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THE EFFECTIVENESS OF COMBINATION OF BACK MASSAGE AND DEEP BREATHING EXERCISES ON CHANGES IN HEMODYNAMIC STATUS (SpO2) PATIENTS OF CONGESTIVE HEART FAILURE

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ABSTRACT

In Indonesia, 25% of deaths are caused by heart defects. 229,696 people, or about 0.13%, were heart failure patients. The main problem that occurs in heart failure is hemodynamic changes. If not treated quickly and appropriately, hemodynamic disorders will result in multiple organ failures. Back massage and deep breathing exercise is a combination of non-pharmacological interventions whose effectiveness is not yet known in improving hemodynamic disorders in CHF patients. To determine the effectiveness of the combination of back massage and deep breathing exercise on changes in the hemodynamic status of patients with congestive heart failure. This type of research is quantitative with a true experimental design, a pre-post test design, and a control group. The sampling technique used is simple random sampling. Data analysis used repeated measure ANOVA, Friedman test, independent t-test, and Mann Whitney. The combination of back massage and deep breathing exercise is given for 3 days with a duration of 15 minutes, effectively increasing oxygen saturation (Mean±SD 98.20±0.616 =1.05 p=0.000). Giving a combination of back massage and deep breathing exercises can improve the hemodynamic status of patients with congestive heart failure. The results of this study can be used as an alternative intervention in improving the hemodynamic status and providing other pharmacological and non-pharmacological therapies.

Keywords:
Congestive heart failure, Hemodynamic status

INTRODUCTION

Cardiovascular disease is a disease that does not cause transmission but is a disease that can cause the number one death globally every year (Kemenkes RI, 2014). Congestive heart failure is the main cause of mortality and morbidity worldwide (Rokhayati & Rumahorbo, 2020; Simandalahi et al., 2019). The World Health Organization (WHO) explained that there is a risk of developing cardiovascular disease.

Deaths caused by heart failure as much as 5% to 10% per year also occur in mild heart failure, which shows an increase of up to 30% to 40% that occurs in severe heart failure. In America, as many as 43.8% of deaths are caused by cardiovascular disease, namely coronary heart disease, and as many as 9%

are caused by heart failure (Simandalahi et al., 2019).

In Indonesia, 25% of deaths are caused by heart defects. Approximately 0.13%, or 22,696 people, are heart failure patients (Simandalahi et al., 2019). In Southeast Asia, Indonesia ranks fourth in patients with congestive heart failure after the Philippines,

Myanmar, and Laos (Lam, 2015). Basic Health Research (Riskesdas) states that Central Java Province occupies the highest the prevalence when compared with the national prevalence is 1.6% (Riskesdas, 2018). Central Java province is the third province with the highest number of heart failure, which is 43,361 people, after East Java province with 54,826 people, and West Java province with 45,027 people (Kemenkes RI, 2014). The incidence of congestive heart failure occurred with female cases as the most cases at 0.2% and males at 0.1%. In the 55-74-year age range, the highest prevalence of congestive heart failure is 0.87%, followed by the 75-year-old age range of more than 0.41%, then the 35-54-year age range of 0.28%, and the age range 15-34 years by 0.07% (Engkartini, 2019).

Congestive Heart Failure (CHF) is a condition that shows the heart cannot pump enough blood to meet the body's metabolic needs and causes congestion (Khasanah, 2019; Wijayati et al., 2019). The American Heart Association states that the signs of CHF include: are shortness of breath, especially when lying down, easily tired, coughing or wheezing, especially when exercising or lying down, swelling of the extremities, and weight gain as a result of fluid accumulation, and confusion or inability to think clearly (Cardiovascular Condition, 2015). In addition, CHF is a disorder of lung function (Platini et al., 2018; Simandalahi et al., 2019). Moreover, he main problem in heart failure is the failure to pump blood to meet the body's cell needs for adequate oxygen and nutrients even though the venous filling pressure is normal to hormonal, neural, renal, and hemodynamics (Udjianti, 2011).

The function of the systemic circulation in the body can be known through an indicator, namely hemodynamic status (Noor Alivian et al., 2021). The hemodynamic status is handled by the central nervous system, which is arranged in the medulla oblongata. Systemic stimuli influence changes in hemodynamic status. Baroreceptors strongly influence the reception of systemic stimuli in determining changes in the hemodynamic status of blood pressure and Mean Arterial Pressure (MAP). The stimulus that enters the baroreceptors in the form of changes in the pressure in the blood vessels will be transmitted to the heart regulation center in the medulla oblongata. Furthermore, the heart center provides a determination of the frequency as well as the strength of the heart rate so that compensation occurs in order to maintain balance (Setiyawan, 2016). The emergence of a stimulus greatly affects changes in hemodynamic status; this stimulus appears in oneself in giving manifestations of physiological changes in the body that impact the disease suffered, but this stimulus can also arise from outside the individual by having physical properties, one of which is a massage (Noor Alivian et al., 2021).

Hemodynamic changes should always be monitored because hemodynamic monitoring has an important role in patient management. Monitoring the hemodynamic status of the patient aims to detect physiological abnormalities that are carried out early and monitor the impact of the intervention. This hemodynamic monitoring has a basis, namely the adequacy of tissue perfusion, where there is a balance that occurs between the supply that requires oxygen, maintaining the state or condition, and electrochemical balance, which results in clinical manifestations that occur in hemodynamic disorders if not handled quickly and appropriately will result in failure of the patient many organ functions (Vincent et al., 2011).

Appropriate medical and nursing actions are needed to improve the patient's health status, especially hemodynamic changes. The current treatment that has been done to overcome the worsening of the condition of the main problem of which is by medical management to increase oxygenation, increase cardiac contractility, and reduce the heart's workload with vasodilators (Simandalahi et al., 2019). The goals are to maintain physical stability, avoid behaviors that can lead to bad conditions, and detect early symptoms of worsening heart failure (PDSK I, 2015).

Other non-medical treatments that can be done to maintain physical stability are yoga, hypnosis, meditation, and relaxation (Herdiana et al., 2021). One non-medical management with the concept of relaxation that can be done is back massage or back massage (Noor Alivian et al., 2021). Back massage is a non-invasive technique that is simple, relaxing, and natural as a safe treatment for most people (Bauer et al., 2010; Naglaa, 2019). Massage has been shown to improve lung function and circulation when the amount of blood in the pulmonary arteries increases. An increase in the amount of blood will have more opportunities for gas exchange, thus allowing more oxygen supply throughout the body and increasing oxygen saturation (Naglaa, 2019). Massage is a stimulation given to the body's skin with its center in the shoulder and back area, or it can be done in one or

more places. This massage is carried out within approximately ten minutes on each part of the body to provide maximum relaxation results (Noor Alivian et al., 2021).

Chen conducted a study about a back massage on the physiological response of patients with congestive heart failure (CHF); the intervention was given as much as one session per day, 10 minutes, and carried out for three days. In each of the variables studied, the results obtained clinical significance in the weak category, including the strength of the effect size on oxygen saturation (0.31), respiratory frequency (0.05), pulse frequency (0.30), diastolic blood pressure (0 .28) and systolic blood pressure (0.30) (Chen et al., 2013). Alivian also conducted another study regarding light massage on blood pressure and oxygen saturation in patients with congestive heart failure. The results of this study explained that after being given the intervention two times/day for five days, a statistical significance of p = 0.002 was obtained. However, clinically, each variable has not shown optimal results, where in systolic blood pressure, the strength of effect size (0.04) is obtained, diastolic blood pressure (0.37), and oxygen saturation (0.07) (Noor Alivian et al., 2021).

Physiologically, back massage is a technique used in relaxation that can affect the body psychologically and physically (Chen et al., 2013). The effects exerted by this relaxation response appear as an elongation of its fibers, reducing the activity of the brain and other body systems and reducing impulses on nerves to the brain. Furthermore, there is a decrease in heart rate, a decrease in oxygen consumption, a decrease in respiratory rate, and an increase in brain activity in alpha waves. This back massage affects relaxation by stimulating the release of endorphins in the brain, which in turn will give rise to suppressing activity in the sympathetic nerves and stimulating activation of the parasympathetic nerves (Chen et al., 2013).

One of the other nursing interventions with the concept of relaxation that can be done is to carry out deep breathing exercises or breathing exercises, where there are nursing interventions that can provide an increase the power of the respiratory muscles in increasing lung compliance to provide an increase in ventilation function as well as increase oxygenation (Nirmalasari, Mardiyono, & Dharmana, 2020; Price SA and Wilson LM, 2006; Smeltzer SaBB, 2008). Deep breathing is a technique that has a relationship with physiological changes that can lead to a relaxation response (Nirmalasari, Mardiyono, Dharmana, et al., 2020).

Research that Nirmalasari has conducted on active range of motion and deep breathing exercises was carried out for three days giving, three times/day, so that it had a significant effect on dyspnea and physiological responses of CHF patients with the strength of the effect size of each variable, namely dyspnea (1 .04), systolic blood pressure (1.135), diastolic blood pressure (0.376), pulse (0.218), respiratory rate (0.480), and oxygen saturation (0.877) (Nirmalasari, Mardiyono, Dharmana, et al., 2020). Herdiana has also conducted other research regarding the intervention of Murottal Al-Qur'an and deep breathing exercises on anxiety and vital signs showing that there are significant differences in vital signs (oxygen saturation, respiratory rate, pulse, and blood pressure) in the intervention group after and before the intervention of Murottal Al-Qur'an and Deep Breathing Exercise with p = 0.000, the results obtained were clinically significant in oxygen saturation, namely (1,15) which was clinically significant, and showed a significant difference in the level of anxiety with p=0.000 (Herdiana et al., 2021).

Interventions using back massage and deep breathing exercises have shown statistically significant results but clinically have not shown optimal results. The results of the previous studies showed that the respiratory rate and effect size results were weak (0.48) (Nirmalasari, Mardiyono, Dharmana, et al., 2020). Research conducted by Nirmalasari showed that the effect size was weak in the diastolic blood pressure (0.376), pulse (0.218), respiratory rate (0.480), and oxygen saturation (0.877) (Nirmalasari, Mardiyono, Dharmana, et al., 2020). Other research conducted by Sepdianto also obtained the results of effect size with a very weak category on the oxygen saturation of 0.11 and on the respiratory rate an effect size result with a weak category of 0.24 so that it was concluded that the intervention given clinically did not provide satisfactory optimal results (Sepdianto TC, 2013).

So far, studies conducted with each intervention have not achieved clinically optimal results in CHF patients, so appropriate administration strategies and techniques are needed. For this reason, it is necessary to do a combination of back massage and deep breathing exercises to get more optimal results.

Nursing problems that often grow in patients with congestive heart failure (CHF) worsen the general symptoms of congestive heart failure (CHF) (Simandalahi et al., 2019). Nursing care based on caring behavior can realize quality nursing services (Renny Triwijayanti, 2015). The application of carative factors in CHF patients accompanied by changes in

physiological responses generates confidence and hope by emphasizing the importance of pharmacological therapy and managing treatment actions by meeting basic human needs such as needs such as oxygenation to improve lung compliance conditions. The application of several carative factors that underlie the combination of giving deep breathing exercises and back massage aims to improve the patient's hemodynamic status.

METHODS

This study used quantitative research with a true experimental design to reveal the effectiveness of the intervention of a combination of deep breathing exercise and back massage on changes in the hemodynamic status of patients with congestive heart failure (CHF). This study used a pre-posttest design with a randomized control group design (Dharma KK, 2011). This study has two groups: the control group and the intervention group. The intervention group performed a combination of back massage and deep breathing exercises, while the control group received standardized hospital therapy. In both the intervention group and the control group, changes in hemodynamic status were measured every day for 3 consecutive days.

This study used a population originating from CHF patients with the NYHA II classification in the Roemani Muhammadiyah Hospital inpatient ward, Semarang. We determined the minimum number of samples using a simple random sampling method with a probability sampling technique based on exclusion and inclusion criteria of 40 respondents who were divided into two groups with 20 respondents each in the control group and the intervention group.

This research was carried out by identifying the respondents based on the exclusion and inclusion criteria determined by recording the patient's identity, starting from filling out observation sheets, questionnaires, informed consent, and interviews. The observation sheet consists of two items: the respondent's characteristic observation sheet and the hemodynamic status observation sheet. Then the selected respondents were measured for hemodynamic status, namely oxygen saturation (SpO2), before and after treatment. The measurement results are written into the oxygen saturation observation sheet (SpO2) daily. Respondents whose SpO2 measurements have been taken in the intervention group will be treated with a combination of deep breathing exercises and back massage. This treatment is done for three consecutive days using 15 minutes. On the other hand, this control group was only given hospital standardization therapy.

The instruments used in this study were observation sheets, questionnaires, pulse oximetry, and Standard Operating Procedures (SPO), a combination of back massage and deep breathing exercises. The questionnaire is a sheet that contains fields that must be filled out to provide information about the characteristics of the respondents, which include: name, age, address, gender, and pharmacological therapy. Meanwhile, the observation sheet includes observation data for measuring the hemodynamic status of the respondent. Researchers and enumerators filled out this instrument. Pulse oximetry was used to measure the oxygen saturation levels (SpO2) to determine the hemodynamic status. This measurement is carried out after the respondent is treated according to Standard Operating Procedures (SPO), a combination of back massage and deep breathing exercise. Of course, this SOP has been validated by 5 experts, namely heart and blood vessel specialists, cardiovascular specialist nurses, physiotherapists, and massage therapists who are competent in their fields.

This research was conducted to collect data by several methods: identification, observation, questionnaire sheets, and interviews. The data that has been collected is then tabulated and analyzed using the Statistical Package for The Social Science (SPSS) 24.0 for the Window program, which includes univariate, bivariate, and multivariate analysis. However, the data normality test was carried out first before carrying out the analysis test. The Shapiro-Wilk test used the normality test because the sample was <50 respondents. Hemodynamic status data on pretest and posttest showed that some of the data were normally distributed ($p > 0.05$), and some of the data were not normally distributed ($p < 0.05$). So that when testing the bivariate analysis in this study, it was carried out using nonparametric and parametric tests. The parametric test was carried out using the Independent T-test, while the nonparametric test was carried out using the Mann-Whitney test. Meanwhile, multivariate analysis was conducted to examine how much influence the intervention of a combination of back massage and deep breathing exercise on hemodynamic status using the Repeated Measures ANOVA and Friedman Test. Then to see how much influence the confounding variable, namely pharmacological therapy on hemodynamic status, uses the Multiple Linear Regression test, which is said to have no effect if $p > 0.05$. The data processing carried out is used as the basis for discussing the problem statement, which is then presented in tabular form so that

conclusions can be drawn.

For ethical considerations, researchers must first take care of and obtain permits for research to be carried out from the Master of Applied Health Nursing study program at the Health Polytechnic of the Ministry of Health Semarang. Afterward, we carried out an ethical clearance test from the Health Research Ethics Committee of the Health Research Polytechnic of the Ministry of Health Semarang, then submitted a research permit to the Home Hospital Roemani Muhammadiyah Semarang to collect data. Data collection carried out by researchers pays attention to ethical aspects, including anonymity, confidentiality, and autonomy. The researcher asked for the respondent's informed consent before conducting the research.

RESULTS

Table 1 above explains that gender, education, and pharmacological therapy occur with a significant value, namely the exact p-value > 0.05 in the intervention group and the control group, which show the same or homogeneous.

Table 2 above shows that the combination of back massage and deep breathing exercise carried out over 3 days obtained oxygen saturation values at post-test-1 p = 0.007, post-test-2 p = 0.005, and more meaningful up to the post-test. -3 p = 0.000, where there is a definition or meaning that there is a significant difference between the intervention group and the control group after treatment. The intervention group, the group that has been given a combination of back massage and deep breathing exercise accompanied by pharmacological therapy, obtained an average increase in oxygen saturation of 1.05. The increase was more significant when compared to the control group, who only received pharmacological therapy with a lower mean increase in oxygen saturation of 0.15. From this statement, it can be concluded that the intervention of a combination of back massage and deep breathing exercise is significantly effective in increasing oxygen saturation in CHF patients. The increase in oxygen saturation in both groups had reached average values, where the mean oxygen saturation was 98.20 in the intervention group and 96.75 in the control group.

Based on table 3 above, it can be seen that the statistical significance of oxygen saturation that occurred in the intervention group was p = 0.000 while in the control group was p = 0.604 which was carried out on day 1 to day 3. The results obtained from this analysis explained that there was a significant significance in oxygen saturation from day 1 to day 3 in the intervention group, but did not show any significant significance in the control group from day 1 to day 3.

Figure 1 above shows that the average value of SpO2 in the intervention group has increased, indicated from pre-test to post-test-3, but in the control group, it is relatively constant. The average value of SpO2 in the intervention group was 98.20 in post-test-3, but what happened in the control group was 96.75.

DISCUSSION

The results of statistical tests for 3 days for oxygen saturation showed a p-value <0.05, which means statistically, the combination of back massage and deep breathing exercise effectively increased oxygen saturation in CHF patients. These conditions

Table 1. Distribution of Respondent Characteristics in the Intervention and Control Group

Characteristic	Intervention f(%)	Control f(%)	Total f(%)	*P**
Gender				
Male	8 (40.0%)	9 (45.0%)	17 (42.5%)	0.749*
Female	12 (60.0%)	11 (55.0%)	23 (57.5%)	
Educational Background				
Elementary school	6 (30.0%)	8 (40.0%)	14 (35.0%)	0.818*
Junior high school	4 (20.0%)	5 (25.0%)	9 (22.5%)	
Senior high school	7 (35.0%)	5 (25.0%)	12 (30.0%)	
Diploma III	3 (15.0%)	2 (10.0%)	5 (12.5%)	
Pharmacological Therapy				
Diuretics	4 (20.0%)	4 (20.0%)	8 (20.0%)	0.926*
Vasodilator	11 (55.0%)	12 (60.0%)	23 (57.5%)	
Diuretics and Vasodilators	5 (25.0%)	4 (20.0%)	9 (22.5%)	
Age	57.40±3.485	59.25±5.720	58.33±4.768	0.085**

Table 2. The Difference in Mean Oxygen Saturation (SpO2) Before and After Treatment Between the Intervention and Control Group

Measurement time	Intervention		Control		P*
	Mean	SD	Mean	SD	
Pre-Test	96.70	0.733	96.70	0.657	0.929
Post 1	97.15	0.587	96.60	0.598	0.007
Post 2	97.30	0.571	96.65	0.587	0.002
Post 3	98.20	0.616	96.75	0.550	0.000
Difference (Pre-Post3)	1.05	0.826	0.15	0.875	0.002

Table 3. Analysis of the Difference in Mean Oxygen Saturation (SpO2) Between the Intervention and Control Group

SpO2		Pretest	Post 1	Post 2	Post 3	*Mean Difference*	F	P*
Intervention	Mean	96.70	97.15	97.30	98.20	1.50	27.31	0.000
	SD	0.733	0.587	0.571	0.616			
Control	Mean	96.70	96.60	96.65	96.75	0.05	0.333	0.604
	SD	0.657	0.598	0.587	0.550			

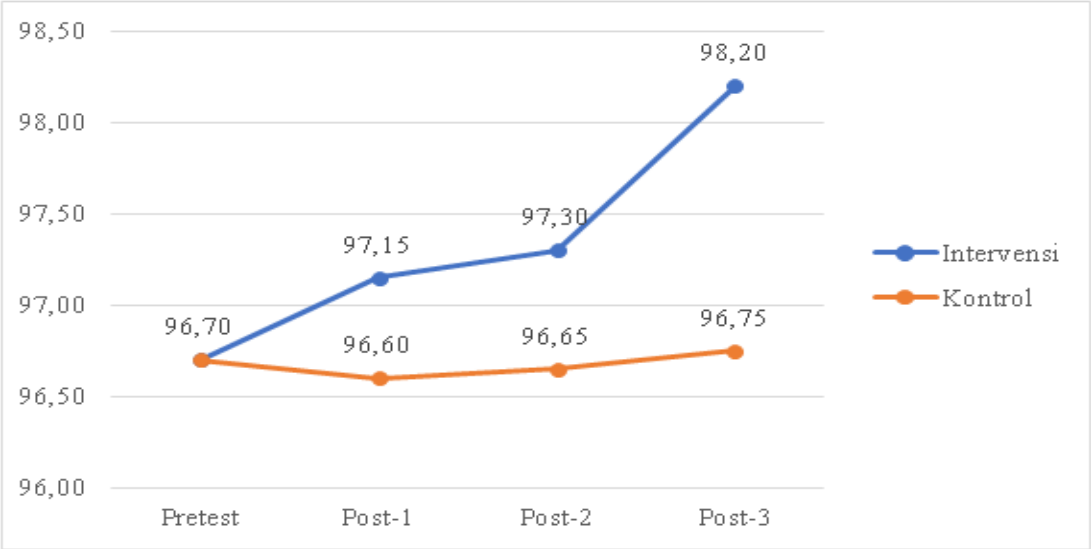

Figure 1. The Description of the Average Oxygen Saturation (SpO2) in the Intervention and Control Group

indicate that the hypothesis is accepted. The difference in the mean of the pre-test and post-test on day 3 was higher in the intervention group compared to the control group. This condition shows that there is a difference in oxygen saturation between the intervention and control groups.

Oxygen saturation increased in the intervention group and also in the control group. By showing a difference in the mean value of the third pre-test and post-test conducted in the intervention group, the results were higher when compared to the control group. The difference in the increase in oxygen saturation can be seen from the difference in the mean. Overall, the increase in oxygen saturation for 3 days in the intervention group was 1.05%, while the increase in the control group was0.15%. The value of increasing oxygen saturation showed a significantly better value in the intervention group compared to the control group. So the analysis of the difference in oxygen saturation test in both groups for 3 days showed that both groups were equally effective statistically in increasing oxygen saturation with p=0.002.

The clinical analysis results of the significance of the effectiveness of the combination of back massage and deep breathing exercise on oxygen saturation obtained an effect size of 2.2 (strong). The analysis results of the combination of back massage and deep breathing exercise on oxygen saturation can increase

the percentage of oxygen saturation until it reaches the cut-off point, which is between 95-100%, with the result that the increase is 98.20%.

None of the respondents had oxygen saturation <95% in the intervention and control groups. There was no decrease in oxygen saturation from the previous event with no difference in oxygen saturation in the control and intervention groups (0%). It is necessary to give one respondent a combination of back massage and deep breathing exercise as well as diuretic or vasodilator pharmacological therapy to increase one incident of decreased oxygen saturation with a cut-off point of 95-100%.

Back massage can improve circulation when blood in the pulmonary arteries increases. An increase in the amount of blood will have more opportunities for gas exchange, thus allowing more oxygen supply throughout the body and will increase oxygen saturation.17 Then the breathing exercise can improve the functional capacity of patients with congestive heart failure and increase tissue perfusion so that oxygenation needs will be met. This intervention will stimulate the release of surfactant secreted in type II alveolar cells. It will increase oxygen saturation (Bulechek 2012; Cahalin & Arena, 2015).

This research has results that with Mokadem's research that back massage could increase oxygen saturation up to 11.35% with a p-value <0.001 (Naglaa EL Mokadem, 2019). Chen also showed that back massage could increase oxygen saturation by 1.7% with a p-value < 0.01 (Chen et al., 2013). Research conducted by Nirmalasari also showed an increase in oxygen saturation of 1.69% after being given deep breathing exercises and a dynamic range of motion with p <0.05 (Nirmalasari, Mardiyono, & Dharmana, 2020). Herdiana conducted a study that gave oxygen saturation results after being given murottal Al-Qur'an intervention and deep breathing exercise of 3.45% with a p-value <0.05 (Herdiana et al., 2021).

The increased oxygen saturation is caused by the increased gas exchange, tidal volume, and respiratory muscle activity due to breathing exercises. During deep breathing exercises, the abdominal muscles will push the diaphragm up during the expiration process. It made the respiratory muscles and diaphragm function optimally, and there will be an increase in tidal volume, optimal oxygen intake, and a decrease in functional residual capacity (G Sivakumar et al., 2011).

This study showed the impact of a combination of back massage and deep breathing exercises on the hemodynamic status of CHF patients with significant changes in hemodynamic status, especially oxygen saturation (SpO2). Compared to only giving pharmacological therapy, it is necessary to provide complementary therapy in addition to pharmacological therapy by giving a combination of back massage and deep breathing exercises.

Health workers, especially nurses, have a role, one of which is as a nursing care provider to provide companion therapy. One therapy combines back massage and deep breathing exercises that can stabilize hemodynamic status and provide convenience to patients. The intervention provided is a simple, relaxing, non-invasive technique and natural and safe treatment for most people. The combination of back massage and deep breathing exercise is safe for NYHA II congestive heart failure (CHF) patients because there are no reports of side effects after the intervention.

CONCLUSION

The results of this research have shown that a combination of back massage and deep breathing exercises with pharmacological therapy changes hemodynamic status in patients with congestive heart failure (CHF). It can be concluded that oxygen saturation (SpO2) can be controlled by 1.05% clinically significant at 2.2 (strong).

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