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Evaluation of the Effect of a Health Education Program on Knowledge and Attitude towards Blood and Plasma Donation among Medical Students at Port Said University

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A B S T R A C T

Background: Blood donation is a vital healthcare intervention, and increasing voluntary blood and plasma donations is crucial to maintaining a stable and safe blood supply. Effective educational programs on the importance and benefits of donations are key strategies for enhancing voluntary donor participation. Objective: To determine the effect of an educational intervention on medical students' knowledge and attitudes regarding voluntary blood and plasma donation. Method: This pretest-post-test interventional study was conducted among first-year medical students at the Faculty of Medicine, Port Said University, Egypt, from November 2022 to May 2023. Cluster random sampling was applied, and data was collected using a valid, pre-designed, and self-administered questionnaire before and after the educational program. The educational program was based on the World Health Organization guidelines, focusing on the identified knowledge gaps based on pre-intervention data. Results: The study included 288 students with a median age of 18 years, of whom 52.6% were males and 86% had never donated blood. The health education program significantly improved participants' knowledge, increasing adequate knowledge from 28.5% pre-intervention to 95.2% post-intervention ($p < 0.001$). Positive attitudes towards blood donation were observed in 99.6% of the participants, and there was no change in attitude post-intervention ($p = 0.287$). The scores of control beliefs about plasma donation improved ($p = 0.015$), while the other belief metrics did not show significant changes. Conclusions: Despite the positive attitudes towards blood donation among the participants, their knowledge levels were insufficient, highlighting the critical need for continued education on blood donation.

INTRODUCTION

Blood is a vital component of the human body, and improving healthcare and preventing infectious diseases requires safe blood transfusions.[1] Despite all research, there is no substitute for blood and blood products, which are life-saving and can improve the clinical state of many patients.[2] A significant gap remains between the demands and supplies of safe blood and blood products, particularly in developing countries.[3]

According to the World Health Organization (WHO), blood donations from at least 1% of a country's population are necessary to meet its basic blood supply

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needs. In Egypt, however, the number of whole blood donations collected in 2018 was 426,860, representing only 0.3% of the population according to the latest WHO report.[3]

Moreover, plasma-derived products such as clotting factors, albumin, and immunoglobulin (Ig) are crucial in the management of several disorders.[4] Additionally, convalescent plasma has emerged as a last resort treatment during the COVID-19 pandemic,. [5] According to the WHO 2021 report, the number of apheresis donations collected in Egypt in 2018 was only 20,183, representing less than 0.1% of the population.[3]

This shortage may be attributed to insufficient knowledge, misinformation, time constraints, and religious beliefs about blood donation.[6] Furthermore, medical literature addressing attitudes towards plasma donation is relatively limited. Therefore, strategies, campaigns, and promotions must be implemented to aid in donor recruitment.

Education is the main aspect of donor recruitment strategies. Donor recruitment campaigns have three essential goals: first, to promote changes in the public's knowledge, attitudes, and beliefs to understand why blood and plasma donation are vital life-saving services to the community; second, to promote changes in people's behavior to be willing to donate blood voluntarily without payment; and third, to ensure that potential donors understand the importance of safe blood donation in order not to donate if they are sick or at risk of transmitting infections.[7]

Many recruitment strategies have focused on youth, as they tend to be more active, healthy, and dynamic than older populations. It is crucial to inspire and educate them to voluntarily donate blood.[8] Identifying gaps in their knowledge and attitudes toward blood and plasma donation can help shape effective interventions. Therefore, this study aimed to determine the effect of blood and plasma donation educational interventions on medical students' knowledge and attitudes toward blood and plasma donation. Medical students were specifically targeted, as they are strategically positioned to educate the public and serve as role models for voluntary blood donation.

METHODS

This study targeted first-year medical students from the Faculty of Medicine at Port Said University. It was conducted from November 1, 2022, to May 30, 2023.

A pretest-post-test interventional study was conducted in three phases. Phase one (pre-intervention): A baseline assessment was conducted using a validated, pre-tested, and self-administered questionnaire to measure their knowledge and attitudes toward blood and plasma donation. Phase two (intervention): This involved a structured educational program based on WHO guidelines,[9] which also identified knowledge gaps based on phase one analysis. The program was delivered in two batches, with each batch receiving training for one day. Sessions were held for 2.5 hours per day, using PowerPoint presentations to deliver the educational program content, followed by discussion with students. The sessions were held in the classrooms, with each class consisting of 10 to 14 students, after regular classes were finished, from 11:30 am to 1:00 pm, and from 2:00 pm to 3:00 pm. The training comprised three modules: the first covered blood donation basics, requirements, and benefits; the second addressed transfusion-related infections and the blood donation process; and the third module focused on knowledge and reasons for plasma donation, the process of donating plasma, and the eligibility criteria for individuals to donate plasma. Phase three (post-intervention): The same questionnaire was administered to the students one week after the educational intervention to assess its effect. The effectiveness of the training was assessed using standardized scores and was analyzed accordingly.

The required sample size was calculated based on Taro Yamane formula for finite population:[10] Given that the total number of first-year students at the Faculty of Medicine, Port-Said University was 380 students, the calculated sample size at 95% level of significance was 195 students. To avoid potential attrition, 10% was added; therefore, the final estimated sample size was 215 students. The actual sample size used in this study exceeded this estimate.

The data was collected using random cluster sampling. Twenty of the twenty-eight first-year classes were selected using a random number generator.

Table 1. Socio-demographic characteristics of participants (N=228)

	Frequency (N)	Percent (%)
Age (years), median (IQR)	18.00 (1.00)	
Gender		
Male	120	52.6
Female	108	47.4
Marital status		
Single	227	99.6
Smoker		
Never smoker	220	96.5
Current smoker	4	1.8
Ex-smoker	4	1.8
Residence		
Urban	72	31.6
Rural	156	68.4
Previous donation status		
Yes	32	14.0
Never	196	86.0
Hypersensitivity to food or drugs		
Yes	34	14.9
No	128	56.1
I don't know	66	28.9
Sources of information about blood donation		
Social media	146	24.90
Friends or relatives	130	22.18
Awareness campaigns at university	99	16.89
TV/radio/newspaper	91	15.52
Awareness campaigns or advertisement outside university	77	13.14
Educational lecture	43	7.34

Data were presented as number and percentage, unless mentioned otherwise

Data collection tool: Data was gathered using a self-administered questionnaire that included six sections: (1) Sociodemographic data: such as age, sex, residence, smoking status, hypersensitivity to food or drugs, and sources of information about blood donation. In addition, a yes-or-no question was included regarding a previous history of blood donation. (2) Blood donation knowledge: The knowledge section on blood donation comprised of twenty items, with each correct answer scored as "1" and each incorrect answer as "0", yielding a maximum possible score of 20. Participants scoring above 70% were classified as having adequate knowledge.[8] (3) Blood donation attitude: The attitude section on blood donation consisted of 10 items rated on a 5-point Likert scale, with responses scored as follows: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The total possible score ranged from 10 to 50. These scores were converted into percentages, with scores ranging from 0% to 49.9% indicating a negative attitude and scores from 50% to 100% indicating a positive attitude.[7] (4) The motivators, facilitators, and barriers of blood donation: This section included altruism, reluctant altruism, subjective norms, reciprocity, incentives, and curiosity, with responses rated on a 5-point Likert scale ranging from "strongly agree" to "strongly disagree". The barriers to blood donation section included low self-efficacy, fear, inconvenience, a lack of knowledge, and negative attitudes, using the same 5-point Likert scale. [11] (5) Critical beliefs about plasma donation: This consisted of four sets of beliefs: behavioral, normative, control, and intention beliefs. For behavioral beliefs, participants rated the likelihood of five positive outcomes (benefits) and four negative outcomes (costs) associated with plasma donation on a 5-point Likert scale (5 = very unlikely, 1 = very likely). Normative beliefs were assessed by asking participants to indicate whether they believed that three relevant referent groups should make a plasma donation on a 5-point Likert scale (5 = not at all, 1 = definitely). Control beliefs were evaluated by rating the likelihood of six barriers and six facilitators affecting their ability to donate plasma on a 5-point Likert scale (5 = very unlikely, 1 = very likely). Intention beliefs were measured with three items: "I would intend to make a plasma donation", "I will try to make a plasma donation," and "I will make a plasma donation, " using a 7-point Likert scale (1 = strongly agree, 7 = strongly disagree). Participants who scored above 50% in the critical beliefs were classified as having good attitude.[12]

The tool was pretested in a pilot study involving twenty students to ensure clarity and comprehensibility. The results of this pilot study were not included in the final report.

Data analysis: Data analysis was performed using Microsoft Excel 2016 and SPSS version 25. The normality of the data was tested using the Kolmogorov-Smirnov test. Descriptive statistics were applied to the qualitative data (frequencies and percentages) and quantitative data (median and

Table 2: Effect of educational intervention on the knowledge about blood donation among medical students

	Pre-intervention correct answers	Post-intervention correct answers
Is blood donation harmful to donor?	196 (86%)	224 (98.2%)
Where is the place of blood donation?	185 (81.2%)	220 (96.5%)
Goal of blood donation	211 (92.5%)	199 (87.3%)
Minimum age to donate blood	169 (74.1%)	210 (92.1%)
Maximum age to donate blood	58 (25.4%)	196 (86%)
What is the minimum weight for blood donation?	46 (20.2%)	195 (85.5%)
What is the maximum volume of blood at once donation?	30 (13.2%)	195 (85.5%)
At what minimum interval can a person donate blood?	63 (27.6%)	205 (89.9%)
Do you know about blood groups?	102 (44.7%)	97 (42.5%)
What is the most common blood group type?	49 (21.5%)	188 (82.5%)
Can pregnant women donate blood?	155 (68%)	220 (96.5%)
Can female during menstruation donate blood?	139 (61%)	199 (87.3%)
Can cigarette smokers donate blood?	133 (58.3%)	200 (87.7%)
Person can be infected by receiving blood transfusion	206 (90.4%)	212 (93%)
Can a person donate when blood pressure is low?	154 (67.5%)	222 (97.4%)
Can a person with high blood pressure donate blood?	88 (38.6%)	204 (89.5%)
Can HIV infect a person who donates blood?	176 (77.2%)	220 (96.5%)
Diseases that can be transmitted by transfusion	138 (60.5%)	208 (91.2%)
Best source of donor blood	194 (85.1%)	224 (98.2%)
Do all surgical procedures require blood transfusion?	166 (72.8%)	211 (92.5%)
Total knowledge		
Adequate knowledge, N (%)[1]	65 (28.5)	217 (95.2)
Total Knowledge score, Median (IQR)[2]	12.00 (4)	19.00 (2)

Data were presented as number and percentage, unless mentioned otherwise. 1 p-value<0.001, 2 p-value <0.01

interquartile range (IQR)). Statistical significance was tested using the McNemar test, chi-square test, and Wilcoxon signed-rank test.

RESULTS

This study included 228 first-year medical students from the Faculty of Medicine at Port-Said University. Of these participants, (52.6%) were males, with a median age of 18 years. The primary sources of information on blood donation were social media (24.9%) and friends or relatives (22.18%), as shown in Table 1.

Knowledge about blood donation pre- and post-intervention:

Table 2 shows the change in knowledge about blood donation following the educational program. Prior to the intervention, only (28.5%) of the participants demonstrated good knowledge about blood donation. This percentage increased to (95.18%) after the intervention ($p \leq 0.001$). The median knowledge score significantly improved from twelve pre-intervention to nineteen post-intervention.

Table 3 illustrates the change in attitudes toward blood donation following the educational program. Before the intervention, nearly all students (99.6%) had a good attitude towards blood donation, which remained unchanged after the intervention. Figure (1) demonstrates the motivators, facilitators, and barriers to blood donation, as reported by the participants. The most common motivators were donating to help patients (98.7%) and helping those known by the participants in need (88.2%). Common facilitators included having a mobile blood donation unit at workplaces or other locations (86%) and the convenience of the blood donation place (85.5%). The most frequently reported barrier was fear, which included concerns about needles and dizziness (68%). The educational intervention significantly improved the scores of control beliefs regarding plasma donation among the participants ($p = 0.015$), as shown in Table 4. However, the other belief categories did not show significant post-intervention changes.

Table 3: Assessment of medical students' attitude about blood donation

		Pre-intervention		Post-intervention	
		Frequency (N)	Percent	Frequency	Percent (%)
Blood donation has some health benefits	Agree	202	88.6	219	96.1
	Neutral	18	7.9	4	1.8
	Disagree	8	3.5	5	2.2
Voluntary blood donation is better than remunerated blood donation	Agree	207	90.5	213	93.4
	Neutral	11	4.8	8	3.5
	Disagree	10	4.4	7	3.1
Blood donation causes ill health	Agree	28	12.3	25	11
	Neutral	71	31.1	62	27.2
	Disagree	129	56.6	141	61.8
Blood donation reduces immunity	Agree	22	9.6	16	7.01
	Neutral	52	22.8	26	11.4
	Disagree	166	72.8	18	81.6
I am willing to donate blood	Agree	163	71.8	183	80.3
	Neutral	43	18.9	28	12.3
	Disagree	22	9.6	17	7.5
I will encourage my friends and relations to donate	Agree	189	82.9	186	81.6
	Neutral	26	11.4	34	14.9
	Disagree	13	5.7	8	3.5
Blood should only be donated to family members and friends.	Agree	25	11.0	31	13.6
	Neutral	19	8.3	23	10.1
	Disagree	183	40.3	174	76.3
Only males should donate blood	Agree	17	7.5	9	4.0
	Neutral	14	6.1	13	5.7
	Disagree	197	86.4	208	91.4
Any healthy adult can donate blood	Agree	199	87.3	199	87.3
	Neutral	10	4.4	11	4.8
	Disagree	19	8.3	18	7.9
Blood transfusion saves lives	Agree	218	95.6	220	96.5
	Neutral	7	3.1	5	2.2
	Disagree	3	1.3	3	1.3
Total attitude score					
High positive attitude, N (%)[1]		227 (99.6)		227 (99.6)	
Attitude score, Median (IQR)[2]		35.00 (4)		35.00 (4.75)	

Data were presented as number and percentage, unless mentioned otherwise. 1 p-value >0.99, 2 p-value =0.287

DISCUSSION

The current study aimed to assess the effect of a health education program on first-year medical students' knowledge and attitudes toward blood and plasma donation. The results showed that the intervention was successful in significantly improving the knowledge of the participants, and while no improvement was observed in the attitude of the students, it was already positive.

The current study showed that only (28.5%) of the participants demonstrated adequate knowledge about blood donation pre-intervention. This rate is lower than that in other studies, such as (48.2%) of

Table 4: Effect of educational intervention on the attitude about plasma donation among medical students in regard of median and IQR

	Pre-intervention		Post-intervention		p-value
Behavioral beliefs	Median	IQR	Median	IQR	
I would be able to help others more.	1	1	1	0	
I would have a stronger connection with Centre staff.	2	2	2	2	
I would be more likely to feel good.	1	2	1	1	
It could take longer than expected to make the donation.	2	1	3	1	
I would need to find more time.	3	1	3	2	
I would be more likely to have to tell staff about donation discomfort.	2	2	2	3	
I would have priority at the Centre.	3	2	3	2	
It would give me more flexibility when I could donate.	2	1	2	1	
I would need to donate more frequently.	3	1	3	1	
Overall	20	6	23	6	0.502
Control beliefs					
The opening hours did not suit the schedule.	2	1	3	2	
My personal health was not allowed.	2	2	2	2	
If my commitments did not allow.	3	2	3	2	
Not having the time to do so.	3	2	3	2	
Not having enough information to decide.	3	2	3	2	
The idea of my red blood cells being returned.	3	1	3	2	
Making an appointment to do so.	2	2	2	2	
Having an experienced staff member does the needle insertion.	1	1	1	1	
Parking is available for the donation time.	2	2	2	3	
Knowing that many more products can be made with plasma.	2	2	2	2	
Being sure that the plasma machines are safe and hygienic.	1	1	1	1	
Knowing that the Blood Service needs different types of donations.	1	1	1	1	
Overall	28	8	29	10	0.015
Normative beliefs					
I would donate to help family member/s.	1	0	1	0	
I would donate to help Friend/s.	1	0	1	0	
I would donate to help Colleague/s.	1	0	1	0	
Overall	3	0.75	3	0	0.385
Intention beliefs					
I intend to make a plasma donation.	2	2	1	2	
I will try to make a plasma donation.	2	2	2	2	
I will make a plasma donation.	2	2	2	2	
Overall	6	6	6	6	0.137

undergraduate health sciences students in Northwest Ethiopia,[8] and (67.7%) of continuing medical education (CME) students in China.[13] The variations in knowledge levels could be attributed to differences in the participants' educational backgrounds regarding blood donation. Notably, the participants in the present study were first-year students, whereas the Ethiopian and Chinese cohorts included older students, who may have been exposed to more relevant information about blood donation through their education.

The health education program effectively enhanced participants' knowledge about blood donation, as the percentage of those with adequate knowledge increased significantly from (28.5%) before intervention to (95.2%) after intervention ($p < 0.001$).

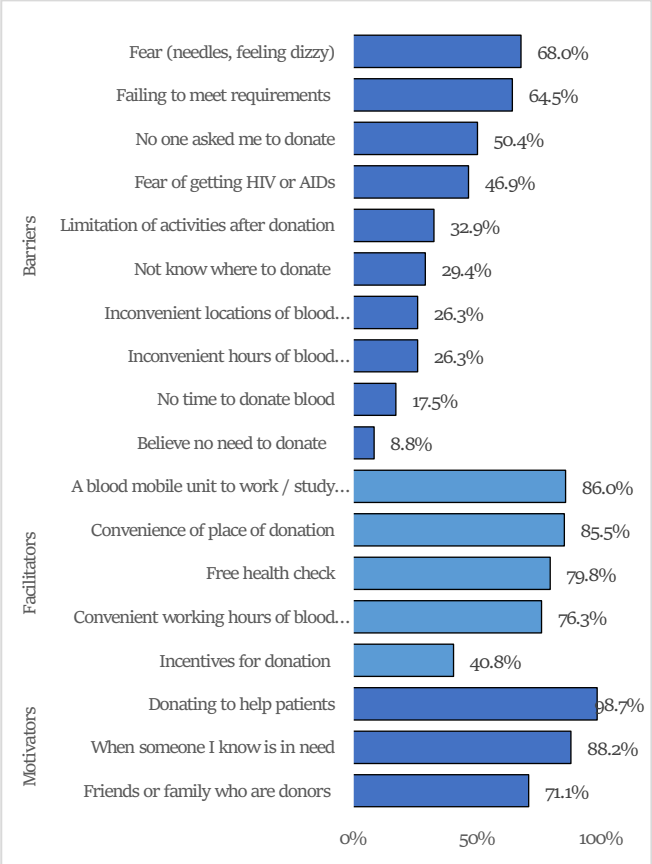

Figure 1: Barriers, facilitators, and motivators of blood donation among the study participants

This substantial improvement aligns with findings from a study conducted among medical students at a Nigerian university, where good knowledge levels increased from (72.8%) to (99.4%) following a similar educational intervention.[7] The comparable post-intervention outcomes in both studies suggest that well-structured health educational programs can effectively bridge knowledge gaps, regardless of initial knowledge levels.

The present study indicated that an impressive proportion (99.6%) of participants had a positive attitude toward blood donation. This level is higher than the rates reported in studies from China (74.2%) and Ethiopia (79.2%).[8,13] In contrast, a survey of medical students at Taif University in Saudi Arabia reported much lower results, with only (28.3%) having a good attitude and (53.3%) having a fair attitude.[14] Additionally, a study from Brazil found that (59.4%) of health sciences undergraduates were willing to donate blood in the future.[15] These variations in attitudes demonstrate the impact of cultural, educational, and contextual factors in shaping attitudes toward blood donation across different regions.

In the current study, the health education program did not lead to a significant increase in the positive attitudes of medical students ($p = 0.287$), which may be attributed to the fact that nearly all participants (99.6%) had already exhibited a positive attitude prior to the intervention. This contrasts with the findings of Ugwu NI and colleagues, who observed a significant improvement in medical students' attitudes toward blood donation. Specifically, their study reported an increase in willingness to donate blood from (81%) before the intervention to (89.2%) afterward.[7]

In the present study, the most frequently reported barriers to blood donation were fear of needles or feeling dizzy (68%) followed by not meeting donation requirements (64.5%). This differs from the results reported by a study conducted at Qatar University, where the main barriers were failing to meet donation requirements and the statement "no one ever asked me to give blood" reported by (45.1%) of undergraduates.[11] Similarly, in Ethiopia, common reasons for not donating included "felt medically unfit" (24.3%) and "no one has asked to donate" (22.8%).[8] In Azad Kashmir, Pakistan, the key barriers among medical students were not being fit for blood donation (42.1%) and worries about sanitation and contracting infectious diseases (30.2%).[16] The prominence of fear in this study underscores the importance of educational interventions to reassure potential donors about the safety and process of blood donation. Tailoring interventions to address specific concerns in different populations is essential for overcoming barriers and enhancing voluntary donation rates.

In terms of facilitators of blood donation, the most common facilitator in the present study was the availability of a mobile unit for blood donation at workplaces or other places (86%). Similarly, a study conducted at Qatar University found that "having a blood mobile unit that come to one's place of work or other places" was the most significant facilitator (83.3%). This alignment underscores the importance of convenience and accessibility in facilitating blood donation. Helping patients was identified as the primary reason for donating, as reported by (98.7%) of students in the present study. Similarly, Ibrahim et al. reported that (97.2%) of students stated that helping patients was their key motivator.[11] Also,

Chinese students highlighted altruism (98.6%) and health benefits (89.6%) as their top reasons for donating blood.[13] Furthermore, health benefits were reported as the most important reason for blood donation by (71.7%) of undergraduate medical students in Azad Kashmir, Pakistan.[16] In Brazil, about (92%) of the participants were primarily motivated by the need to help blood banks meet their demands.[15] These findings suggest that the core motivator of helping others is consistent across different settings, in addition to secondary motivators that vary depending on the cultural context and local practices.

The theory of planned behavior indicates that human actions are influenced by three types of considerations: behavioral beliefs, normative beliefs, and control beliefs. While behavioral beliefs are related to the outcomes of the behavior, normative beliefs involve the normative expectations of peers and respected figures toward the behavior and the motivation to conform with them. Control beliefs are related to the factors that facilitate or hinder the behavior and the perceived ability to perform it.[17] While there were no significant changes in behavioral, intention, or normative beliefs post-intervention, the results revealed a significant change in the control beliefs regarding plasma donation following the intervention ($p = 0.015$). This indicates that educational interventions can effectively alter beliefs that discourage plasma donation by providing significantly sound information. In addition, promoting plasma donation should consider the factors within individuals' control. Similarly, Giles et al., emphasized the practical importance of self-efficacy in the context of blood donation behavior. [18]

Limitations: This study measured the changes immediately after the intervention, focusing on short-term effects. However, without a longer follow-up period, it is difficult to assess long-term retention of knowledge or attitudinal changes. The intervention was conducted as a single session, which may not have been sufficient for deep-rooted changes in attitudes or practices regarding blood donation. In addition, this study was conducted at a single medical institution. Thus, contextual factors could limit the applicability of these findings to other institutions or regions with different social, cultural, or educational environments.

CONCLUSIONS

Despite the generally positive attitudes towards blood donation among medical students (99.6%), their initial knowledge of blood donation was insufficient. Following the implementation of an educational program on blood and plasma donation, the percentage of students with adequate knowledge significantly increased from 28.5% to 95.2%. This underscores the importance of continuous education on blood donation. While the intervention did not result in a significant shift in attitudes, it did lead to a marked improvement in control beliefs regarding plasma donation. This suggests that educational efforts can effectively address misconceptions and barriers to plasma donation.

Ethical Considerations

The research protocol was approved by the Port-Said University Ethical Committee with ERN code: MED (1/5/2023) s.no (91) PHI_008. Verbal informed consent was obtained from all participants. All the procedures were conducted in accordance with the principles of the Declaration of Helsinki.

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