes	162	13.3
No	1054	86.7

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<b>Blood donation history</b>		
Yes	334	27.5
No	882	72.5
<b>Knowledge status about hematopoietic stem cell donation</b>		
Yes	871	71.6
No	241	19.8
I don't know	104	8.6
<b>Information source***</b>		
Television	177	20.3
Radio	8	0.9
Banner	40	4.6
Newspaper	88	10.1
Social Media	627	72.0
Other**	65	7.5

\*Health Sciences: Nursing, Emergency and Disaster Management, Nutrition and Dietetics.

Other: Faculty of Science and Literature, School of Physical Education and Sports, Faculty of Veterinary Medicine, Faculty of Agriculture, Vocational School of Social Sciences, Faculty of Theology, Faculty of Economics and Administrative Sciences, Vocational School of Technical Sciences.

\*\* School, Friend, Course, Red Crescent, etc.

\*\*\* More than one option ticked

When the answers given by the students to the questions about HSCT were analyzed; the statement “3 tubes of blood sample are adequate for hematopoietic stem cell donation” was answered correctly by 15.4% of the students before the training, this percentage has increased to 94.9% after the training. While the statement "When there is a compatible donor, hematopoietic stem cell collection is performed like blood donation through a needle from the arm and it is the most commonly used method" was answered correctly by 23.3% of the students before the training; this percentage has increased to 93.4% after the training. While the statement “Donor gets informed about the patient's identity before donating bone marrow” was answered correctly by 19% of the students before the training; this percentage has increased to 73.2% after the training. While the statement “After donating bone marrow, hematopoietic stem cell donor stays in hospital for a long term” was answered correctly by 31.3% of the students before the training; this percentage has increased to 87.2% after the training. While the statement “Hematopoietic stem cell donor has the right to withdraw from being a donor when there is a compatible donor” was answered correctly by 35.3% of the students before the training; this percentage has increased to 93.5% after the training (Table 2).

Table 2. Distribution of the Pre and Post-Training Answers Given to the Knowledge Questions About HSCT (N = 1216)

Variable	Pre-Training n (%)	Post-Training n (%)
<b>3 tubes of blood sample are adequate for hematopoietic stem cell donation</b>		
Yes	187 (15.4)	1154 (94.9)
No	22 (1.8)	16 (1.3)
I don't know	1007 (82.8)	46 (3.8)
<b>There is a high chance of finding compatible donors in hematopoietic stem cell treatment</b>		
Yes	112 (9.2)	439 (36.1)
No	332 (27.3)	645 (53.0)
I don't know	772 (63.5)	132 (10.9)

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<b>The patient or the donor do not pay any fees for hematopoietic stem cell treatment</b>		
Yes	469 (38.6)	1080 (88.8)
No	53 (4.4)	74 (6.1)
I don't know	694 (57.1)	62 (5.1)
<b>The state provides the donor a work permit for transplant procedures</b>		
Yes	251 (20.6)	1041 (85.6)
No	32 (2.6)	43 (3.5)
I don't know	933 (76.7)	132 (10.9)
<b>When there is a compatible donor; hematopoietic stem cells are collected only under general anesthesia through a needle from the hipbone in the operating room</b>		
Yes	208 (17.1)	528 (43.4)
No	99 (8.1)	622 (51.2)
I don't know	909 (74.8)	66 (5.4)
<b>When there is a compatible donor; hematopoietic stem cell collection is performed like the blood donation process through a needle from the arm and it is the most commonly used method</b>		
Yes	283 (23.3)	1136 (93.4)
No	60 (4.9)	22 (1.8)
I don't know	873 (71.8)	58 (4.8)
<b>Donor gets informed about the patient's identity before donating bone marrow</b>		
Yes	354 (29.1)	285 (23.4)
No	231 (19.0)	890 (73.2)
I don't know	631 (51.9)	41 (3.4)
<b>Hematopoietic stem cell recipient gets informed about the donor's identity before receiving bone marrow</b>		
Yes	309 (25.4)	252 (20.7)
No	212 (17.4)	908 (74.7)
I don't know	695 (57.2)	56 (4.6)
<b>After donating bone marrow, hematopoietic stem cell donor stays in hospital for a long term</b>		
Yes	64 (5.3)	85 (7.0)
No	380 (31.3)	1060(87.2)
I don't know	772 (63.5)	71 (5.8)
<b>Hematopoietic stem cell donor has the right to withdraw from being a donor when there is a compatible donor</b>		
Yes	429 (35.3)	1137(93.5)
No	26 (2.1)	26 (2.1)
I don't know	761 (62.6)	53 (4.4)
<b>Those with chronic diseases can donate hematopoietic stem cells</b>		
Yes	77 (6.3)	94 (7.7)
No	304 (25.0)	1007(82.8)
I don't know	835 (68.7)	115 (9.5)

When the knowledge scores of the students on HSCT were evaluated; the pre-training knowledge score average was  $28.72 \pm 22.01$ ; it was calculated as  $81.41 \pm 15.90$  after the training. The average increase of  $52.68 \pm 24.35$  units in the post-training hematopoietic stem cell transplant knowledge score of the students compared to the pre-training was found to be statistically significant ( $p=0.001$ ) (Table 3).

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Table 3. Evaluation of the Pre and Post-Training Knowledge Scores on HSCT (N =1216)

	Pre-Training Mean±SD	Post-Training Mean±SD	Difference	Test Value; p
<b>Hematopoietic Stem Cell Transplantation Knowledge Score</b>	28.72±22.01	81.41±15.90	52.68±24.35	Z:-29.730; p=0.001*

Z: Wilcoxon Signed Ranks Test; \*p<0.01 statistically significant

When we analyzed the students' pre and post-training attitudes concerning hematopoietic stem cell transplantation; while the pre-training awareness of the need for hematopoietic stem cell donors in Turkey was 51.9%, it has increased to 92.1% after the training. Before the training, while 25.5% of students stated that they definitely wanted to donate hematopoietic stem cells; this percentage has increased to 45.9% after the training. Before the training, only 2.1% of the students participating in the study had hematopoietic stem cell donor records. This rate has increased to 7.2% after the training. The students who shared their contact information during the study were invited to the blood and stem cell donation event held three months after the end of the study. After the three-day donation event, 62 people who registered as hematopoietic stem cell donors were among the informed group. Before the training, while 52.1% of the students stated that they would donate if somebody unrelated needed hematopoietic stem cell transplantation, this rate has increased to 67% after the training (Table 4).

Table 4. Distribution of the Pre and Post-Training Answers Given to the Attitude Questions on Hematopoietic Stem Cell Donation (N=1216)

Variable	Pre-Training n (%)	Post-Training n (%)
<b>I am aware of the need for hematopoietic stem cell donors in Turkey</b>		
Yes	631 (51.9)	1120 (92.1)
No	147 (12.1)	22 (1.8)
I don't know	438 (36.0)	74 (6.1)
<b>I definitely want to donate hematopoietic stem cells</b>		
Yes	310 (25.5)	558(45.9)
No	145 (11.9)	112 (9.2)
I don't know	761 (62.6)	546(44.9)
<b>I have an application as a hematopoietic stem cell donor</b>		
Yes	26 (2.1)	88(7.2)
No	1077 (88.6)	-
I don't know	113 (9.3)	-
<b>I will donate if somebody unrelated needs hematopoietic stem cell transplantation</b>		
Yes	634 (52.1)	815(67.0)
No	53 (4.4)	78 (6.4)
I don't know	529 (43.5)	323(26.6)
<b>I will only donate if a relative needs hematopoietic stem cell transplantation</b>		
Yes	308 (25.3)	310(25.5)
No	559 (46.0)	692(56.9)
I don't know	349 (28.7)	214(17.6)
<b>I will donate if I am a compatible donor for hematopoietic stem cell transplantation</b>		
Yes	601 (49.4)	798(65.6)
No	70 (5.8)	63 (5.2)
I don't know	545 (44.8)	355(29.2)

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When the students' sociodemographic characteristics and their pre and post-training knowledge scores on HSCT were analyzed; no statistically significant relationship was determined between their ages and their pre and post-training HSCT knowledge scores ( $p>0.05$ ). The pre and post-training knowledge scores of female students on HSCT were found to be statistically significantly higher than those of men. ( $p=0.001$ ). The pre and post-training knowledge scores of the students studying in health sciences were found to be statistically significantly higher than those studying in other departments ( $p=0.001$ ). The pre and post-training knowledge scores of the students studying in undergraduate programs were found to be statistically significantly higher than those studying in associate degree programs ( $p=0.001$ ). A statistically significant difference was determined between the pre-training knowledge scores of the participant students on HSCT concerning their academic levels. ( $p=0.001$ ). According to the Dunn-Bonferroni test results performed to determine the difference; the knowledge scores of the third-year students on HSCT were found to be significantly higher than those on different academic levels. ( $p=0.001$ ;  $p=0.001$ ;  $p=0.001$ ). After the training, a statistically significant difference was found between the HSCT knowledge scores of the students according to their sociodemographic characteristics (gender, department, duration of degree, grades). ( $p=0.001$ ) (Table 5).

**Table 5.** Evaluation of the Students' Sociodemographic Attributes and Their Pre and Post-Training Knowledge Scores on HSCT (N=1216)

		HSCT Knowledge Score		
Age	r	Pre-Training 0.007	Post-Training 0.055	
	p	0.811	0.053	
HSCT Knowledge Score		Gender		
		Male(n=392) Mean±SD	Female(n=824) Mean±SD	Test Value p
	Pre-Training	22.44±20.50	31.71±22.08	Z:-7.059 0.001*
	Post-Training	78.10±17.94	82.98±14.58	Z:-4.752 0.001*
	Difference p	55.67±26.02 0.001*	51.26±23.40 0.001*	Z:-7.059 0.001*
HSCT Knowledge Score		Department		
		Health Sciences (n=499) Mean±SD	Other (n=717) Mean±SD	Test Value p
	Pre-Training	36.36±21.70	23.41±20.63	Z:-10.352 0.001*
	Post-Training	86.23±12.11	78.05±17.30	Z:-9.593 0.001*
	Difference p	49.87±22.28 0.001*	54.64±25.53 0.001*	Z:-10.352 0.001*
HSCT Knowledge Score		Duration of Degree		
		Associate (n=213) Mean±SD	Bachelor's (n=1003) Mean±SD	Test Value p
	Pre-Training	22.41±19.74	30.06±22.24	Z:-4.661 0.001*
	Post-Training	74.65±17.23	82.84±15.23	Z:-7.576 0.001*
	Difference p	52.24±25.78 0.001*	52.78±24.05 0.001*	Z:-4.661 0.001*



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		Grades				Test Value p
		First (n=413) Mean±SD	Second (n=518) Mean±SD	Third (n=185) Mean±SD	Fourth (n=100) Mean±SD	
HSCT Knowledge Score	Pre-Training	25.11±20.92	29.3±21.68	40.2±22.02	19.1±19.27	χ <sup>2</sup> :80.265 0.001*
	Post-Training	78.50±18.22	81.7±15.18	86.5±10.13	82.32±15.52	χ <sup>2</sup> :27.542 0.001*
	Difference p	53.40±26.41 0.001*	52.3±23.45 0.001*	46.32±21.75 0.001*	63.16±20.84 0.001*	χ <sup>2</sup> :38.497 0.001*

r = Spearman's Correlation Coefficient; Z: Mann Whitney U Test;

χ<sup>2</sup>: Kruskal Wallis Test, Wilcoxon Signed Ranks Test; \*p<0.01 statistically significant

## 5. Discussion

The sociodemographic characteristics of the students participating in the study are consistent with the studies in this field of the literature (Sikora et al., 2014; Yazıcı et al., 2015; Güler et al., 2017; Ordin et al., 2018). Of the students, 72% obtained information about HSCT via social media. One study stated that 70% obtained via social media and 58% via television (Kaya et al., 2015; Sezek et al., 2015). Another study stated that the information sources were television, newspaper, book-magazine and health professions, respectively (Güler et al., 2017). The information sources vary according to the sample groups in other studies in the literature. However, high usage of social media as a source of information by the young population is consistent with our study.

It was observed that people with a relative in need of transplantation or a family history of blood cancer/organ cancer were more willing to donate hematopoietic stem cells and organs (Koçak et al., 2010; Studts et al., 2010; Ozturk Emiral et al., 2017; Kulakçı Altıntaş, 2018; Bağcivan et al., 2020). The results of our study are in line with the literature.

The studies indicated a significant positive relationship between donating blood and willingness to donate hematopoietic stem cells (Galanis et al., 2008; Kaya et al., 2015; Sezek et al., 2015; Suluhan et al., 2016). This case is parallel with our study. Because, this situation make the participants more aware.

The answers given by the participant students to the knowledge questions are in line with the literature. The study conducted by Sikora et al. (2014) determined that the most incorrectly answered question was about the region where the hematopoietic stem cell is obtained from, with a rate of 49% (n = 786) (Sikora et al., 2014). The study conducted by Narayanan et al. (2016) determined that the most incorrectly answered questions were about the stem cell collection area and the hospitalization duration (Narayanan et al., 2016). The studies indicated that there was a large group who believed stem cells are collected from the hip bone and under general anesthesia (Sikora et al., 2014; Mohamed and Azzazy, 2016; Narayanan et al., 2016; Hazzazi et al., 2019). The most important obstacle against donation was the belief that this process is painful and scary. Our study shows that training can fix this misinformation. Our study demonstrates that one of the obstacles against stem cell donation by the young population is the unawareness of the fact that they are supported by the state financially and time-wise. The study conducted by Kwok et al. (2015) also reinforces our assertion (Kwok et al., 2015). Similar to our study; the researches demonstrated that while the students' pre-training knowledge was insufficient, there was a significant increase in their post-training knowledge scores (Sikora et al., 2014; Kaya et al., 2015; Sezek et al., 2015). This shows the need and importance of training on the subject. Again in the studies conducted, the willingness to donate has increased in connection with the increase in the students' knowledge scores after the training (Abdrbo et al., 2017; Kim and Shin, 2019). Studies in

the field of organ donation also revealed the inadequacy of the knowledge level of the students (Yılmaz, 2011; Uzuntarla, 2016; Güler et al., 2017). The knowledge scores of the participants were found to be high in some studies in the literature. This shows parallelism with the sample selection (Kwok et al., 2015; Kulakcı Altıntaş, 2018).

Considering the factors of the willingness to be a donor; a certain group declared that they would only want to donate if a relative needed HSCT. No impressive change was determined in this group after the training. This was evaluated as the group accepted to be an HSCT donor due to obligation. Although the willingness to donate to unrelated individuals varied according to the educational status and the attributes of the study group; the rate has increased with the training provided. The literature and our study reinforce this conclusion (Kaya et al., 2015; Uzuntarla, 2016; Kim and Shin, 2019).

Training is one of the main criteria for creating donor awareness and consciousness; it can eliminate prejudices, fix misinformation and increase the number of donors. While many studies in the literature could analyze intentions and the willingness to donate, they could not examine whether these intentions were materialized or not. The participants in our study who had intentions to donate were asked for their contact information. Although 71% of these students had stated that they would, only 51% shared their contact details. In the study conducted by Kwok et al., 51.5% shared their contact information. The results match those mentioned in our study (Kwok et al., 2015). The informed group was invited to the blood and stem cell donation campaign organized three months later in addition to our study, and 62 individuals who registered as HSC donors after the three-day donation campaign were among the informed group.

In the study conducted by Kavurmacı et al. with a 24-31 age group; when the students' knowledge status about organ donation was analyzed; 42.5% stated that they had information about donation (Kavurmacı, Karabulut and Koc, 2014). In the study conducted by Akış et al. with a group aged 36-50 and above; it was determined that 72% of the research participants had sufficient knowledge about tissue and organ donation. (Akış M et al., 2009). In a web-based research conducted with an 18-60 age group; it was determined that 69.1% had a high knowledge score (Kwok et al., 2015).

There are studies in the literature showing that the young population did not have sufficient knowledge about HSCT (Mohamed and Azzazy, 2016; Hazzazi et al., 2019). As age increases, knowledge status increases in connection with education; however, age is not the only determining factor. The change in the knowledge scores could not be determined since the age factor was limited in our study. Broader studies need to be undertaken on this subject.

The study conducted by Sikora et al. determined that a higher amount of correct answers were given by women compared to men; whereas the study conducted by Güler et al. stated that the knowledge status did not differ according to gender (Sikora et al., 2014; Güler et al., 2017). There are studies in the literature in which the female population showed a positive trend in knowledge status about hematopoietic stem cell and organ donation. Similarly, while the pre-training knowledge status of the women was high in our study; a significant increase was observed in the knowledge scores of the male gender after the training. It is considered that the knowledge scores were high due to the heightened awareness rate of the female population on social issues.

In the study conducted by Güler et al. (2017) in Adıyaman on "The knowledge and opinions of university students about organ donations", it was determined that there was no relationship between the knowledge status on organ donation and the departments of education (Güler et al., 2017). In the study conducted by Kaya et al. to determine the effect of training on the knowledge status and attitudes of first-year university students regarding stem cell donation and transplantation; while the knowledge status of medical students has increased from 8% to 91%; it has increased from 8% to 68% for law students. After the training; the proportion of knowledgeable students was found to be significantly higher for medical students than law students

(Kaya et al., 2015). In the study conducted by Tarhan et al.; while the knowledge status of the students about organ donation and transplantation was 58.3% before the given information; afterwards it has increased to 84%. This was found to be statistically significant (Tarhan et al., 2012). In the review of the literature, there are differences in the relationship between the knowledge level and the departments of study. This difference may have resulted from the attributes of the groups studied and the research design. However, one can see that the provided training closes this knowledge gap. Broader studies need to be undertaken and provided to the literature in this field.

In our study, the increase in the knowledge scores of the students in undergraduate programs was found to be higher than those in associate degree programs. This might be related to a longer education period during the undergraduate program, increased age and awareness, and a higher education level obtained. In the review of the literature, no study was found showing any relationship regarding the hematopoietic stem cell donation process and the duration of degree. In the study conducted by Aktaş et al.; the knowledge status on organ donation was determined as 76.9% for second-year students, 84.4% for fifth-year students, and 97.1% for sixth-year students (Koçak et al., 2010). In the study conducted by Altıntaş (2018); it was revealed that students' opinions about organ donation implied significant difference according to academic level. The group with the biggest willingness to donate was the third-year students, followed by the second and fourth-year students respectively (Kulakcı Altıntaş, 2018). In the study conducted by Ordin et al. (2018); it was determined that the fear of medical neglect and bodily injury increased and their willingness to donate decreased, in connection with the advancement in the students' academic level (Ordin et al., 2018). In the study conducted by Yazıcı et al. (2015); no significant difference was found between the academic level and the consideration of donating organs (Yazıcı et al., 2015). The study conducted by Figueroa et al. (2013) suggested that the academic level was an effective factor in organ donation. In the study, the third-year students took the first place with a 63% donor rate, followed by the second-year students with 62.3% and the first-year students with 51% (Figueroa et al., 2013). Although there are studies in the literature showing that the knowledge status and awareness about hematopoietic stem cell and organ donation increase as the duration of education increases; there are also contradictory studies. As the academic level advances, it is expected that the willingness to donate increase in connection with the increased knowledge status. However, there are studies indicating that the most prominent group in terms of knowledge status and willingness to donate is the third-year students. Our study corroborates these conclusions. Third-year is one of the appropriate periods for providing information and training, as a year in which consciousness and awareness are created and sources of stress are less than those of fourth-year.

## 6. Conclusions

Although there are many factors affecting the status of being a donor; the most important one is to provide the young population with an accurate education of high quality. Broader studies need to be undertaken on this subject. Although the willingness to be a hematopoietic stem cell donor is influenced by factors such as age, gender and education level; the knowledge level on the subject is one of the main criteria for being a donor. In the studies conducted, the willingness of the participants to be a donor was around fifty percent, and the actual rate of registered individuals was quite low. However, as can be seen in the literature and our study; the willingness to donate increases when training is provided on this subject (Yılmaz, 2011; Kaya et al., 2015; Sezek et al., 2015; Kim and Shin, 2019). In scope of this conclusion we can accept H<sub>1</sub> hypothesis of the study.

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