THE EFFECT OF USING A METRONOME ON THE SPEED OF CHEST COMPRESSIONS IN CARDIO PULMONARY RESUSCITATION (CPR)

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Abstract

Introduction:*Cardio Pulmonary Resuscitation (CPR) is an intervention in the administration of chest compressions that aims to restore and maintain the function of vital organs in victims of cardiac arrest. The lack of quality of CPR in nursing students has an impact on the safety level of a person who experiences cardiac arrest. Therefore, nursing students need CPR skills training using metronome aids in determining the speed of chest compressions in accordance with the American Heart Association (AHA) recommendations. The purpose of this study was to determine the effect of the use of the metronome on the speed of chest compressions in CPR.*

Methods: *This research belongs to the quantitative type of design of Quasy Experiments (pseudo-experiments) pretest posttest without control groups. The sample used in this study was 25 students of the 6th semester nursing study program of the Kendal Institute of Health Sciences. Sampling technique using purposive sampling.*

Results:*The results of the study obtained that the average pre-intervention was 126 x / min and the average post-intervention was 117 x / min. The results of the hypothesis test using the Wilcoxon test obtained an ap value of 0.036 (p <0.05) which means that there is an influence of the use of metronome on chest compression speed in CPR.*

Conclusions:*Chest compression exercises using a metronome can be used to regulate the speed of chest compressions.*

Keywords:*Cardiac arrest, Metronome, Chest compression speed*

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INTRODUCTION

Cardiac arrest is an emergency situation when someone has heart disease, cardiac arrest does not only occur in old age but can occur at a young age (Hirlekar et al., 2018). If someone experiences a cardiac arrest, treatment must be carried out immediately and appropriately so as not to result in permanent cell damage due to a lack of oxygen supply throughout the body, especially in the brain and heart (Turangan, Kumaat, & Malara, 2017).

Data from WHO, (2019) cardiovascular disease is the number one cause of death in the world, claiming around 17.9 million lives every year. The incidence of cardiac arrest in Indonesia and Central Java itself is not known with certainty, but the prevalence of heart disease based on doctors' diagnoses in Indonesia is 1,017,290 people, while in Central Java, based on doctors' diagnoses, the prevalence of heart disease in Central Java is estimated at around 91,161 people (Research and RI Health Development, 2018).

Someone who is experiencing cardiac arrest and respiratory arrest intervention that can be used is Cardio Pulmonary Resuscitation (CPR). The main goal of CPR is to maintain and restore normal oxygen supply to vital organs so that spontaneous circulation returns and can function normally (PERKI, 2017). Implementation of CPR is able to prevent neurological deficits and improve the quality of life for someone who experiences a cardiac arrest (Imardiani & Septiany, 2021).

American Heart Association (AHA) guidelines provide evidence-based strategies that can be used in cardiovascular emergency care. The focus of the AHA guidelines is to ensure the quality of CPR performed (AHA, 2020). AHA (2020) recommends giving chest compressions at a rate between 100-120. Second, compress at a minimum depth of 2 inches (5-6cm). Third, it allows full recoil after each compression. Fourth, minimize interruptions and fifth, provide adequate ventilation for 2 (two) rescue breaths after 30 compressions, each artificial breath is given for more than 1 (one) second, each time it is given the chest will rise (AHA, 2020).

There are several ways to maintain the quality of CPR so that it remains stable and accurate, namely by using a tapping sound on the metronome application (Chung et al., 2012). These inexpensive and easily accessible devices are even available as smartphone apps to guide CPR (Fonseca et al., 2012). The metronome can produce rhythmic and clear beats with a pre-programmed frequency in one-minute periods. The device can be set for a minimum rate of 100 beats per minute, assisting and guiding the rescuer to perform the appropriate number of high-quality external chest compressions (ECC) (Kern, Stickney, Gallison, &Smith, 2010). According to research conducted by Imardiani and Vickha Septiany (2021) the quality of CPR compression greatly affects a person's survival,

The results of a preliminary study that was conducted at the Bachelor of Nursing in Kendal Institute of Health Sciences with a total of 54 students obtained the results of 33 people doing compression rates perfectly (61.1%), 21 people doing compression rates imperfectly (38.9%)) and there were no students who did not (0%), the preliminary study was based on the evaluation results using the OSCA (Objective Structured Clinical Assessment)

method.The lack of quality CPR for nursing students has an impact on the safety level of a person experiencing a cardiac arrest. Therefore, nursing students need training in CPR skills, so that after graduation, theycan become a nurse who can respond quickly, responsively and effectively in providing assistance to someone with Out-of Hospital Cardiac Arrest (OHCA) and In Hospital Cardiac Arrest (IHCA), these skills must be in accordance with the latest developments in existing knowledge

(Nori, Saghafinia, Kalantar Motamedi, &Khademolv Hosseini, 2012). Based on the background above, the researcher is interested in conducting research with the title "The effect of using the metronome on the rate of chest compressions in CPR".

METHODS

Study Design

This study uses a Quasy Experiment design (quasi-experimental), the design that researchers use is pretest posttest without control group. The sampling technique in this study used purposive sampling with a sample of 25 semester 6 students at STIKES Kendal with the criteria for chest compression speed at pretest less than 100 x/minute or more than 120 x/minute and female sex. Data collection tools use counters, stopwatches, and observation sheets. The hypothesis test used is the Wilcoxon Signed Rank Test.

RESULTS

Table 2 shows that the calculation of chest compressions in CPR without using a metronome shows that the minimum number of chest compressions is 86 x/minute and the maximum number is 275 x/minute for the median chest compression rate before using the metronome of 126 x/minute. Calculation of chest compressions in CPR after using the metronome shows that the minimum number of chest compressions is 60 x/minute and the maximum number is 147 x/minute for the median speed of chest compressions after using the metronome of 117 x/minute.

Table 1 Characteristics of respondents based on age (N = 25)

Variable	Median	IQR	Min-Max	CI95%
Age	21.00	1	20-23	20.61-21.23

Table 2. Chest compression rates before and after exercise using the metronome (N = 25) concentration measurement

Variable	Median	IQR	Min-Max	95% CI
The rate of chest compressions before exercise using the metronome	126.00	18	86-275	117.92-146.56
Chest compression rate after exercise using the metronome	117.00	11	60-147	110.55-122.65

Table 3 shows the number of respondents who experienced a change in chest compressions from rapid to normal range,

Table 3 Wilcoxon Rank Test

	N
Posttest –Pretest Negative Rank	17
Positive Rating	7
ties	1
Total	25

there were 17respondents, respondents who experienced changes in chest compressions from slow to normal range there were 7 respondents and the speed of chest compressions was the same between pre and post using the metronome there was 1 respondent.

Table 4 shows that (p=0.036), this value is <0.05, so it can be interpreted that there is a significant effect on the average chest compression rate in CPR before and after chest compression exercises using the metronome.

Table 4. Results of Wilcoxon test analysis

	Median (Minimum-maximum)	*p.s*
Chest compression rate in CPR before exercise using Metrome (n=25)	126 (86-275)	0.036
Chest compression rate in CPR after exercise using Metrome (n=25)	117 (60-147)	

DISCUSSION

Age

The median age of the respondents was 21 years and according to the Indonesian Ministry of Health (2009), 21 years old was included in the early adult age category. Maximum cardiovascular function occurs in adulthood, namely the age of 20 to 30 years because the cardiovascular system will continue to develop from the age of children and reaches its peak of development at the age of 20 years. This is due to the development of body cells including muscle and heart cells which continue to develop until the age of 20 and decline after the age of 30 due to the aging process (Sudirjo & Alif, 2018). Similar research was conducted by Ayu, Saputra, I Kadek., &Sawitri, (2021) it was found that the majority of respondents who performed CPR were 22 years old, because conditions in the cardiovascular system were still developing.

The median of respondents who perform chest compressions in CPR is 21 years old and is an adult, so good cardiovascular function will automatically affect the strength of a person's body muscles, this has an impact on someone when doing chest compressions in CPR.

The effect of using the metronome on the rate of chest compressions in CPR

The results of the statistical test obtained a p value of 0.036, meaning that the value of p <0.05 so that it can be concluded that there is an effect of using the metronome on the speed of chest compressions in CPR on the Manikin demonstration by Semester 6 Nursing Students at Kendal STIKES. The results of this study are in line with the results of research conducted by Imardiani and Septiany (2021) with a total of 37 respondents who obtained a p value of 0.001 so that there was a significant effect of giving the metronome intervention on the frequency of CPR in the research subjects.

The metronome application can guide rescuers when performing chest compressions in CPR. This is in accordance with several studies conducted using two

groups of study subjects, the metronome rhythm intervention group and without metronome. The implementation system for each group is given 2-3 hours of learning about CPR implementation and airway management, then participants are given a booklet and CD Room about CPR implementation to take home, as well as practice with the metronome at 100 x/minute. The results for the metronome group were 121 x/minute, while the group without metronome was 109 x/minute with a value of p=0.002 (Hafner, Jou, Wang, Bleess, & Tham, 2015). The same thing was also shown by a study of 155 medical personnel and health students, there was a change in the frequency of the speed of CPR compressions before 106.

Apart from using the metronome, the use of music is also an option that can guide helpers in setting the compression rhythm according to the AHA recommendations (Mancini et al., 2015). The music "Staying Alive" is one of the music recommended by the AHA to have a rhythm of 103 bpm. The use of music in performing CPR is believed to be able to provide memory, especially related to rhythm during CPR compression (Hafner et al., 2015). The more often a person is exposed to listening to music, especially one that is already popular, it will help a person to be able to repeat the sounds heard (Hafner et al., 2015). The AHA's goal of using 103 bpm music entitled "Stayin alive" is to produce 100 times the compression level for the layman. Another explanation is because when using music in CPR learning, compression rate is more concentrated on target bpm. Therefore, based on this explanation, 100-110 bpm music is suitable for CPR education using music (Kim et al., 2017).

Use of the metronome can assist in guiding the execution of CPR compressions. This is consistent with various studies conducted with two groups of study subjects, groups without using a metronome and groups using a metronome. In the implementation of the group that did the slow/fast speed, the intervention was given for 4 days, namely July 6 2022 – July 9 2022, every day the respondents were given an intervention to adjust the metronome beat in doing the chest speed in CPR for 2 minutes. But in the last minute students experienced a decrease in performance / fatigue when performing chest compressions in CPR. This is in line with research conducted by Jänti, Silfvast, Turpeinen, Kiviniemi, & Uusaro, (2009) factors that affect the quality of CPR compression. As an example, studies have shown that rescuer fatigue reduces the quality of CPR even after 1 minute of chest compressions, and rescuers may not notice this decreased performance. These participants felt more fatigued during chest compressions without rhythm monitoring (metronomeguidance), but in a 10-minute scenario. Most studies have demonstrated that human factors contribute to poor quality of CPR, including difficulty in CPR under stress and agitated cardiac conditions, lack of internal sensors for rate and depth of chest compressions, rescuer fatigue, and infrequent CPR resuscitation (Abella et al., 2005). One possible solution to overcome this problem is to measure the quality of resuscitation by implementing CPR using the metronome by health care providers.

CONCLUSIONS

The results of this study indicate that there is an effect of using the metronome on the rate of chest compressions. Future researchers can carry out further studies regarding the use of the metronome to test the stability of the tempo of chest compressions

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