Original Article

Relationship between cardiopulmonary resuscitation training and level of training and gender

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ABSTRACT

Since the introduction of the modern techniques for cardiopulmonary resuscitation, professionals have discussed the need to standardize its application and teaching both among health care professionals and the general public. The main aim of this study was to examine the training level, compression rate average, depression average and number of cycles in seven minutes in participants trained in cardiopulmonary resuscitation (CPR). As secondary objectives were to analyse the gender interaction with other variables, and to analyse the level of training on the correct execution of CPR. Research was conducted in a sample of fifty-two Spanish participants with training in CPR. There were no significant differences according to training level in terms of depressed sternum, compression rate average, depression average or compression depth average ($P > 0.05$). However, the number of cycles in seven minutes was higher in participants with training than in participants without training ($P = 0.002$). In conclusion, there were a low percentage of participants that offer optimal quality in the practice of CPR. It would be interesting to carry out simulation situations with

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mannequin as a practice and training. **Keywords:** Cardiopulmonary resuscitation; Training; Resuscitation education.

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INTRODUCTION

One of the most frequent causes of death among middle-aged adults in the countries with highest developmental index is the sudden cardiac arrest (SCA). According to the study of López-Mesa, Martin-Hernández, Pérez-Vela, Molina-Latorre & Herrero-Ansola, (2011) SFC affects between 30 and 55 people per 100,000 habitants per year with a survival that does not reach 8%. Disease progression analysis, made at the end of s. XX, predicted a globalised increase in the frequency of coronary illness before the year 2020 (Chugh et al., 2008). A significant percentage of this deaths occur suddenly, only in the United States, there are more than 300,000 cases per year (Morentin & Audicana, 2011; Bayés de Luna & Elosua, 2012; Mora, 2015). In Spain, it is estimated that there are more than24,500 SCA, one arrest for every 20 minutes, producing 25% in households in an unexpectedly, which makes more important the use of resuscitation techniques (Perales-Rodríguez de Viguri, Álvarez-Fernández & López Mesa, 2007).

The increase of suffering a SCA, justifies the learning and use of the cardiopulmonary resuscitation (CPR) on part of the various strata of society. The training is based on the probability of recovery from a patient with the use of the defibrillation in the first minute is a 90% (Anderson et al., 2013 and Vigo-Ramos, 2014). This percentage decreased by around 10% for every minute that passes without defibrillation to the patient. However, this reduction is much lower among patients receiving of basic CPR through effective compressions and ventilations, in this case the decrease in effectiveness every minute is around 3-4%, which gives an idea of the importance of initiate precociously before any SCA (Field et al., 2010). In Spain the estimation between the time of the arrest and the beginning of the CPR is of approximately 20 minutes. Only 10% of the cases it will be realised before the arrival of the emergency services. At present, the survival registered in our country is lower than 10% and more than half of this presents neurological aftermath (Curos, 2001; Codesido & Vázquez, 2007 and Miró et al, 2008).

The specific training in CPR must be done by means of theoretical-practical courses with few students and with practices carried out on mannequins with simulation of real cases. In order to acquire the proper skill and training, sequential and repeated practice is essential until its realisation is almost automatic (Curos, 2001). In this regard, people who acquire this knowledge, after obtaining the title, do not usually have a specific subsequent training that guarantees the quality of CPR.

The low incidence of PCR does not allow to maintain a level of training of the skills required for a proper CPR stable in the time (Codesido & Vázquez, 2007), which leads to the loss of them, so it is necessary that the teaching of the CPR be contemplated as a competition that must be trained periodically (Aguirre, 2012). The quality of a good CPR practice is an important determinant in the outcome after cardiac arrest, with special relevance being the physical preparation of the subjects who carry out the resuscitation (Mejía, Espinoza, Rivera-Chávez & Quintana-Mendoza, 2016 and Elguea, García, Navarro, Martínez, Ruiz & Esponda, 2017). Recent studies assess the quality of both hospital and prehospital CPR by detecting significant deficits in physical fatigue of people who perform CPR (Barcala-Furelos, Abelairas-Gómez, Romo-Pérez & Palacios-Aguilar, 2013).

In order to maintain a high-quality CPR, the training of the rescue team is important (Isbye et al., 2008; Cave et al 2011). In families (Blewer et al., 2011) or at school (Cheskes, 2017). Due to this, it deserves special consideration, training in first aid courses and training of the practicing personnel (Fraga, Stratton, Asensio, Castillo, Vega & Mock, 2004). As this knowledge must be taught in a way adequate and continuous, so that it can respond quickly and effectively to situations that require it (Garmendia, Perales & Miranda, 2010; Calicchia, Cangiano & Papaleo, 2012 y Delavar, Gholami, Ahmadi & Moshtaghian, 2012).

In regard to training problems after the course, the European Resuscitation Council (ERC) as well as the American Heart Association (AHA) are currently encouraging a quality CPR performance (Koster et al., 2010 and Field et al., 2010). In the last times, there has been updated the methodology of teaching of the courses, adapting itself to the society needs. The new courses are realized by means of DVD, to reduce the formation time and with a personal inflatable manikin. Also, the application exists iCPR for mobile devices (Semeraro, Taggi, Tammaro, Imbriaco, Marchetti & Cerchiari, 2011). The use of this device during the CPR, allow an immediate reaction to the rescue team and the information stored in the rescue team and can be used to supervise the quality of the CPR.

The main aim of this study was to examine the training level, compression rate average, depression average and number of cycles in seven minutes in participants trained in CPR. As secondary objectives were a) to analyse the gender interaction with other variables, and b) to analyse the level of training on the correct execution of cardiopulmonary resuscitation (CPR).

METHOD

Participants

A total of 52 Spanish participants with training in CPR aged between 25-37 years old (M=28, 34 years), were invited to participate (55.8% male) in this research with descriptive and transversal design.

Variables and Instruments

In this study the variables used were:

- **Gender:** female and male
- **Participant with training:** yes and not
- **Compression Rate Average (CRAAA):** good and no good
- **Depression Average (CDAAA):** good and no good
- **Sternum:** low depressed sternum, ideal and high depressed sternum
- **Number of cycles in seven minutes**

The manikin used was a Simulator Hal S1000 de Gaumard connected to a laptop computer (Toshiba Satellite Pro 4300 series). There were no modifications of the manikin itself, apart from the cable connecting it to the computer.

The interface was divided into three parts, the area on the left which contains two bars in red and green refers to the compression rate in the first (compression rate) and the second column to understanding the sternum (compression and release).

In the central block of the screen there were two numbers and a chronometer. The numbers establish the number of compressions and the number of ventilations performed in each cycle. The end of each cycle will be marked by the vents. Finally, the chronometer tells us the time that each participant has been doing CPR manoeuvres.

Finally, in the block on the right, there were another two columns that refer to ventilation. In the first we analysed the volume of oxygen that we were able to inflate to the simulator, it was reflected as (ventilation volume), while the second column tells us the duration of ventilation (ventilation duration).

The obtained data give us an average of the parameters obtained in each cycle. The parameters analysed by the simulator taking into account that we have imposed as objectives a C/V ratio (compression/ventilation in 30/2), a compression rate of 110 (compression rate per minute), a compression depth of 4 cm (depth of compression), ventilation rate 12 and an estimated ventilation time of 0,8 seconds.

On the other hand, we found parameters based on ventilation such as the number of ventilations, the time in each of them or the ratio percentage.

Procedure

Permission from the Human Research Ethics Committee of the University of Granada and the participating with training was obtained. All the participants were informed that data would remain confidential.

Data Analysis

The statistical program SPSS 22.0 was used to analyse these data. Descriptive statistics are provided using means and frequencies. Comparative analysis was conducted using ANOVA and contingency tables.

RESULTS

Gender, training, CRAAA, CDAAA percentages are presented in table 1 as well as compression rate and compression depth average and number of cycles in seven minutes of the study participants. Table 1 shows that 42.4% of the participants demonstrated and ideal sternum compression, while the remaining participants demonstrated low depressed sternum compression (28.8%) or high depressed sternum compression (28.8%). Result showed that 11.5% and 42.3% of the participants had a good CRAAA and CDAAAA respectively. The compression rate average and compression depth average were 103.71±17.44 and 4.02±1.05 respectively, with a number of cycles in seven minutes of 22.73±4.70.

Table 1. Descriptive the variables

Gender			
Male		55.8% (n=29)	
Female		44.2% (n=23)	
Participants with training		**Sternum**	
Yes	55,8% (n=29)	**Low Depressed Sternum**	28,8% (n=15)
No	44,2% (n= 23)	**Ideal**	42,4% (n= 22)
		High Depressed Sternum	28,8% (n=15)
Compression Rate Average (M= 103,71; SD.=17,44)		**Depression Average (**M= 4,02; SD=1,049)	
Good	11,5% (n= 6)	**Good**	42,3% (n= 22)
No Good	88,5% (n= 46)	**No Good**	57,7% (n= 30)
Number of cycles in seven minutes		M= 22,73 (SD=4,699)	

Date for depressed sternum, CRAAA, CDAAAA, compression rate average, compression depth average and number of cycles in seven minutes of the study participants according to gender are shown in table 2. There were no significant differences according to gender in terms of depressed sternum, CRAAA, CDAAAA, compression rate average, compression depth average or number of cycles in seven minutes (P > 0.05).

Table 2. Variables with gender

Sternum	Low Depressed Sternum	Ideal	High Depressed Sternum	X^2
Male	34.5% (n=10)	34.5%(n=10)	31.0%(n=9)	p=.411
Female	21.7%(n=5)	52.2%(n=12)	26.1%(n=6)	
CRAAA	**Good**	**No Good**		X^2
Male	34.5% (n=10)	65.5%(n=19)		p=.568
Female	52.%(n=12)	47.8%(n=11)		
CDAAAA	**Good**	**No Good**		X^2
Male	13.8% (n=4)	86.2%(n=25)		p=.200
Female	8.7%(n=2)	91.3%(n=21)		
Compression Rate Average				X^2
Male	M= 103.27; DT=16.485			p=.842
Female	M= 103.27; DT=16.485			
Compression Depth Average				X^2
Male	M= 4.02; DT=1.200			p=.951
Female	M= 4.03; DT=0.846			
Number of cycles seven minutes				X^2
Male	M= 23.00; DT=4.705			p=.647
Female	M= 22.39; DT=4.744			

Date for depressed sternum, CRAAA, CDAAAA, compression rate average, compression depth average and number of cycles in seven minutes of the study participants according to training level are shown in table 3. There were no significant differences according to training level in terms of depressed sternum, CRAAA, CDAAAA, compression rate average or compression depth average (P > 0.05). Number of cycles in seven minutes was higher in participants with training than participants without training (P = 0.002).

Table 3. Variables with participants with training

Sternum	Depressed Sternum	Ideal	High Sternum	X^2
Participants with training	20.7% (n=6)	51.7%(n=15)	27.6%(n=8)	p=.232
Participants without training	39.1%(n=9)	30.4%(n=7)	30.4%(n=7)	
CRAAA	**Good**	**No Good**		X^2
Participants with training	13.8% (n=4)	86.2%(n=25)		p=.568
Participants without training	8.7%(n=2)	91.3%(n=21)		
CDAAAA	**Good**	**No Good**		X^2
Participants with training	51.7% (n=15)	48.3%(n=14)		p=.123
Participants without training	30.4%(n=7)	69.6%(n=16)		
Compression Rate Average				X^2
Participants with training	M= 101.65; DT=15.911			p=.345
Participants without training	M= 106.30; DT=19.255			
Compression Depth Average				X^2
Participants with training	M= 4.11; DT=1.147			p=.517
Participants without training	M= 3.92; DT=0.924			

Number of cycles seven minutes		X^2
Participants with training	M= 24.91; DT=5.672	p=.002**
Participants without training	M= 21.00; DT=2.815	

DISCUSSION AND CONCLUSIONS

The present study contain with 52 persons on CPR training is similar to other articles developed in various places (Ashton, McCluskey, Gwinnutt & Keenan, 2002; Martínez-Natea & Sánchez-Mendiola, 2007; Barcala-Furelos, et al., 2013) studying the level of training and fatigue after the exercise of resuscitation. The practice and teaching of CPR is important in the various contexts of society. Noteworthy are the studies carried out in schools (Plant & Taylor, 2013). In adolescents (Peiró, Sancho, Loro, Sancho & Folgado, 2006; Miró et al., 2008), lifeguards (Haque, Udassi, Udassi, Theriaque, Shuster & Zaritsky, 2008; Subgerman et al., 2009) or medical students (Martínez-Natea & Sánchez-Mendiola, 2007).

The training of resistance is vitality important in this type of individuals, because, the greater resistance will increase the number of cycles and, therefore, the probability of recovery of the patient (Gempeler, 2015).

The CRAAA and CDAAAA have obtained "no good" values in most situations, 88.5% and 57.5% respectively. We understand that this can be generated by the high level of untrained participants, as well as the non-specialization of training because CPR is not a common practice as proposed by Martínez-Natera & Sánchez-Mendiola, (2007) and Arriaza & Rocco (2012).

Also, the values obtained in the compression rate average, compression depth average and number of cycles in seven minutes present low values in this study with the subjects that have developed the CPR. This variation is mainly explained by the age difference of the individuals and by the training or not of them.

Contrasting the relational results in terms of gender, was found association with the rest of variables so, despite what some authors indicate (Haque et al, 2008; Sugerman et al. 2009; Mpotos, Vekeman, Monsieurs, Derese & Valcke, 2013; Zamora, De Los Santos, Sierra & Luna, 2015) when they point to greater strength and resistance in the masculine gender against the feminine gender, in our case the technique is similar between men and women.

In the case of trained subjects, they present a higher level of resistance in the number of cycles. This is produced by what the studies indicate, Blewer et al., (2011), Cave et al., (2011) and Barcala-Furelos et al. (2013), that the training of resistance contributes to a greater number of cycles and a considerable decrease in fatigue (Reder & Quan, 2003; Fraga et al., 2004 and Isbye et al, 2008).

Finally, some limitations presented by this research are associated with the sample used because of the few participants involved in the study and homogeneity. For this reason, it would be interesting to improve the quantity and quality of the sample, not only by increasing the number of participants, but by increasing the age range to encompass other social areas.

In conclusion, the present study reveals that there are a low percentage of participants who perform training and therefore offer optimal quality in the practice of CPR. Therefore, it raises the need to create teaching programs for resuscitation and specific training techniques from early ages. In addition, it would be interesting to carry out simulation situations with mannequin as a practice and training.

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