

Body donation for research and teaching purposes: the contribution of blood donation units in the progress of anatomical science

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Background: Cadaver's dissection has a fundamental role in teaching and understanding the anatomy. Postmortem body donation (PMBD) is an important source of cadavers and provides an opportunity to carry out research or educational activities in medicine and surgery. The objective of the current study is to determine the perspectives and attitudes toward PMBD among blood donors (BLD) and elderly people. These data are fundamental to highlight the PMBD extent and individual factors that might influence PMBD.

Materials and methods: Six hundred and fifty questionnaires were distributed to 500 (327 male and 173 female, mean age 39.9 ± 9.6 years) blood donors (BLD) and 150 elderly people (62 males and 88 females, mean age 74 ± 9.4 years). A specially designed self-administered questionnaire covering demographic data, knowledge and attitude of the participants concerning body donation (BD) was used.

Results: Concerning the perception of BD among BLD and elderly people, the most common reason for BD in both study groups was the contribution in research, while the commonest reason for hesitating about BD was the lack of information, following by personal reasons. The BLD were more likely to be interested in BD for contribution in research and personal reasons. Additionally, BLD were less likely than the elderly to hesitate about BD for religious and personal reasons and more likely to hesitate about BD for not being informed. BLD who were interested in BD for contribution in research were significantly older. Elderly people who hesitated about BD for personal reasons were significantly older. In the BLD group, those who responded that blood and body donation are the same were significantly younger, while in the elderly group — significantly older. The proportion of BLD who declared that blood and body donation is the same was significantly higher in more educated people.

Conclusions: A need for well-organised and informative BD programmes is evident. Orientating the public towards this practice is of high moral and medical value, since with this important promotion the altruistic act of BD will expand globally. (Folia Morphol 2019; 78, 3: 575–581)

Key words: body donation, anatomy, teaching, medical education, cadaver

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INTRODUCTION

"The dead teach the living" is the motto reflecting the fundamental role of cadavers' dissection in teaching and understanding the anatomy, surgical practice and novel scientific techniques [3, 4, 17, 22]. Postmortem body donation (PMBD) is an important source of cadavers and provides an opportunity to carry out research or educational activities in medicine and surgery. PMBD is defined as the informed and free act of donating whole body after death for medical education and research. This altruistic choice is of high moral value [5]. Culture, society and spirituality contribute to the variable characteristics of body donors and body donation (BD) programmes worldwide. PMBD is still relatively rare, and in attempts to increase BD, many countries have instituted programmes and regulations surrounding the donation of cadavers or body parts. BD programmes represent the main source of cadavers for the Departments of Anatomy. Cadavers' dissection provides a unique opportunity to integrate anatomical and clinical education. Traditional dissection courses [8, 9, 21] have been an integral part of medical education since the 1800s [13, 20]. Although the development of medical technologies, cadavers' dissection remains the highlight of anatomy education, as it provides students a clear aspect of the anatomical structures and their spatial orientation within the body, as well as the understanding of anatomical variation within the same or different populations [17, 18, 20]. Research has shown that body donors for the science of anatomy are a unique and irreplaceable learning tool for undergraduate medical education [18]. Previous studies focused on cadaveric donations, emphasizing on individual donations, on gender differences to explain the different context of voluntary donations [7, 14]. They concluded that the BD is incited by the altruism which differs by gender, age and socioeconomic and educational status of the population. A tendency for BD was highlighted for married couples, as they donated together [14].

The objective of the current study is to determine the perspectives and attitudes toward PMBD among blood donors and elderly people. These data are fundamental to highlight the PMBD extent and individual factors that might influence PMBD.

MATERIALS AND METHODS

The current study was conducted in the Blood donation Unit of Sotiria Regional Chest Diseases Hospital (Athens region) and in the Elderly Care Unit of Agion

Table 1. Demographic characteristics of the sample (600 subjects, 500 blood donors and 150 elderly)

	Blood donors (n = 500)	Elderly (n = 150)
Gender:		
Males	327 (65.4%)	62 (41.3%)
Females	173 (34.6%)	88 (58.7%)
Men age ± SD	39.9 ± 9.6	74.0 ± 9.4
Mean BMI ± SD	25.7 ± 3.6	29.1 ± 4.9
BMI:		
Normal	210 (42.0%)	24 (16.0%)
Overweight	239 (47.8%)	66 (44.0%)
Obese	51 (10.2%)	60 (40.0%)
Educational level:		
None/primary school	1 (0.2%)	78 (52.0%)
Middle school	3 (0.6%)	38 (25.3%)
High school	162 (32.4%)	33 (22.0%)
TEI	149 (29.8%)	0 (0.0%)
University/postgraduate studies	185 (37%)	0 (0.0%)
Other	0 (0.0%)	1 (0.7%)
Religion:		
Christian Orthodox	475 (95.0%)	149 (99.3%)
Other	25 (5.0%)	1 (0.7%)
Family history	81 (16.2%)	26 (17.3%)
Personal history	7 (1.4%)	93 (62.0%)
Previous surgery	52 (10.4%)	43 (28.7%)
Smoking	163 (32.6%)	25 (16.7%)
Alcohol consumption	35 (7.0%)	10 (6.7%)
Having tattoo	33 (6.6%)	1 (0.7%)

BMI — body mass index; SD — standard deviation; TEI — Technological Educational Institute

Anargyron after obtaining a signed informed permission from the Ethical Committees of the Institutions.

Six hundred and fifty questionnaires were distributed to 500 (327 male and 173 female, mean age 39.9 ± 9.6 years) blood donors (BLD) and 150 elderly people (62 males and 88 females, mean age 74 ± 9.4 years). Samples' characteristics are summarised in Table 1. All participants were of Greek nationality (Caucasian whites).

A specially designed self-administered questionnaire covering demographic data, knowledge and attitude of the participants concerning BD was prepared and given for response. The methodology was explained to all participants and clarifications were provided without influencing the respondents. The inclusion criterion for the participation in the study was the age of 18 years and above and exclusion criterion was the denial of consent. Respondents were assured that their anonymity would be respected. The process of collection of the completed

Table 2. Perceptions of blood donors and elderly concerning body donation

	Blood donors (n = 500)	Elderly (n = 150)	P*
Interested in being body donor for:			
Contributing in research (physicians' education)	265 (53.0%)	39 (26.0%)	< 0.001
Personal reasons	107 (21.4%)	16 (10.7%)	0.003
Financial reasons	4 (0.8%)	2 (1.3%)	0.626**
Hesitating in being body donor for:			
Religious reasons	31 (6.2%)	31 (20.7%)	< 0.001
Personal reasons	105 (21%)	65 (43.3%)	< 0.001
Not being informed	167 (33.4%)	25 (16.7%)	< 0.001
Not being appropriate for it	9 (1.8%)	38 (25.3%)	< 0.001
Is blood and body donation the same?	51 (10.2%)	19 (12.7%)	0.393
If no, why:			
It is unknown	129 (28.7%)	17 (13%)	< 0.001
It scares me	65 (14.5%)	34 (26%)	0.002
Religious reasons	27 (6.0%)	13 (9.9%)	0.120
Personal/Family reasons	103 (22.9%)	84 (64.1%)	< 0.001
Simple procedure	130 (29.0%)	89 (67.9%)	< 0.001
Possible reaction from friends and family	107 (23.8%)	8 (6.1%)	< 0.001
Not being informed	116 (25.8%)	27 (20.6%)	0.222

*Pearson's chi-square test; **Fisher's exact test

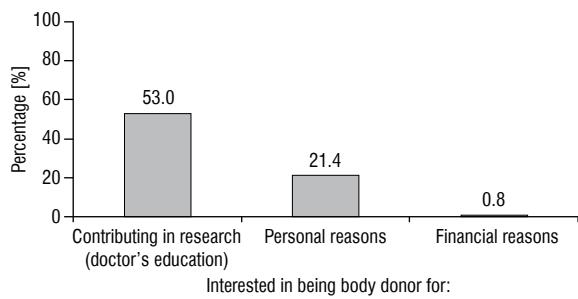
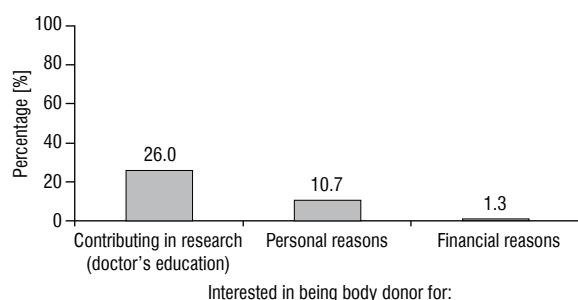
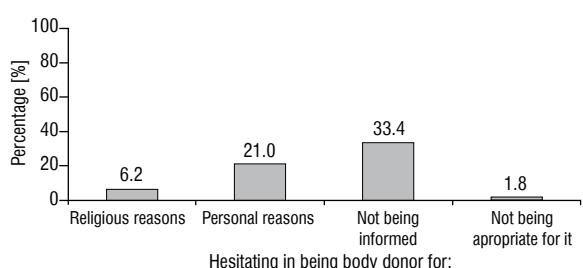
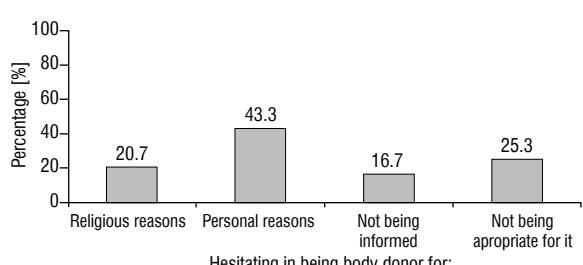
questionnaires as well as the validation of the answered fields was supervised by an academic teacher in collaboration with post-graduate medical students. Responses from all questionnaires were registered in a database using 2010 Microsoft Excel for Windows. Records included each registrant's full name, year of birth, date of registration, gender, race/ethnicity, religious affiliation, marital status, and primary (current or past) occupation.

Statistical analysis

Continuous variables are presented with mean \pm standard deviation (SD). Quantitative variables are presented with absolute and relative frequencies. For the comparison of proportions, χ^2 and Fisher's exact tests were used. For the comparison of means between two groups, the Student's t-test was computed. All p values reported are two-tailed. Analysis was conducted using SPSS statistical software (version 22.0) for Windows. Statistical differences among groups were studied using a one-way ANOVA analysis and a *post hoc* Bonferroni test. Significance level was set at $p < 0.05$.

RESULTS

The majority of participants were Christian Orthodox (95% in BLD group and 99.3% in the elderly group). Family history existed in 16.2% of the BLD group and in 17.3% of the elderly group, while personal history was present at 1.4% in the BLD group and at 62.0% in the elderly group. A percentage of 10.4% and 28.7% of the BLD and the elderly, respectively, had a previous surgery. The proportion of smokers was 32.6% in BLD and 16.7% in the elderly. Concerning BD perception among BLD and elderly people (Table 2), the most common reason for BD was the contribution in research in both study groups (Figs. 1, 2). The most common reason for hesitating about BD (Fig. 3) was the lack of information following by personal reasons in the BLD group and personal reasons in the elderly group (Fig. 4). The percentage of positive responders in the question: "Is blood and body donation the same?" was 10.2% in BLD and 12.7% in the elderly group. Comparing the perceptions between two groups, BLD were more likely to be interested in BD for contribution in research and personal reasons. Additionally, BLD were less likely than elderly patients to have hesitation in being body donor for religious or personal reasons and more likely to have hesitation in being body donor for not being informed. Comparing the responses for the reason that blood and BD are not the same, BLD were less likely than the elderly, to have marked "It scares me", personal/family reasons and simple procedure and more likely to mark "It is unknown" and "Possible reaction from friends and family". Tables 3 and 4 summarise the gender and age differences in perceptions of BLD and elderly people concerning BD. Regarding to the responses for the reason that blood and BD are not the same, female BLD were more likely than the male ones to mark "It scares me", while in the elderly group, males were more likely to be interested in being body donors for contribution in research. BLD who declared their interest in being BD for contribution in research were significantly older. Also, BLD who hesitated about BD for "Not being informed" or those who responded "It is unknown", "Possible reaction from friends and family" and "Not being informed" for the explanation why blood and BD are not the same were significantly younger. Elderly people who hesitated about BD for personal reasons were significantly older. In the BLD group, those who responded that blood and BD are the same were significantly younger, while in the elderly group — significantly older. The proportion of BLD who declared that blood donation and BD are the same was significantly higher in more educated people

**Figure 1.** Reasons for blood donors being interested in body donation.**Figure 2.** Reasons for elderly people being interested in body donation.**Figure 3.** Reasons for blood donors hesitating about body donation.**Figure 4.** Reasons for elderly people hesitating about body donation.**Table 3.** Age differences in perceptions of blood donors and elderly people concerning body donation — mean (SD)

	Blood donors (n = 500)	P*	Elderly (n = 150)	P*
Interested in being body donor for:				
Contributing in research (doctors' education)	No 37.9 (9.5) < 0.001	74.0 (8.8)	0.914	
	Yes 41.6 (9.4)	74.2 (10.9)		
Personal reasons	No 39.9 (9.7) 0.822	74.1 (9.2)	0.808	
	Yes 39.7 (9.0)	73.5 (10.9)		
Financial reasons	No 39.9 (9.6) 0.737	74.1 (9.4)	0.875	
	Yes 38.3 (3.0)	73.0 (1.4)		
Hesitating in being body donor for:				
Religious reasons	No 39.9 (9.7) 0.480	74.0 (9.6)	0.996	
	Yes 38.7 (8.4)	74.0 (8.4)		
Personal reasons	No 40.2 (9.6) 0.116	72.5 (9.1)	0.024	
	Yes 38.6 (9.4)	76.0 (9.4)		
Not being informed	No 40.8 (9.0) 0.001	73.6 (9.3)	0.168	
	Yes 37.9 (10.4)	76.4 (9.4)		
Not being appropriate for it	No 39.9 (9.6) 0.535	74.0 (9.0)	0.897	
	Yes 37.9 (9.0)	74.2 (10.4)		
Is blood and body donation the same?	No 40.2 (9.5) 0.025	73.4 (9.4)	0.025	
	Yes 37.0 (9.6)	78.5 (8.1)		
If no, why:				
It is unknown	No 40.8 (9.1) 0.023	73.8 (9.4)	0.207	
	Yes 38.6 (10.3)	70.7 (8.8)		
It scares me	No 40.4 (9.6) 0.239	73.8 (9.3)	0.360	
	Yes 38.9 (9.4)	72.1 (9.6)		
Religious reasons	No 40.1 (9.6) 0.754	73.4 (9.5)	0.875	
	Yes 40.7 (8.3)	73.0 (8.8)		
Personal/family reasons	No 40.7 (9.5) 0.055	71.6 (8.6)	0.106	
	Yes 38.6 (9.5)	74.4 (9.7)		
Simple procedure	No 40.4 (9.8) 0.508	72.5 (9.7)	0.458	
	Yes 39.7 (8.9)	73.8 (9.3)		
Possible reaction from friends and family	No 41.3 (9.4) < 0.001	73.2 (9.2)	0.297	
	Yes 36.5 (9.2)	76.8 (12.6)		
Not being informed	No 40.7 (9.0) 0.050	73.5 (9.5)	0.828	
	Yes 38.7 (10.7)	73.0 (9.1)		

*Student's t-test; SD — standard deviation

($p = 0.050$). Also, BLD not being Christian Orthodox were more likely to respond "Personal/family reasons" ($p = 0.006$) and "Simple procedure" ($p = 0.009$) for the explanation why blood and BD are not the same

as compared to the Christian Orthodox people. BLD subjects having a tattoo were more likely to answer that blood donation and BD are the same ($p = 0.003$). BLD with family history ($p = 0.002$) or those with previous

Table 4. Perceptions of blood donors and elderly people concerning body donation by gender

	Blood donors (n = 500)			Elderly (n = 150)		
	Males	Females	P*	Males	Females	P*
Interested in being body donor for:						
Contributing in research (physicians' education)	No	144 (44.0%)	91 (52.6%)	0.068	39 (62.9%)	72 (81.8%)
	Yes	183 (56.0%)	82 (47.4%)		23 (37.1%)	16 (18.2%)
Personal reasons	No	265 (81.0%)	128 (74.0%)	0.067	56 (90.3%)	78 (88.6%)
	Yes	62 (19.0%)	45 (26.0%)		6 (9.7%)	10 (11.4%)
Financial reasons	No	324 (99.1%)	172 (99.4%)	1.000**	61 (98.4%)	87 (98.9%)
	Yes	3 (0.9%)	1 (0.6%)		1 (1.6%)	1 (1.1%)
Hesitating in being body donor for:						
Religious reasons	No	307 (93.9%)	162 (93.6%)	0.915	50 (80.6%)	69 (78.4%)
	Yes	20 (6.1%)	11 (6.4%)		12 (19.4%)	19 (21.6%)
Personal reasons	No	266 (81.3%)	129 (74.6%)	0.077	34 (54.8%)	51 (58%)
	Yes	61 (18.7%)	44 (25.4%)		28 (45.2%)	37 (42%)
Not being informed	No	219 (67%)	114 (65.9%)	0.808	49 (79.0%)	76 (86.4%)
	Yes	108 (33%)	59 (34.1%)		13 (21.0%)	12 (13.6%)
Not being appropriate for it	No	322 (98.5%)	169 (97.7%)	0.504**	47 (75.8%)	65 (73.9%)
	Yes	5 (1.5%)	4 (2.3%)		15 (24.2%)	23 (26.1%)
Is blood and body donation the same?						
No	291 (89.0%)	158 (91.3%)	0.411	53 (85.5%)	78 (88.6%)	0.568
Yes	36 (11.0%)	15 (8.7%)		9 (14.5%)	10 (11.4%)	
If no, why:						
It is unknown	No	206 (70.8%)	114 (72.2%)	0.761	46 (86.8%)	68 (87.2%)
	Yes	85 (29.2%)	44 (27.8%)		7 (13.2%)	10 (12.8%)
It scares me	No	258 (88.7%)	126 (79.7%)	0.010	43 (81.1%)	54 (69.2%)
	Yes	33 (11.3%)	32 (20.3%)		10 (18.9%)	24 (30.8%)
Religious reasons	No	275 (94.5%)	147 (93.0%)	0.533	46 (86.8%)	72 (92.3%)
	Yes	16 (5.5%)	11 (7.0%)		7 (13.2%)	6 (7.7%)
Personal/Family reasons	No	222 (76.3%)	124 (78.5%)	0.598	16 (30.2%)	31 (39.7%)
	Yes	69 (23.7%)	34 (21.5%)		37 (69.8%)	47 (60.3%)
Simple procedure	No	213 (73.2%)	106 (67.1%)	0.173	17 (32.1%)	25 (32.1%)
	Yes	78 (26.8%)	52 (32.9%)		36 (67.9%)	53 (67.9%)
Possible reaction from friends and family	No	224 (77.0%)	118 (74.7%)	0.586	49 (92.5%)	74 (94.9%)
	Yes	67 (23.0%)	40 (25.3%)		4 (7.5%)	4 (5.1%)
Not being informed	No	212 (72.9%)	121 (76.6%)	0.389	41 (77.4%)	63 (80.8%)
	Yes	79 (27.1%)	37 (23.4%)		12 (22.6%)	15 (19.2%)

*Pearson's chi-square test; **Fisher's exact test

surgery ($p < 0.001$) were more likely to respond positively about their interest in being body donor for personal reasons. No other significant demographic differences were found in the perceptions of BLD or elderly people.

DISCUSSION

The majority of published data emphasize that cadaver's dissection is fundamental in medical edu-

cation. A high correlation exists between PMBD and its perception as "an act of altruism". However, a considerable percentage of medical students had scant knowledge of this issue, since they were not informed about organ and tissue donation during their academic training [5]. Raikos et al. [24] in their study mentioned that the majority of young participants (73.4%) agreed with BD for educational use, while

only 13.8% disagree, and 12.8% did not reply or they do not know. In the current study, the most common reason for BD was the contribution in research, in both study groups, while the most common reason for hesitating about BD was the lack of information following by personal reasons. Blood donors were more likely to be interested in BD for contribution in research and personal reasons, while, comparing to the elderly, were less likely to have hesitation in being body donor for religious reasons, personal reasons or not being appropriate for it and more likely to have hesitation in being body donor for not being informed. Blood donors who declared their interest in being body donor for contribution in research were significantly older. The proportion of blood donors who declared that blood and body donation are the same was significantly higher in more educated people.

Regarding the relation between BD and religion, many religions show support for BD. The Hindu, Buddhist, Muslim and Christian religions all support the idea of BD and/or organ donation for the betterment of the world. The support of these religions is critical in many parts of the world, as many people actively practice these religions [8–10]. In the current study, blood donors not being Christian Orthodox were more likely to respond "Personal/Family reasons" and "Simple procedure" for the explanation why blood and BD are not the same as compared to the Christian Orthodox people. PMBD is not regarded as an act contrary to religious faith [5], as almost all religions globally support and encourage donation [1, 19]. Atheists and agnostics expressed a 6-fold greater approval of PMBD than Catholics [5]. This propensity shows that there are strong motivations probably linked to the awareness of the great ethical value of BD and to a widespread sentiment of civic altruism and human solidarity.

Concerning PMBD, there is a lack of specific legislation concerning the ownership of cadavers, the terms and conditions of donors' informed consent, and bodies' preservation in many countries [6]. Despite the lack of specific legislation regarding PMBD, many centres for the collection of BD have been established and important programmes for BD have been initiated [23]. PMBD for scientific purposes is rare in several countries, like Italy, probably due to the fact that donating the body for scientific purposes is less useful than organ donation. In the current study elderly people hesitating in being body donor for personal reasons were significantly older. In blood donors group, those who responded that blood and BD are the same were

significantly younger, while in the elderly group — significantly older. The proportion of blood donors who declared that blood and BD are the same was significantly higher in more educated people.

In the current study, the most common reason for hesitating about BD was the lack of information following by personal reasons in the blood donor group and personal reasons in the elderly group. The idea that one's body can be dissected may create psychological obstacles, which can only be overcome by emphasizing the importance of BD and its scientific and medical utility. Physicians and students can play a pivotal role in promoting PMBD and also may act as a good vehicle of information for patients and relatives. Although, in Ciliberti et al. [5] study, the vast majority of respondents did not consider PMBD as an insult to the human body, the authors underlined that those who did were about 80% less likely to be in favour of PMBD. Kharkar and Dase [12] pointed out that students concern that their bodies might not be handled correctly prevents BD. The ceremony with which some research institutes express their gratitude for the gift of body donors plays an important role and raises students' awareness of the need to treat donors' bodies respectfully [2, 11, 12]. Fear that death has not been adequately verified has been declared that may affect the willingness to BD. An important issue related to PMBD concerns the relationship with the family. Ciliberti et al. [5] data indicate that a high percentage of students associate PMBD with discomfort for their families. They also highlight the need for well-organised and informative BD programmes. Orientating the public towards this practice is of high moral and medical value. Media and other social bodies could take an important role in promoting this generous act, globally [25].

The questionnaire used in this pilot study will require further studies in order to allow its validation.

CONCLUSIONS

Postmortem body donation is an important source of cadavers and provides an opportunity to carry out research or educational activities in medicine and surgery. Concerning BD perception among blood donors and the elderly, the most common reason for BD in both study groups was the contribution in research, while the commonest reason for hesitation in being body donor was the lack of information following by personal reasons. The blood donors were more likely to be interested in being BD for contribution in research and personal reasons. Additionally, blood donors compare to the elderly were less likely to hesitate about BD

for religious and personal reasons and more likely to hesitate about BD for not being informed. Blood donors who declared their interest in being body donors for contribution in research were significantly older. Elderly people who hesitated about BD for personal reasons were significantly older. In the BLD group, those who responded that blood and BD are the same were significantly younger, while in the elderly group — significantly older. The proportion of blood donors who declared that blood and BD are the same was significantly higher in more educated people. Blood donors with family history or with previous surgery were more likely to respond positively about their interest in being body donor for personal reasons. A need for well-organised and informative BD programmes is evident. Orientating the public towards this practice is of high moral and medical value, since with this important promotion the altruistic act of BD will expand globally.

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