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ORIGINAL ARTICLE

Crossing the wide gap between positive attitude towards blood donation and its poor practice among university students: can knowledge and demographic characteristics help?!

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Abstract

Aim Egypt suffers from a continuing shortage of blood supply. University students constitute a significant portion of healthy potential blood donors. Due to lack of evidence, we investigated the knowledge, attitude, and practice (KAP) of Minia University students with regard to blood donation.

Subjects and methods We conducted a cross-sectional study which included 576 randomly selected students at Minia University, Egypt aged 20–25 years. A structured questionnaire assessed the KAP, with its related factors. Logistic regression analysis was used to calculate the odds ratios for students' KAP across different levels of sociodemographic characteristics.

Results While 65% of the students had positive attitude towards blood donation, 53% of the students had insufficient knowledge about blood donation, and only 35% of them had donated blood before. Age and residence were not significantly associated with KAP, while donors have a multivariable-adjusted OR (95% CI) = 0.37 (0.26–0.54) for being female students versus being males. Studying public health was associated with knowledge and attitude, but not with practice of blood donation. A 1-point increment in knowledge score was associated with significantly 18 and 11% higher odds for having positive attitude and for being a donor respectively. However, the increased likelihood of donating created by having a positive attitude was insignificant.

Conclusions There was a gap between attitude, on one hand, and knowledge and practice, on the other hand, of Egyptian university students with regard to blood donation. Collaborations between Ministries of Health and Education to facilitate and encourage blood donation practice for students at their place of study are required.

Keywords KAP · Cross-sectional · Voluntary non-remunerated blood · Egypt · University students

Introduction

Blood is an essential element of human life and there are no substitutes for it. Globally, millions of lives are saved through blood transfusion. The World Health Organization (WHO) recommends that for any country to meet the minimum demand for blood, donations should be made by at least 1% of the population (WHO 2010). Although many individuals are eligible to donate blood, and abundant availability of blood is feasible and expected, there is nevertheless a permanent shortage of blood because only a small proportion of eligible people donate in developed countries, and even smaller proportions do so in developing countries (Riley et al. 2007; WHO 2011a).

In Egypt, as few as 60 daily donors head to the National Blood Transfusion Center to donate blood (Mostafa 2010). In spite of the large number of hospital-based blood banks that belong to different sectors such as the Egyptian Ministry of Health, the private medical sector, university hospitals, and army force medical facilities (Moftah 2002), blood donation rates in Egypt are, however, low by international standards, as only 1–2% of the population donates blood, which is a relatively low rate compared with the increased demand of the

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country (WHO 2011b). Due to the lack of several factors including a stabilized culture of blood donation, good infrastructure, and effective policies, a permanent shortage of blood supply can describe the Egyptian situation (Moftah 2002; Mostafa 2010; WHO 2011b).

Selection of donors is another important issue, not only to meet the need, but also to improve the overall safety of blood supply (Van den Burg et al. 1998). According to the WHO, voluntary non-remunerated donors are the safest source of blood (WHO 2004). Thus, a policy aimed at obtaining 100% donation of blood in all countries from voluntary unpaid donors by the year 2020 has been adopted, which further limits the availability of blood sources in some countries (WHO 2009).

Healthy and active young people are the most appropriate potential blood donors, and undergraduate university students constitute a significant portion of them (Van den Burg et al. 1998; WHO 2004; WHO 2009; WHO 2012), especially in Egypt (CAPMAS 2016). Thus, motivating the healthy young population towards voluntary blood donation may substantially narrow the gap between the increased demand and decreased supply of blood. Therefore, understanding the knowledge, attitude, and practice (KAP) for blood donation among university students is of utmost importance.

Despite the worldwide interest, especially in developing countries, for conducting studies that measure KAP for blood donation among university students (Ahmed et al. 2014, Al-Johar et al. 2016, Allerson 2012, Baig et al. 2013, Batiha and Albashtawy 2013, Cunha and Dias 2008, Elias et al. 2016, Hosain et al. 1997, Kowsalya et al. 2013, Lownik et al. 2012, Mamatya et al. 2013, Mirza et al. 2015, Mishra et al. 2016, Mohammed et al. 2011, Mustafa et al. 2015, Nigatu and Demissie 2014, Nwabueze et al. 2014, Raghuwanshi et al. 2016, Safizadeh et al. 2009, Salaudeen and Odeh 2011, Vásquez et al. 2007, Wiwanitkit 2002), there is nevertheless a paucity of these investigations in the Middle East and Arab countries. The available studies among Arab students have shown variable levels of knowledge about and favorable attitude towards blood donation, and several fears, especially of pain and wasting time, as major obstacles for practicing blood donation (Al-Johar et al. 2016; Baig et al. 2013; Batiha and Albashtawy 2013; Mustafa et al. 2015). Nevertheless, none of the studies was conducted in Egypt. Therefore, the objective of this study is to measure the KAP of blood donation and its related factors among students at Minia University, Egypt.

Methods

Study design and population

This cross-sectional study was conducted among undergraduate students in Minia University, Minia Governorate, Egypt, during the period from March–April, 2018. Minia Governorate is one of the governorates of Upper Egypt, inhabited by more than 5 million residents over 32.297 km^2 divided into nine districts. Minia University is composed of 20 Faculties, and our sample was chosen randomly from students studying inside the main campus, which harbors 16 Faculties (faculties of Science, Pharmacy, Medicine, Nursing, Education, Physical Education, Art Education, Specific Education, Kindergarten Education, Fine Arts, Tourism and Hotels, Alsun, Dar Al-Uloum, Computer and ITCs Science and Law).

A simple random sample technique was used to select students of a certain grade and accordingly, the 4th grade students were selected. The sample size was calculated according to this formula: $n = [z^2 - p\,(1 - p)]/e^2$, where n = sample size, z = is the 95% confidence level (CI), p = expected prevalence of students blood donor (0.5%) and e = the 5% margin of error. Accordingly, the minimum sample size needed was 322 students; however, to increase the validity and the power of the study, we invited randomly more than double the minimum sample size, 745 students, to participate in the study. A total of 135 students were unwilling to participate, leaving 610 students eligible for the study. After excluding 34 students who did complete the questionnaire (with missing data for at least 30% of the questions in the knowledge and attitude sections, or not reported on their blood donation practice items), 576 4th-grade students were enrolled in the current study, with a response rate of 94.4%.

Ethical consideration

Informed consent was obtained from students and faculties' deans, and the ethics committee of Minia University Faculty of Medicine approved this study's protocol; approval number 3915/12D, January 2018.

Assessment tool

A pilot study of 50 students was conducted to validate the data, which were collected by a self-administered structured questionnaire. The questionnaire was designed in the light of parameters assessed in similar studies (Ahmed et al. 2014; Baig et al. 2013; Batiha and Albashtawy 2013; Hosain et al. 1997; Kowsalya et al. 2013; Mamatya et al. 2013; Mirza et al. 2015; Mishra et al. 2016; Mustafa et al. 2015; Nigatu and Demissie 2014; Raghuwanshi et al. 2016; Wiwanitkit 2002). However, the questionnaire was modified to suit and to assess the situation in Egypt. The questionnaire collected data about students' demographic characteristics and their KAP with regard to blood donation, with 89% reliability rate by using Cronbach's alpha test. Results of the pilot study showed 54%, 67%, and 31% of the students respectively had insufficient knowledge about, a positive attitude towards, and

practiced blood donation. The final questionnaire was modified to include 25 knowledge questions instead of 20 questions in the pilot study, ten attitude items instead of eight in the pilot study, and added items for the place where the most recent blood donation was conducted.

Knowledge score

Knowledge was assessed via 25 questions that covered general knowledge about blood donation, ABO and Rhesus (Rh) blood typing, transfusion-transmitted diseases, long-term risks to donors, and knowledge about donor eligibility. Each question was rated zero for wrong answer and one for right answer, then a knowledge score was calculated by summing the scores for all statements. Thus, the overall score ranged between zero and 25 points. Based on earlier studies (Ahmed et al. 2014; Batiha and Albashtawy 2013; Kowsalya et al. 2013; Mamatya et al. 2013; Mirza et al. 2015; Mishra et al. 2016; Nigatu and Demissie 2014; Raghuwanshi et al. 2016; Wiwanitkit 2002), the level of knowledge for each student was classified as "Good" (> 80% = > 20 points), "Fair" (60%–80% = 15–20 points) and "Insufficient" (< 60 % = < 15 points).

Attitude score

A 3-point Likert scale (Norman 2010) of students' responses to ten statements was used to assess the students' beliefs and perceptions with regard to blood donation. Scores for positive attitude statements ranged from two (for students who agreed) to zero (for students who disagreed). The opposite of this scoring system was used for negative attitude statements. Accordingly, the total attitude score ranged between zero and 20 points. Levels of attitude were then classified as: "Positive" (> 80% = > 16 points), "Neutral" (60%–80% = 12–16 points) and "Negative" (< 60% = < 12 points), based on earlier studies (Hosain et al. 1997; Kowsalya et al. 2013; Mamatya et al. 2013; Mirza et al. 2015; Mustafa et al. 2015; Nigatu and Demissie 2014; Raghuwanshi et al. 2016).

Practice assessment

Each student stated if he/she had ever donated blood before, and if so, how frequently, and where and when he/she had done so for the most recent donation.

Statistical analysis

Statistical analyses were performed by the Statistical Package for Social Science (SPSS, version 22). Mean with standard deviation values and proportions of students' characteristics were calculated, and the differences in those variables were tested by the Student's *t*- test and $\chi 2$-test. Two-tailed tests of significance were conducted, and P values < 0.05 were considered statistically significant. Logistic regression analysis was used to determine the odds ratios (OR) for good knowledge, positive attitude, and donating blood at different levels of student characteristics.

Results

This study included 576 students, whose age ranged between 20 and 25 years with a mean of 21.9 ± 1.0 years. Almost 57% of the students were females and more than half of students, 55%, resided in urban areas.

Supplemental Figure 1 shows that more than half of students, 53%, had an insufficient knowledge score, 45% had a fair score, and only 1.6% of them had a good knowledge score about blood donation. In general, Minia University students had an insufficient knowledge score about blood donation, with a mean of 13.8 (range 0 to 25, 55%) (Table 1).

Considerable proportions of the students reported "I do not know" for some general knowledge items about blood donation, donor eligibility, and long-term risks to donors. For example, 54%, 33%, and 21% of students respectively were uncertain if there are different Rh blood types, whether a person suffering skin allergy can donate, and whether blood donation can cause mental disorders. The majority of students, 96%, knew that diseases can be transmitted through blood, and 73% of them knew the ABO blood typing. With regard to knowledge about donor eligibility, although 77% of the students knew that pregnant females cannot donate blood, a significant majority of students, 86%, gave incorrect answers about donation during menstruation. Two-thirds to three-quarters of the students respectively gave correct answers about donation with high and low blood pressure. On the other hand, more than one-third of them gave incorrect answers about donation while having the common cold (Table 1). With regard to knowledge about long-term risks to donors, only small percentages of them were aware that a donor is not at a high risk of contracting HIV (29%), hepatitis (21%) or other infectious diseases (17%) (Table 1).

About two-thirds of the students, 65%, had a positive attitude score, 32% were neutral, and only 3.1% of students had a negative attitude score towards blood donation (Supplemental Figure 2). Table 2 shows that Minia University students have a positive attitude score towards blood donation, with a mean of 17.0 (range 0 to 20). The majority of students, 95%, agreed that blood donation is a very good action and saves many people, while only 5% did not wish to donate unless there are rewards or incentives (Table 2).

Only 35% of our sample had donated blood before and among those ever-donors, 43% had donated more than once. The blood transfusion vehicle is the place where more than half, 58%, of students' blood donation took place. Non-remunerated voluntary donation represented about 73% of

Table 1 Assessment of blood donation knowledge among Minia University' students

Items	Correct *N* (%)	Incorrect *N* (%)	Don't know *N* (%)
General knowledge			
How much blood is there in the body?	376 (65.3)	58 (10.1)	142 (24.6)
How much blood is removed during one donation?	358 (62.2)	58 (10.1)	160 (27.7)
How much time is taken to withdraw blood?	270 (46.9)	118 (20.5)	188 (32.6)
Do you know the ABO blood type?	418 (72.6)	18 (3.1)	140 (24.3)
Do you know the Rh blood type?	261 (45.3)	2 (0.3)	313 (54.4)
Are there diseases transmitted through blood?	553 (96.0)	4 (0.7)	19 (3.3)
Knowledge about donor eligibility			
What are the age limits of blood donor?	298 (51.7)	206 (35.8)	72 (12.5)
What is the minimum weight of blood donor?	275 (47.7)	133 (23.1)	168 (29.2)
What is the minimal interval between two donations by the same person?	308 (53.5)	154 (26.7)	114 (19.8)
Can a pregnant woman donate?	443 (76.9)	19 (3.4)	114 (19.7)
Can females donate during menstruation?	43 (7.5)	393 (86.2)	140 (24.3)
Can a person donate during fever?	421 (73.1)	34 (5.9)	121 (21.0)
Can a person donate while having a common cold?	217 (37.7)	218 (37.8)	141 (24.5)
Can a person with a high BP donate?	377 (65.5)	92 (16.0)	107 (18.5)
Can a person with low BP donate?	448 (77.8)	41 (7.1)	87 (15.1)
Can a smoker donate?	315 (54.7)	175 (30.4)	86 (14.9)
Can a person on medications for chronic diseases donate?	425 (73.8)	48 (8.3)	103 (17.9)
Can a person with chronic alcoholism donate?	366 (63.5)	77 (13.4)	133 (23.1)
Can a person suffering skin allergy donate?	202 (35.1)	185 (32.1)	189 (32.8)
Knowledge about long-term risks to donor			
Is there a high risk of contracting HIV during donation?	337 (58.5)	166 (28.8)	73 (12.7)
Is there a high risk of contracting hepatitis during donation?	368 (63.9)	122 (21.2)	86 (14.9)
Is there a high risk of contracting other infections during donating?	408 (70.8)	95 (16.5)	73 (12.7)
Does blood donation cause bleeding disorders?	386 (67.0)	71 (12.3)	119 (20.7)
Does blood donation cause anemia?	373 (64.8)	121 (21.0)	82 (14.2)
Does blood donation cause mental disorders?	425 (73.8)	33 (5.7)	118 (20.5)
Overall knowledge score (mean ± SD)	13.8 ± 3.8		

Table 2 Assessment of attitude towards blood donation among Minia University students

Attitude statements	Agree *N* (%)	Not decided *N* (%)	Disagree *N* (%)
Blood donation is a good action.	545 (94.6)	27 (4.7)	4 (0.7)
Blood donation saves many people.	548 (95.1)	24 (4.2)	4 (0.7)
Blood donation prevents many complications.	327 (56.8)	190 (33.0)	59 (10.2)
My donation will encourage others to donate.	511 (88.7)	51 (8.9)	14 (2.4)
I will donate blood only for my family.	191 (33.2)	48 (8.3)	337 (58.5)
Blood donation is a religious duty.	325 (56.4)	176 (30.6)	75 (13.0)
I will donate blood only for rewards.	28 (4.9)	36 (6.3)	512 (88.8)
Donating blood makes me feel like I have helped one of my family members or friends.	517 (89.8)	41 (7.1)	18 (3.1)
I will donate blood for a leave from the university.	100 (17.4)	77 (13.3)	399 (69.3)
Laboratory tests performed on the donated blood may help me to evaluate my health	526 (91.4)	40 (6.9)	10 (1.7)
Attitude score (mean ± SD)	17.02 ± 2.4		

the last donation experience, while 27% were done for replacement or family need (Table 3).

Table 4 shows the crude and multivariable-adjusted ORs (95% CIs) for factors associated with good knowledge of, positive attitude towards, and practice of blood donation. Studying Public Health was associated with our students' knowledge and attitude, but not with their practice of blood donation.

A 1-point increment in knowledge score was associated with significantly 18% and 11% higher odds respectively for having a positive attitude and for being a donor. With a 1-point increment of attitude score, the multivariable-adjusted ORs (95% CIs) of having good knowledge and being a donor were 1.09 (1.01–1.18) and 1.04 (0.96–1.12) respectively. Students who had donated blood before had a significantly (89%) increased odds for having good knowledge, but a non-significant (32%) increased odds for having positive attitude.

Table 3 Blood donation practice among Minia University' students

Blood donation practice	*N* (%)
Ever donated blood	202 (35.1)
Frequency of donation in lifetime (*N* = 202)	
Once	116 (57.4)
More than once	86 (42.6)
The place of your last donation	
Hospital	46 (22.8)
Blood bank	39 (19.3)
Blood transfusion vehicle	117 (57.9)
Main reason for the last time donation	
Voluntarism	146 (72.3)
Replacement/family	56 (27.7)
Feeling after donation	
Positive feeling	178 (88.1%)
Indifferent	24 (11.9%)

Discussion

Blood collection agencies face major problems in coping with an increasing demand for blood and blood products, especially in developing countries (Riley et al. 2007; WHO 2011a). Egypt has consistently suffered from a blood supply shortage, especially after the 2011 revolution. The central blood bank in Cairo has stated that donations have dropped by half since the revolution (Shafei 2013). Studying KAP of blood donation among a sample of 576 Minia University students revealed unsatisfactory levels of knowledge about and practice of blood donation despite the overall positive attitude.

The overall insufficient knowledge score of Minia University students, 55%, was similar to those scored by university students in Iran, 38% (Safizadeh et al. 2009); Pakistan, 45% (Kowsalya et al. 2013); Nepal, 32% (Mamatya et al. 2013); Jordan, 55% (Batiha and Albashtawy 2013); Ethiopia, 40% (Nigatu and Demissie 2014) and India, 57% (Raghuwanshi et al. 2016); while well below the good knowledge scores of university students in Thailand, 80% (Wiwanitkit 2002) and Pakistan, 92% (Ahmed et al. 2014) and 88% (Mirza et al. 2015). A systematic review of KAP surveys of blood donation in developing countries showed varying levels of knowledge, which were attributed to the different questions and scoring systems used (Lownik et al. 2012). That review concluded that most of the respondents to those surveys demonstrated sufficient general knowledge, but insufficient knowledge regarding eligibility requirements and hazards to donors. In our study, students showed relatively good general knowledge about blood donation,whereas their insufficient knowledge about donor eligibility was comparable to that of students from Pakistan (Mohammed et al. 2011; Kowsalya et al. 2013; Mirza et al. 2015), Nepal (Mamatya et al. 2013), Saudi Arabia (Baig et al. 2013), Jordan (Batiha and Albashtawy 2013) and India (Mishra et al. 2016).

In Bangladesh, the most common misconception about long-term hazards for donors was the assumption of donation-induced physical weakness (Lownik et al. 2012), while among students of Saudi Arabia (Baig et al. 2013), South Africa, Moldova, and Iran (Lownik et al. 2012), it was the incorrect belief with regard to catching infections. More than three-quarters of Nepalese students (Mamatya et al. 2013) and one-third of Pakistani students (Safizadeh et al. 2009) believed that donors were at a high risk of contracting hepatitis and HIV, while a smaller proportion of our students reported the same misconception, 21–29%. This may be attributed to the different subjects studied by students in the different studies; for example, while Nepalese students were studying Business, Arts, and Fashion (Mamatya et al. 2013), some of our students had studied Public Health and some of the Pakistani students had studied Human Sciences (Mohammed et al. 2011). It is still surprising, in this era of freely available knowledge via advanced technology, that large proportions of the students were unaware about safety measures taken throughout the donation process. Education at schools and universities can explain the students' satisfactory general knowledge, while the unsatisfactory specific knowledge about donors'eligibility and hazards to donors reflects the shortage of strategies and policies to recruit, inform, and motivate young people for donation.

Similarly to findings from most studies, our study showed that the majority of students demonstrated a positive attitude towards blood donation. However, the attitude of only 47% of Ethiopian university students was positive (Nigatu and Demissie 2014); the authors justified that by the lack of inclusion of medical students in their study. On the other hand, the 35% ever-donors in our studied students was midway in the

Table 4 Logistic regression for factors associated with knowledge about, attitude towards and practice of blood donation among Minia University students

	Good knowledge				Positive attitude				Donated blood			
	N	Model 1[a]	Model 2[b]	Model 3[c]	*N*	Model 1[a]	Model 2[b]	Model 3[c]	*N*	Model 1[a]	Model 2[b]	Model 3[c]
Age	269	0.73 (0.57–0.63)	1.02 (0.77–1.33)	0.96 (0.73–1.27)	558	1.03 (0.52–2.03)	1.42 (0.69–2.94)	1.33 (0.63–2.80)	202	1.55 (1.21–1.99)	1.34 (1.02–1.76)	1.30 (0.99–1.71)
Sex												
Male	108	1.00 (reference)	1.00 (reference)	1.00 (reference)	239	1.00 (reference)	1.00 (reference)	1.00 (reference)	120	1.00 (reference)	1.00 (reference)	1.00 (reference)
Female	161	1.27 (0.91–1.76)	1.09 (0.76–1.67)	1.28 (0.88–1.88)	319	1.67 (0.65–4.29)	1.68 (0.64–4.43)	1.65 (0.61–4.48)	82	0.36 (0.25–0.51)	0.39 (0.27–0.56)	0.37 (0.26–0.54)
Residence												
Rural	107	1.00 (reference)	1.00 (reference)	1.00 (reference)	254	1.00 (reference)	1.00 (reference)	1.00 (reference)	92	1.00 (reference)	1.00 (reference)	1.00 (reference)
Urban	162	1.54 (1.11–2.15)	1.12 (0.78–1.60)	1.09 (0.76–1.58)	304	0.96 (0.37–2.46)	0.69 (0.26–1.82)	0.64 (0.24–1.71)	110	0.99 (0.71–1.41)	1.19 (0.83–1.72)	1.16 (0.79–1.68)
Studied public health												
No	107	1.00 (reference)	1.00 (reference)	1.00 (reference)	320	1.00 (reference)	1.00 (reference)	1.00 (reference)	124	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	162	4.37 (3.07–6.23)	4.25 (2.91–6.21)	4.29 (2.92–6.31)	238	3.72 (1.06–12.9)	4.49 (1.20–16.72)	2.41 (0.59–9.87)	78	0.81 (0.57–1.15)	0.97 (0.66–1.43)	0.69 (0.45–1.06)
Knowledge score		–	–	–	558	1.22 (1.09–1.36)	–	1.18 (1.05–1.34)	202	1.07 (1.02–1.12)	–	1.11 (1.05–1.17)
Attitude score	269	1.11 (1.03–1.19)	–	1.09 (1.01–1.18)		–	–	–		1.07 (0.99–1.15)	–	1.04 (0.96–1.12)
Donated before												
No	160	1.00 (reference)	1.00 (reference)	1.00 (reference)	361	1.00 (reference)	1.00 (reference)	1.00 (reference)		1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	109	1.57 (1.11–2.21)	–	1.89 (1.28–2.79)	197	1.42 (0.49–4.03)	–	1.32 (0.44–3.99)		–	–	–

[a] Model 1 presents odds ratios (95% confidence intervals) from a crude model which contains only one variable at the time

[b] Model 2 presents odds ratios (95% confidence intervals) from a multivariable-adjusted model adjusted for age, sex, residence, and studying a public health course, except for the studied factor. $R^2 = 0.59$

[c] Model 3 presents odds ratios (95% confidence intervals) from a multivariable-adjusted model adjusted for age, sex, residenc,e and studying a public health course, knowledge score (continuous), attitude score (continuous), and practicing donation (yes vs no), except for the studied factor. $R^2 = 055$

percentage range [11% in Thailand (Wiwanitkit 2002) to 55% in India (Raghuwanshi et al. 2016)] of students in previous studies who have donated blood; 25% in Iran (Safizadeh et al. 2009), 23% (Mirza et al. 2015) and 39% (Mohammed et al. 2011) in Pakistan, 13% (Kowsalya et al. 2013) and 30% (Elias et al. 2016) in other Indian studies, 18% in Nepal (Mamatya et al. 2013), 19% (Baig et al. 2013) and 14% (Mustafa et al. 2015) in Saudi Arabia, and 24% in Ethiopia (Nigatu and Demissie 2014).

More than half of blood donations in our study had been collected in mobile transfusion vehicles, which was similar to Pakistan (Mohammed et al. 2011). Lack of time or fear of wasting time were reported as reasons for non-donation in Nepal (Mamatya et al. 2013), Saudi Arabia (Baig et al. 2013; Al-Johar et al. 2016), Jordan (Batiha and Albashtawy 2013), India (Mishra et al. 2016; Raghuwanshi et al. 2016), and Tanzania (Elias et al. 2016). This reveals how important it is to approach students at their study places. Many studies showed that students refused to donate for incentives (Elias et al. 2016; Mamatya et al. 2013; Mohammed et al. 2011; Raghuwanshi et al. 2016), while Saudi (Baig et al. 2013) and Tanzanian (Nigatu and Demissie 2014) studies showed the opposite. The majority of our students' donations, 73%, were voluntary non-remunerated, while 27% were replacement donations, which was similar to findings from Pakistan (Mohammed et al. 2011), Nepal (Mamatya et al. 2013), India (Raghuwanshi et al. 2016), and Tanzania (Elias et al. 2016). In contrast, 30% of Saudi students preferred incentives (Baig et al. 2013), and Ethiopian student donors had high odds for paid and replacement donations in comparison with voluntarism; odds ratios (95% CIs) were 3.16 (1.03–3.48) and 2.24 (1.31–3.81) respectively (Nigatu and Demissie 2014). Many students and their families still look to family donors as the safest source for blood (Allain 2010), which might justify the substantial proportion for replacement donation.

In the current study, age and residence were not significantly associated with knowledge, attitude, or practice in the multivariable-adjusted regression model, while donors were significantly more likely to be male students. Age and residence were not associated with blood donation in Pakistan (Ahmed et al. 2014) or India (Raghuwanshi et al. 2016), but knowledge was higher in Ethiopian urban than rural students (Nigatu and Demissie 2014). Knowledge and practice were higher in male than female students, while attitude did not differ by gender in Iran (Safizadeh et al. 2009), Pakistan (Ahmed et al. 2014; Kowsalya et al. 2013; Mohammed et al. 2011), or Nepal (Mamatya et al. 2013). Meanwhile, knowledge was higher in females but still donation was higher in male students in Jordan (Batiha and Albashtawy 2013), Ethiopia (Nigatu and Demissie 2014), and India (Raghuwanshi et al. 2016). The culture in these developing countries that looks at females as a vulnerable sex implies some social limitation on females, in addition to different fear barriers (fear of needles, sight of blood, or developing anemia) which are more prevalent among females than males (Lownik et al. 2012; Batiha and Albashtawy 2013).

Students who had studied Public Health had higher odds for having good knowledge and positive attitude scores; however, this was not translated into higher odds for donating blood. Several studies have shown that the subject of study had an impact on KAP of blood donation (Nigatu and Demissie 2014; Nwabueze et al. 2014; Raghuwanshi et al. 2016). However, mechanisms to transform the academic knowledge and the inspired positive attitude to practical community services are lacking (Lownik et al. 2012). If it is not possible to add Public Health to the syllabus of all students in the university, at least short health education sessions by Public Health staff are recommended.

The higher the knowledge score of our students, the more likely they are to have a positive attitude and to be donors. It has been shown previously that knowledge and attitude scores are positively correlated with blood donation practice (Kowsalya et al. 2013; Mamatya et al. 2013; Safizadeh et al. 2009). Among Ethiopian students, good versus poor knowledge was associated with a more than 2-fold increase in positive attitude and 3-fold increase in practice (Nigatu and Demissie 2014). An Indian study compared 500 student donors with 500 non-donors, and reported significant higher knowledge and positive attitude among donors (Mishra et al. 2016). In contrast, another Indian study showed that knowledge score was inversely associated with the practice of blood donation among university students; in that study, knowledgeable students — mainly medical students — were less likely to donate due to lack of time or request (Raghuwanshi et al. 2016).

Having an experience of blood donation was associated with significantly (89%) increased odds for having a good knowledge, but non-significantly (32%) increased odds for having a positive attitude in our study. Knowledge of donors was higher than non-donors (Lownik et al. 2012; Mishra et al. 2016), because during the process of blood donation, donors usually gain much knowledge from the blood bank or transfusion vehicle staff (Lownik et al. 2012). In contrast, some unpleasant experiences during blood donation may reduce the likelihood of having positive attitude after donation (Batiha and Albashtawy 2013). In our study, 12% of donors did not report positive feelings after donation.

To the best of our knowledge, this is the first Egyptian study to assess university students' KAP with regard to blood donation, and can be considered as a base for strategies to motivate a significant sector of the community, by number and in safety, towards blood donation. However, like all KAP studies, the current study limitations include the possibility of recall and interviewer bias. Second, 18% of the randomly invited students refused to participate; however, sampling bias was unlikely, because we have sociodemographic

data for those non-respondents, which did not differ significantly from respondents' data. Third, although Minia University includes students from all over Egypt, and there are no great differences in sociodemographic characteristics of students in different Egyptian universities, nevertheless generalizability of the findings of this study should be confirmed by studies from other universities, including private universities.

In conclusion, this study showed a gap between positive attitude towards blood donation, on the one hand, and insufficient knowledge about and practice of blood donation, on the other hand. Collaborations between Ministry of Health blood collection agencies and the Ministry of Higher Education, targeting students at their place of study, are recommended, because while information about blood donation is the responsibility of the collecting organizations, nevertheless health education and role modeling via Public Health University staff can be very effective.

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Compliance with ethical standards

Conflicts of interest All authors declare that they have no conflict of interest.

Ethical approval All procedures performed were in accordance with the ethical standards of the Minia University Research Committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all students included in the study.

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