

Mind-Body-Spiritual Nursing Care Effects on Spirituality and Cardiovascular Risk Markers

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Abstract— Patients with coronary heart disease (CHD) undergoing hospitalization experience various stressors. These stressors may increase expression of cardiovascular risk marker molecules, resulting in building up atherosclerotic plaque. This study aimed at explaining the influence of a mind-body-spiritual nursing care on spirituality and cardiovascular risk markers. This study employed a pre-post-test quasi-experiment with control group design. CHD patients treated in various rooms divided into the control group (20 respondents) and the treatment group (21 respondents). The variables of interest were measured at both pre and post intervention. The spirituality was measured using a questionnaire, while the cardiovascular risk markers were tested using enzyme-linked immunoabsorbant assay from the respondents' serum of venous blood sample. The control group received a standard-nursing intervention while the treatment group received a mind-body-spiritual (MBS) nursing care for three respective days. Data collection took place in 2017. The results showed that mind-body-spiritual nursing care improves patients' spirituality ($p = 0.000$) and the cardiovascular risk markers, particularly VCAM-1 and MCP-1, but not the Hsp70 and eNOS. Additionally, pathway analysis shows that mind-body-spiritual nursing care firstly increases the CHD patients' spirituality, which, in turn, attenuates the expression of VCAM-1 and MCP-1 through the improvement of Hsp70 expression. These findings indicate the mind-body-spiritual care's potential in preventing the process of further build-up of atherosclerotic plaque in CHD patients. It can be concluded that MBS nursing care plays an important role in improving spirituality and thus the expression of cardiovascular risk markers.

Keywords— Mind-body-spiritual therapy; Hsp70 heat shock proteins; vascular cell adhesion molecule-1 (VCAM-1); nitric oxide synthase (eNOS); and monocyte chemoattractant protein 1 (MCP-1)

I. INTRODUCTION

Coronary heart disease (CHD) is one of the major health problems in both developed and developing countries. This disease ranks as the first cause of death worldwide. More than 3 million deaths occur before the age of 60 years, and is expected to increase to 23.3 million deaths by 2030 [1]. Patients with CHD treated in the hospital experience physical, psychological, and spiritual distresses. Nonetheless, nursing care provided for the

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patients addresses mainly physical and physiological aspects of care, leaving other aspects of care given less attention [2].

Some studies support the use of psychological or spiritual-based interventions in reducing anxiety, increasing self-acceptance, and influencing patient positively at cell or molecular level. A pre-surgical psychological intervention has been shown to improve pain tolerance and post-operative immunologic resistance [3]. A combination of relaxation, hypnosis, and meditation has shown its effectiveness in reducing postoperative pain, anxiety, tension and analgesic use in 20 studies involving a total of 1297 patients [4]. Another intervention that combined a health education, retreat in the mountain, meditations and natural activities proved to partially decrease both physical and mental symptoms in patients with chronic physical and mental illness [5]. Other studies have demonstrated the effectiveness of mind-body therapy in children with cancer [6], weight-loss programs [7], smoking cessation programs [8], and reduced stress of medical students [9].

In a systematic review of 96 studies, there is evidence that meditation and spiritual activity reduces stress and anxiety through increased alpha waves in the brain, decreased cortisol levels, increased activity in the frontal and prefrontal lobes, increased frontal and prefrontal blood flow, cortex thickness, and communication between prefrontal, frontal lobes, and parietal [10].

In addition to mind-body intervention, spiritual-based intervention, i.e. zikir (Islamic spiritual mantram) proved useful, including increasing Hsp72 [11], lowering cortisol levels [12]–[14], reducing depression among heart failure patients [12], lowering the stress level of leprosy patients [14], and regulating blood sugar and improving motivation to recover [13]. Spiritual intervention of repeating spiritual mantram by 71 HIV respondents increases faith levels and decreases salivary cortisol levels of HIV patients [15].

Based on the aforementioned studies, there is a gap in research, indicating that, to date, there is little known about the effect of combining mind, body and spiritual care on cardiovascular risk markers on patients with CHD. Given the effectiveness of this intervention when done separately, it is important to investigate the effectiveness of the combined intervention of mind, body and spiritual in a comprehensive nursing care. This study aimed to prove the influence of mind-body-spiritual nursing care on cardiovascular markers in CHD patients, including Hsp70 heat shock proteins (Hsp70), endothelial nitric oxide synthase (eNOS), vascular cell adhesion molecule-1 (VCAM-1), and monocyte chemoattractant protein 1 (MCP-1).

II. METHODS

Study design and participants

The research used a pre-post control group design. The study flow diagram is displayed in Figure 1. Respondents were all patients with a medical diagnosis of coronary heart disease (CHD) hospitalized at three tertiary hospitals in Surabaya. The inclusion criteria were diagnosis of CHD with ACS (acute coronary syndromes), religion of Muslim, 40-75 years old, GCS 4-5-6, and hemodynamically stable. Patients were excluded from the study if they met the following criteria: menstruating (for female patients) or lacking of family support. Criteria for discontinuing patients from this study were the respondents were discharged from the hospital, passed away, or withdrew from the study. A total of 41 respondents were recruited consecutively during the study. Information about the study was given to both patients and families. After the patient agreed to

participate in the study, the baseline data were collected. Patients for control group who received standard nursing care were recruited first, and followed by patients for treatment group who received mind-body-spiritual nursing care.

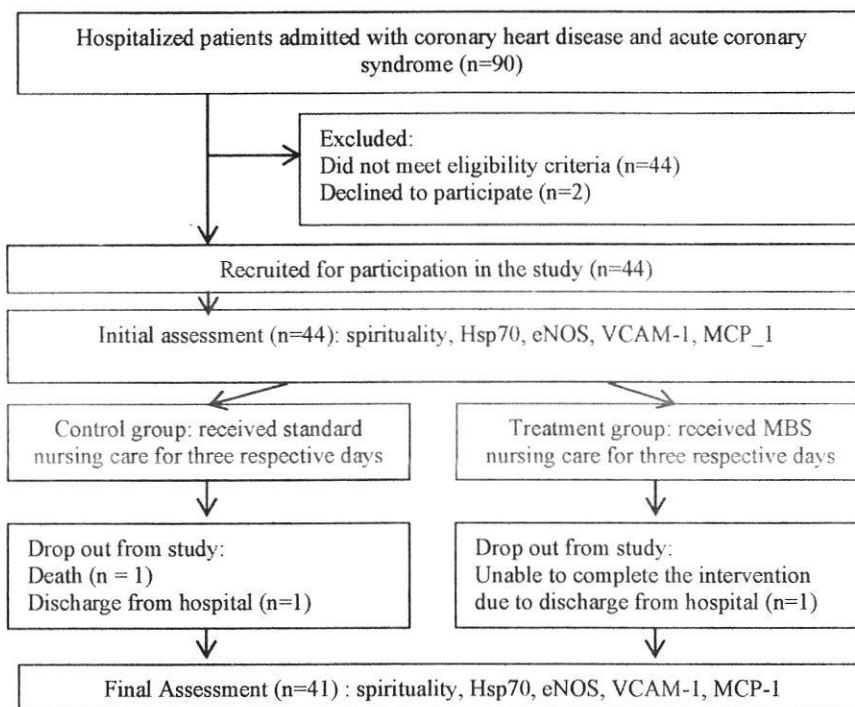


Figure 1- Study flow diagram

Intervention

The mind-body-spiritual nursing care was developed from previous studies and comprised both a qualitative and a cross-sectional study. The MBS nursing care is defined as a comprehensive nursing care undertaken by nurses with the emphasis on coping strategies, relaxation, and spiritual aspects carried out simultaneously for three consecutive days. The intervention involved coping strategies aimed at helping patients resolve the tension through problem solving skills, information seeking, planning, acting directly as planned, and asking for help if necessary. Breathing relaxation was conducted three times a day, 20 minutes each time, aimed at muscle and mind relaxation. Zikr (Islamic spiritual mantram) was also performed by repeating the words: Subhanallah, Alhamdulillah, Laa Illa ha ilallah, and Allahu Akbar, 33 times each time over three times a day. Furthermore, the intervention included listening to the recitation of the Holy Qur'an Al-Fatihah via MP3 twice a day in the morning and in the evening.

Outcome measures

Spirituality, Hsp70, eNOS, VCAM-1, and MCP-1 expressions were measured at baseline and at the fourth day, after intervention was given. Spirituality was measured using a questionnaire. The researchers developed the questionnaire on spirituality based on a previous qualitative study involving both nurses and CHD patients.

The study concluded that spirituality during illness comprised patience, did whatever it takes to recover, and offered whatever result to God's will.

The expressions of Hsp70, eNOS, VCAM-1, and MCP-1 were measured from respondents' serum using ELISA (enzyme-linked immunosorbent assay) technique. Serum was separated from the whole blood after the blood was drawn. Blood sampling was performed by experienced nurses through a 3ml cubital vein. It was then fed into the non-anti-coagulant vacutainer, and allowed to stand for 30 minutes at room temperature, then centrifuged at 3000rpm for 5 minutes; serum was taken and placed in the microtubes, then stored in a freezer with temperature of minus 20°C.

Statistical methods

The data were analyzed using Wilcoxon signed rank test to compare results at pre and post-test, while the Mann Whitney U Test was used to differentiate the two groups. To establish the relationships among variables, path analytical model was evaluated.

Ethical considerations

Some ethical considerations applied in this study include the principle of beneficence, the principle of justice and the principle of respect for human dignity. The study was approved by both a tertiary university hospital in Surabaya' Ethics Committee (No. 092 / KEH / 2017, dated February 8, 2017) and the Ethics Committee of a tertiary, government-owned, top referral hospital in Surabaya (No. 262 / Panke.KKE / IV / 2017, dated April 6, 2017).

III. RESULTS

The study was conducted in 2017 at three tertiary hospitals in Surabaya, Indonesia, involving 41 respondents. Twenty subjects were allocated to the control group, while the other 21 were in the intervention group.

Table 1 Baseline Characteristics of Respondents

Variables	Sub-Variables	Intervention group (n=21)		Control group (n=20)		p Kolmogorov-S
		n	%	n	%	
Sex	Man	15	71.43	14	70	1.000
	Woman	6	28.57	6	30	
Age	40-50	4	19.05	5	25	1.000
	51-60	6	28.57	4	20	
	61-70	11	52.38	11	55	
Ethnic	Javanese	17	80.95	17	85	1.000
	Madurese	1	4.76	2	10	
	Bataknese	0	0	1	5	
	Sundanese	1	4.76	0	0	
	Malay	2	9.52	0	0	
Occupation	Housewife/not working	2	9.52	3	15	0.951
	Labor, Retired, Farmer, Driver	3	14.29	4	20	
	Private employees	4	19.05	3	15	
	Entrepreneur	7	33.33	6	30	
	Government employees	5	23.81	4	20	
Diagnosis	Angina, UAP	2	9.52	2	10	1.000
	NSTEMI	4	19.05	3	15	
	STEMI	14	66.67	14	70	
	Ischemia	1	4.76	1	5	

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Variables	Sub-Variables	Intervention group (n=21)		Control group (n=20)		p Kolmogorov-S
		n	%	n	%	
Family support	Good	21	100	20	100	1.000
	Average	0	0	0	0	
	Poor	0	0	0	0	
Hospitalized Experience	1	14	66.67	14	70	1.000
	2	5	23.81	5	25	
	3	2	9.52	1	5	
Number of days of care	1	21	100	20	100	1.000
	2	0	0	0	0	
	3	0	0	0	0	
	4	0	0	0	0	
Formal education	None/Elementary-Junior high	8	38.10	8	40	1.000
	Senior high	9	42.86	7	35	
	Diploma	0	0	2	10	
	≥ S1	4	19.05	3	15	
Health insurance	Govt health insurance class III	8	38.10	2	10	0.394
	Govt health insurance class II	7	33.33	10	50	
	Govt health insurance class I	6	28.57	6	30	
	Private insurance	0	0	2	10	
Religious rituals	Rare	1	4.76	2	10	1.000
	Sometimes	9	42.86	7	35	
	Often	2	9.52	2	10	
	Always	9	42.86	9	45	

UAP: Unstable angina pectoris; NSTEMI: Non ST segment elevation myocardial infarction; STEMI: ST segment elevation myocardial infarction; Govt: Government of Indonesia

Table 1. presents the baseline characteristics of respondents. The Kolmogorov Smirnov test shows that all variables had $p > 0.05$, indicating there was no difference of respondent characteristics between control group and treatment group, thus it has no potential as to interfere with the measured variables.

Table 2 Spirituality and Cardiovascular Risk Markers at Pre and Post-test

Variables		Intervention Group (n=21)		Control Group (n=20)		p (Mann Whitney)
		$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	
Spirituality	Pre-test	17.70	± 6.06	18.00	± 3.74	0.937
	Post-test	26.38	± 0.74	18.00	± 6.36	
	Δ	8.38	± 3.54	0.35	± 1.04	
	p (Wilcoxon)	0.000		0.107		
Hsp70	Pre-test	13.80	16.522	8.89	7.33	0.230
	Post-test	15.68	21.03	8.94	7.84	
	Δ	-0.11	12.17	0.04	2.04	
	p (Wilcoxon)	0.487		0.737		
eNOS	Pre-test	50.56	30.30	44.21	16.49	0.412
	Post-test	49.24	32.84	44.09	17.79	
	Δ	-1.32	23.7	-0.11	6.28	
	p (Wilcoxon)	0.498		0.939		
VCAM-1	Pre-test	23.49	15.23	19.29	9.87	0.305
	Post-test	22.95	16.59	21.47	10.06	
	Δ	-0.54	14.95	2.17	5.74	
	p (Wilcoxon)	0.092		0.156		
MCP-1	Pre-test	3421.06	12592.38	531.778	274.83	0.312
	Post-test	591.56	502.31	565.25	219.42	
	Δ	-2829.5	12368.5	33.47	168.26	
	p (Wilcoxon)	0.000		0.575		

Table 2 shows no significant difference in spirituality, Hsp70, eNOS, VCAM-1 and MCP-1 expressions between the control group and the treatment group ($p > 0.05$) at pre-test. This indicates both groups have similar

characteristics at baseline. At post-test, there were differences in spirituality and MCP-1 expression in the treatment group ($p = 0.000$), but no differences in other variables (Hsp70, eNOS, and VCAM-1). It can also be seen that there is no difference in spirituality nor expression of Hsp70, eNOS, VCAM-1, and MCP-1 in the control group ($p > 0.05$). Measurements of pre and post-test results (Δ) found significant variables, such as spirituality ($p = 0.000$), VCAM-1 ($p = 0.028$), and MCP-1 ($p = 0.006$), but some other variables were not significant. This shows that mind-body spiritual care has an effect on spirituality, VCAM-1 expression, and MCP-1 expression.

Paired tests between pre-test and post-test results in the treatment group showed significant differences in spirituality and MCP-1 expression ($p = 0.000$), but not significant in Hsp70, eNOS, and VCAM-1 expression variables. In the control group, paired tests between pre-test and post-test showed no significant variables, either spirituality or Hsp70, eNOS, VCAM-1 and MCP-1 ($p > 0.05$). This suggests that mind-body-spiritual nursing care changed the spirituality and expression of MCP-1 of the respondents in the treatment group.

Figure 2 shows a path analysis using partial least square program. It can be seen that spirituality influences Hsp70 expression. Hsp70 further affects the expression of VCAM-1 and MCP-1.

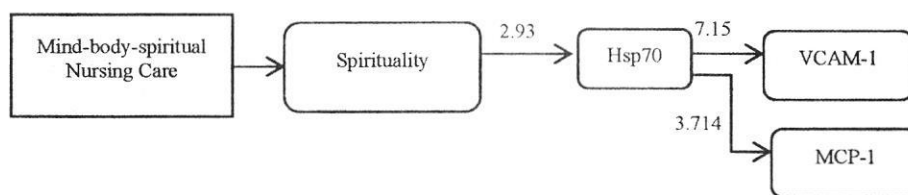


Figure 2 - The mechanism on how MBS nursing care influences spirituality, Hsp70 eNOS, VCAM-1, and MCP-1 Expressions

IV. DISCUSSION

The results show that mind-body-spiritual nursing care improves cardiovascular risk markers (VCAM-1 and MCP-1) through increasing spirituality, followed by Hsp70. The increment of the spirituality probably because the activity of zikr and listening to QS Al Fatihah in the mind-body-spiritual nursing care triggers the God Spot in the temporal lobes, resulting in prefrontal cortex activation, which then stimulates the process of cognition and coping, producing patience to deal with pain, never lose hope and always try to seek for treatment, and put all the results of the treatment in God's hand. These findings are consistent with the conceptual framework of the study that mind-body-spiritual nursing care, mainly the spiritual activity, stimulates both prefrontal cortex and temporal lobes, resulting in learning process and leads to spirituality enhancement.

This finding is also consistent with Bamby et al. that proved spiritual activity increases activity in the frontal and prefrontal lobes, improving frontal and prefrontal blood flow, cortex thickness, and communication between the prefrontal, frontal, and parietal lobes [10]. Prefrontal cortex activity can stimulate a cognitive response, which further contributes to learning and coping based on problem solving. Someone who uses problem-based coping will continue to try to recover by keeping seeking treatment, but at the same time realize that everything comes from God; therefore, he/she puts all the results in the God's will and be happy with whatever happens.

Moreover, the mind-body-spiritual nursing care influences the Hsp70 expression, shown by the path analysis diagram. This is possible because of the mind-body-spiritual components, i.e. deep breathing relaxation, activity of dzikr, and listening to the Qur'an recitation, perceived as stressors that trigger unfolding proteins and promote Hsp70 gene expression. This finding supports the finding of previous research which proves that spiritual stressors increase Hsp72 expression. In the previous study, 12 members of the dhikr group who were observed for three weeks experienced an increase in Hsp72 expression due to the activity of zikr they performed [11].

There was no difference in the expression of eNOS in the two groups, where there was a decrease in eNOS expression at post-test in both groups, i.e. -1.32 in the treatment group and -0.11 in the control group. There is no difference between the control group and the treatment in terms of the difference in the value of eNOS expression and the difference between before and after treatment. This suggests that mind-body-spiritual nursing care has no effect on eNOS expression in patients with coronary heart disease.

Hypothetically, the mind-body-spiritual nursing care should improve the expression of eNOS, but this study found otherwise: a decrease in the expression of eNOS in the group of people who received nursing care mind-body-spiritual. There are several possibilities that could explain the finding. Firstly, the intervention given was unable to trigger the parasympathetic nervous system. Previous Indian studies of healthy medical students have shown that slow breathing affects the activity of the parasympathetic system of heart rate response and ECG response of a standing position and a valsava maneuver [16]. Breath in relaxation tested to 16 students in Germany was also shown to decrease sympathetic activity as measured by skin conduction rates [17]. This possibility does not occur in this study, so there is no increase in eNOS expression. Unfortunately, in this research, sympathetic and parasympathetic activities are not measured, so it is difficult to know the mechanism of unchanged eNOS expression.

Secondly, the measurement of the eNOS expression was not performed immediately after intervention, but it took time at post-test, a day after the intervention finished. The sympathetic and parasympathetic autonomic nervous system responds shortly after stimulation is given, i.e. within seconds to minutes [18], thus the measurement of the intervention should be performed immediately after intervention.

Thirdly, there may be some confounding variables affecting eNOS expression that cannot be controlled, i.e. calcium levels, the real condition of the respondent's blood vessels, as well as calcium and calmodulin.

The study proved no statistical difference in terms of Hsp70 and eNOS between the treatment and the control group. This suggests that Hsp70 and eNOS, in addition to being influenced by mind-body-spiritual nursing care, are also influenced by other factors, which were not measured by this study, including calcium, calmodulin, physical, physiological, psychological and spiritual stressors that were fluctuated experienced by CHD patients during treatment.

This study also proved the hypothesis that the mind-body-spiritual nursing care influences expression of the inflammatory markers: MCP-1 and VCAM-1. Path analysis results showed that the cardiovascular risk inflammatory markers are influenced by HSp70 expression. These findings again agree with the conceptual framework that the mind-body-spiritual nursing care influenced the God Spot, resulting in learning and relaxation, hypothalamus and pituitary activation; HSF triggers Hsp70 expression.

This reinforces previous findings that spiritual activity has an effect on inflammatory markers. As studies by King, Manious, and Pearson [19], [20] show, there is a relationship between religious activity and inflammatory mediators. Individuals who do not engage in religious activity have increased inflammatory mediators i.e. c-reactive protein, fibrinogen, and white blood cell count [19], [20]. This study also corroborates a review by Lucchese and Koenig [21] which discusses the findings of several previous studies on the linkage between spiritual activity with decreased inflammatory mediators and cardiovascular health.

Spirituality leads to decreased expression of VCAM-1 and MCP-1, possibly through the HPA (hypothalamus-pituitary anterior) axes pathway. According to previous study, activation of the HPA axes resulted in an increase in Hsp70 expression, which further affected the expression of VCAM-1 and MCP-1. However, in this study, increased expression of Hsp70 and eNOS is not solely due to the intervention of the nursing care of MBS, but possibly by other factors that cannot be controlled.

The limitation of this research is not to control some variables that have potential to confound variable of Hsp70 and eNOS expression, so, in the research, it is known that the two variables change not because of intervention, but because of other cause. Variables that may affect eNOS expression but are not measured or controlled in this study are calmodulin, calcium, and Hsp90 expression.

Other variables that may affect the outcome, but are extremely difficult to control, are the stressors experienced by patients physically, psychologically, socially, and spiritually, which continue to fluctuate over time, which is very difficult to really control by the researcher, and may affect Hsp70 expression.

V. CONCLUSION

Mind-body-spiritual nursing care enhances spirituality, which includes patience, ikhtiyar and tawakkal. The mind-body-spiritual nursing care influences the expression of Hsp70 and eNOS, although no statistically significant differences in Hsp70 and eNOS expression were found between the control group and the treatment group. Moreover, the mind-body-spiritual nursing care influences the expression of inflammatory mediators VCAM-1 and MCP-1 through Hsp70 changes, hence, mind-body-spiritual nursing care has the potential for further prevention of atherosclerotic plaque formation.

Further research needs to be done by looking for some variables that affect eNOS and HSp70 that are not controlled in this study. Clinicians should be aware that hospital patients with acute coronary syndrome experience some issues, which influence the cardiovascular risk markers. Mind-body-spiritual nursing care can be given to the patients to help patients not only cope with the issues, but also improve the spirituality and cardiovascular risk markers.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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