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THE CORRELATION BETWEEN FATIGUE AND SLEEP QUALITY AMONG PATIENTS WITH HEART FAILURE

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ABSTRACT

Heart failure (HF) patients may experience fatigue and poor sleep quality due to impairment in cardiac structure or function. These distressing symptoms may create a vicious circle leading to poor outcomes but often undervalued and ignored among patients. This study aimed to investigate the relationship between fatigue and sleep quality among patients with HF in Indonesia. A cross-sectional, correlational study design was performed with 153 convenience samples recruited from a cardiology outpatient department at a medical center in Indonesia. Descriptive statistics, bivariate analyses (Independent T-tests, One-way Analysis of Variance/ANOVA, and Pearson correlation), and hierarchical regression analysis were utilized to analyze the data. Instruments included demographic characteristics and clinical variables questionnaire, the Multidimensional Assessment of Fatigue (MAF), and the Pittsburgh Sleep Quality Index (PSQI). The mean age of participants was 61.86±10.79 years old and the mean duration of HF diagnosis was 4.26±5.48 years. All participants complained of fatigue, while 73.2% had poor sleep quality. Participants who were poor sleepers had a higher proportion of individuals used massage, not having taken dyslipidemia drugs, had normotension or well-controlled blood pressure, and suffered from hypertensive heart disease (HHD) and renal diseases. All fatigue domains, except the degree of interference in ADL, was significantly associated with sleep quality. However, only the timing domain determined sleep quality, meaning, the longer the fatigue, the poorer the sleep quality. This study suggests future interventions should be directed to decrease the level of severity, distress reduction, and particularly shorten fatigue duration should be developed to improve the sleep quality.

Kata kunci:
kelelahan
gagal jantung
kualitas tidur

ABSTRAK

Penderita gagal jantung umumnya mengalami kelelahan dan kualitas tidur buruk yang disebabkan oleh gangguan struktur atau fungsi jantung. Gejala-gejala ini dapat menyebabkan prognosis yang buruk namun sering sekali kurang diperhitungkan dan diabaikan. Penelitian ini bertujuan untuk menginvestigasi hubungan antara kelelahan dan kualitas tidur pada pasien gagal jantung. Metode penelitian menggunakan deskriptif korelasi dengan pendekatan potong lintang. Sampel berjumlah 153 orang yang direkrut menggunakan teknik *convenience sampling* dari klinik jantung di departemen rawat jalan dari sebuah rumah sakit rujukan di Indonesia. Statistik deskriptif, analisis bivariat (*independent T-tests, one-way analysis of variance/ANOVA, Pearson correlation*), serta *hierarchical regression analysis* digunakan untuk menganalisa data. Instrumen yang digunakan yaitu kuesioner faktor demografi dan variabel klinis, *Multidimensional Assessment of Fatigue* (MAF), dan *Pittsburgh Sleep Quality Index* (PSQI). Hasil penelitian menunjukkan bahwa rata-rata usia partisipan 61.86 ± 10.79 tahun dan rata-rata lamanya menderita gagal jantung 4.26 ± 5.48. Semua partisipan mengalami kelelahan, sementara 73.2% memiliki kualitas tidur yang buruk. Partisipan yang berkualitas tidur buruk memiliki proporsi yang lebih tinggi pada individu yang menggunakan pijatan, tidak meminum obat dislipidemia, memiliki normotensi atau tekanan darah yang terkontrol dengan baik, dan menderita penyakit jantung hipertensi serta penyakit ginjal. Penelitian ini menemukan bahwa semua domain kelelahan, kecuali domain tingkat gangguan dalam aktivitas sehari-hari, secara signifikan berhubungan dengan kualitas tidur. Namun, hanya domain waktu yang menjadi determinan kualitas tidur, yang berarti semakin lama durasi kelelahan, semakin buruk kualitas tidur individu. Disarankan perlu dikembangkannya intervensi untuk mengurangi tingkat keparahan, mengurangi tekanan, dan terutama upaya untuk memperpendek durasi kelelahan guna meningkatkan kualitas tidur.

BACKGROUND

Patients with HF experience many complaints and burdens. Some symptoms are suffered as the compensation of disrupted heart function. Along with dyspnea, fatigue is one of the two cardinal symptoms of HF (Yancy et al., 2013). Investigating and treating fatigue is useful since proper management may ameliorate with other predictive factors of outcome in HF (Wu et al., 2012).

Fatigue is often being undervalued and not reported during the assessment (Stephen, 2008, Jones et al., 2012). Both newly diagnosed and experienced patients with HF sometimes struggled with recognizing fatigue as their symptom and considered it as unimportant symptom and the situation worsen if elderly patients described fatigue as a natural outcome of the aging process without thinking of the relation to heart function (Yu et al., 2010).

Separate from the general symptoms, poor sleep quality is highly prevalent among HF patients, ranging from 70%-90% (Chen et al., 2010, Moradi et al., 2014, Nasir et al., 2015, Wang et al., 2010). Poor sleep quality also has been associated with poor outcomes such as depression (Nasir et al., 2015), and reduced cognitive function (attention and executive) (Garcia et al., 2012), and as a predictor of patient's quality of life (Chen et al., 2010, Gau et al., 2011) making the finding of contributing factors to sleep quality beneficial to prevent the worsening conditions of patients.

Fatigue and sleep quality seems may create a vicious circle in HF and can adversely affect the outcome, therefore, continuous assessment of sleep should be a part of the clinical routine in the management of HF patients (Johansson et al., 2015) and should not be undervalued (Gau et al., 2011). Identification of sleep quality, however, tend to be ignored (Nasir et al., 2015). It may be caused by the traditional notion of prioritizing treatment of the associated medical condition (Liu et al., 2011).

Some studies have explored factors related to sleep quality in HF population. However, the varied findings have been found across different countries and cultures. In Indonesia, people believe and use massage as common and first choice treatment to overcome health problems because it is considered cheap and can be applied by their relatives. Thus, examining the relationship of this traditional practice and sleep quality in HF is interesting. To date, there is limited information related to fatigue and sleep quality among patients with HF in Indonesia. Therefore, it is necessary to investigate fatigue and other specific factors in sleep quality among Indonesian patients with HF to reveal potential contributing factors and design specific intervention to improve sleep quality.

METHODS

An observational analytic with cross-sectional approach was used as the study design. The participants were recruited using convenience sampling technique from a cardiology outpatient department of a Cardiovascular and Brain Center at a medical center located in North Sulawesi, Indonesia. Data were collected from November 2016 to April 2017. Criteria of the participants included in this study were patients with HF as diagnosed by physicians, adults (aged >= 18 years old), and can communicate effectively in Bahasa Indonesia. Patients with a psychiatric disorder were excluded from this study. The sample size was computed using the software G*Power version 3.1.9.2. Applying regression analysis based on Faul et al. (2009) with an effect size 0.15, a power of 0.8 at a significant alpha level of 0.05, and 15 predictors, a sample size of 139 was determined. There was 10% of additional samples to anticipate the probability of risk missing data (Roberts et al., 2017, Yeatts and Martin, 2015). Thus, the total sample was 153.

Demographic characteristics and clinical variables were collected using a self-developed form. Demographic characteristics data included age, gender, educational level, marital status, religion, smoking, body mass index (BMI), drink, exercise, and the use of massage. Self-reported clinical variables included prescription of cardiovascular medications, duration of HF diagnosis, New York Heart Association (NYHA) functional class, and comorbidity. Fatigue was measured by the Multidimensional Assesment of Fatigue (MAF) (Belza et al., 1993). The Cronbach's alpha for this scale in HF population is 0.93 (Redeker et al., 2010b, Nasiri et al., 2016), in the current study alpha was 0.76. PSQI was used to measure sleep quality. A global sleep score greater than 5 yielded a sensitivity of 89.6% and a specificity of 86.5% as a cutoff point for determining poor sleep quality (Buysse et al., 1989). The Cronbach alpha ranges from 0.78-0.84 (Moradi et al., 2014, Mills et al., 2015). The Cronbach's alpha for this current study was 0.76.

The descriptive statistics employed included means, standard deviations, frequency, percentage, and range. Bivariate analyses were used to identify the relationships between variables (demographic characteristics, clinical variables, fatigue, and sleep quality). Hierarchical multiple regression analysis with enter method was assigned to test the variance of sleep quality explained by fatigue after controlling for demographic and clinical variables. An alpha level at 0.05 was considered statistically significant. The data were analyzed using IBM SPSS version 23 for Windows (IBM Corp, Indonesia).

This study was approved by the hospital and university Institutional Review Boards (Muhammadiyah University of Yogyakarta) No: 005/EP-FKIK-UMY/X/2016. Eligible patients were referred from the physicians during an outpatient clinic visit. If willing to join, patients were contacted by researcher or research assistants individually. Patients were asked to sign a written informed consent form before completing the questionnaires.

RESULTS

Characteristics of the Participants

The demographic characteristics and clinical variables of the participants is shown in Table 1. The mean age of the sample was 61.86 (SD = 10.79), ranging from 29 - 87 years. The participants had a mean BMI of 25.56 kg/m2 (SD = 4.92), ranging from 13 kg/m2 to 47 kg/m2. The majority of participants were male (66%) and graduated from high school (55.6%). One hundred and twenty-nine participants (84.3%) had a spouse, and 24 (15.7%) did not have a spouse. All participants had a religion with more than three-quarters being Christians (75.2%). Twenty-five participants (16.3%) reported that they were smokers, 78 participants were nonsmokers (51%), and 50 participants had quit smoking (32.7%). Tea was the most favorite type of drink among participants (69.9%) with approximately 7.35 cups/week (SD = 4.99). There were 36.6% participants reporting they did regular exercise. Lastly, only 13.7% participants used massage, and the traditional massage was the highest chosen type (85.71%).

The results showed the mean number of prescribed CV medications used was 4.27 (SD = 1.81), ranging from one to seven medications. There were 32.7% participants taking four CV medications daily, whereas those taking five prescriptions were 28.8%. Twenty-four participants (15.7%) used three medications and 14.4% received six types of drug. Only 6.5% participants took two medications, while those taking one and seven prescriptions per day represented 1.3% and 0.7%, respectively. From several classes of cardiovascular drugs, antiplatelet was the highest medication used (78.4%). Specifically, a typical medication in the treatment of HF in this study was beta-blockers with 111 participants (72.5%). The majority (90.2%) was in NYHA Class II, whereas 5.2% and 4.6% were in NYHA Class I and III, respectively. The mean duration of HF diagnosis was 4.26 years (SD = 5.48), ranging from 0-24 years. The mean number comorbidity was 2.40 (SD = 0.99), ranging from one to six diseases.

Fatigue

The score of global fatigue index (GFI) as the total score of MAF questionnaire was achieved by summing all the four domains (with a possible range of 1 - 50). Three fatigue domains includes are (severity, distress, and degree of interference in ADL) have scale range of 1 up to 10, while timing domain only has a possible range of 1 up to 4. The GFI score in the present study ranged from 10up to 44 with a mean of 22.99 (SD = 6.78). Severity domain had a mean of 4.77 (SD = 1.61), whereas distress domain received a mean of 4.31 (SD = 1.59). The mean of the degree of interference in ADL domain was 2.16 (SD = 0.94), and timing domain reached a mean of 2.88 (SD = 0.68). Data for the MAF are provided in Table 2.

Table 1. Demographic Characteristics and Clinical Variables (n=153)

Variables	Categories		n (%)	Mean	SD	Range
Age				61.86	10.79	29-87
BMI				25.56	4.92	13-47
Gender	Male		101 (66)			
	Female		52 (34)			
Educational level	Elementary		30 (19.6)			
	High school		85 (55.6)			
	College		38 (24.8)			
Marital status	Not having a spouse		24 (15.7)			
	Having a spouse		129 (84.3)			
Religion	Christian		115 (75.2)			
	Catholic		11 (7.2)			
	Muslim		26 (16.9)			
	Hindu		1 (0.7)			
Smoking	Yes		25 (16.3)			
	No		78 (51)			
	Quit		50 (32.7)			
Type of drink	Tea	Yes	107 (69.9)			
		No	46 (30.1)			
	Coffee	Yes	48 (31.4)			
		No	105 (68.6)			
	Alcohol	Yes	9 (5.9)			
		No	144 (94.1)			
Exercise	Yes		56 (36.6)			
	No		97 (63.4)			
Use of massage	No		132 (86.3)			
	Yes		21 (13.7)			
	Professional massage		3 (14.3)			
	Traditional massage		18 (85.7)			
Duration of HF				4.26	5.48	0-24
Number of Comorbidities				2.40	0.99	1-6
Prescribed CV medications				4.27	1.81	1-7
	Antiplatelet		120 (78.4)			
	Beta-blockers		111 (72.5)			
	Antianginals		110 (71.9)			
	Dyslipidemia drugs		96 (62.7)			
	Diuretics		84 (54.9)			
	ARBs		74 (48.4)			
	ACE inhibitors		58 (37.9)			
NYHA class	I		8 (5.2)			
	II		138 (90.2)			
	III		7 (4.6)			

Note: BMI=Body Mass Index; HF=Heart Failure; ARB=Angiotensin II Receptor Blockers; ACE=Angiotensin-Converting Enzyme; NYHA=New York Heart Association

Sleep Quality

Every component of the PSQI was weighted equally, with a possible scale range of 0-3. The score of seven components were accumulated to get a global sleep score ranging from 0 to 21. The global PSQI score of the 153 participants in the current study ranged between 2-19 with a mean of 8.54 (SD = 4.00). There were 112 (73.2%) participants had poor sleep quality and 41 (26.8%) participants had good sleep quality. Sleep latency had the highest score with a mean of 1.84 (SD = 1.16), and use of sleeping medication was the lowest (mean 0.2, SD = 0.62).

Table 2. MAF and Domain Scores (n=153)

Variables	Mean ± SD	Range
GFI	22.99 ± 6.78	10-44
Severity	4.77 ± 1.61	2-10
Distress	4.31 ± 1.59	1-9
Degree of interference in ADL	2.16 ± 0.94	0-7
Timing	2.88 ± 0.68	1-4

Note: GFI=Global Fatigue Index; ADL=Activity Daily Living

Table 3. Global PSQI and Components Scores (n=153)

Variables	Mean ± SD	Range
Global PSQI	8.54 ± 4.00	2-19
Sleep latency	1.84 ± 1.16	0-3
Sleep disturbances	1.79 ± 0.51	1-3
Daytime dysfunction	1.33 ± 0.62	0-3
Subjective sleep quality	1.31 ± 7.90	0-3
Sleep duration	1.20 ± 1.04	0-3
Habitual sleep efficiency	0.86 ± 1.14	0-3
Use of sleeping medications	0.20 ± 0.62	0-3

Note: PSQI=Pittsburgh Sleep Quality Index

Table 4. The Association between Categorical Data of Demographic Characteristics and Sleep Quality (n=153)

Variables	Categories	n	Mean	SD	*p*-value
Gender	Male	101	8.44	3.89	0.667
	Female	52	8.73	4.23	
Educational level	Elementary	30	9.40	4.16	0.380
	High School	85	8.44	4.01	
	College	38	8.07	3.85	
Marital status	Not having spouse	24	9.75	4.41	0.106
	Having spouse	129	8.31	3.89	
Religion	Christian	115	8.62	3.95	0.219
	Catholic	11	6.64	2.66	
	Moslem	26	9.15	4.51	
	Hindu	1	4.00	-	
Smoking	Yes	25	7.76	4.38	0.450
	No	78	8.89	4.04	
	Quit smoking	50	8.38	3.76	
Drink tea	Yes	107	8.18	3.74	0.117
	No	46	9.37	4.47	
Drink coffee	Yes	48	7.77	4.01	0.110
	No	105	8.88	3.96	
Drink alcohol	Yes	9	7.89	5.01	0.619
	No	144	8.58	3.95	
Exercise	Yes	56	8.04	4.07	0.241
	No	97	8.83	4.07	
Use of massage	Yes	21	10.62	4.84	0.039*
	No	132	8.21	3.77	

Note: *p<.05, **p<.01.
p-values were calculated using Independent T-test (2 categories) and One-Way ANOVA (>2 categories), as appropriate

Table 5. The Association between Categorical Data of Clinical Variables and Sleep Quality (n=153)

Variables	Categories	n	Mean	SD	*p*-value
ACE inhibitors	Yes	58	8.60	4.12	0.871
	No	95	8.49	3.95	
Beta-blockers	Yes	111	8.18	3.86	0.074
	No	42	9.48	4.23	
ARBs	Yes	74	8.62	3.81	0.799
	No	79	8.46	4.19	
Diuretics	Yes	84	8.73	4.19	0.518
	No	69	8.30	3.76	
Antianginals	Yes	110	8.25	3.81	0.151
	No	43	9.28	4.42	
Antiplatelet	Yes	120	8.53	4.09	0.988
	No	33	8.55	3.67	
Dyslipidemia drugs	Yes	96	7.97	3.92	0.026*
	No	57	9.47	3.99	
NYHA Class	I	8	8.13	3.39	0.144
	II	138	8.41	4.04	
	III	7	11.43	2.94	
Cardiovascular Problems					
CAD/ACS	Yes	66	7.85	4.05	0.064
	No	87	9.06	3.90	
Hypertension	Yes	50	7.46	3.65	0.020*
	No	103	9.05	4.08	
Atrial arrhythmia	Yes	46	9.33	4.32	0.109
	No	107	8.19	3.83	
HHD	Yes	28	10.79	4.17	0.003**
	No	125	8.03	3.79	
Non-Cardiovascular Problems					
Type II diabetes	Yes	35	8.06	3.51	0.422
	No	118	8.68	4.14	
Renal diseases	Yes	25	10.64	4.08	0.004**
	No	128	8.12	3.87	
Chronic pulmonary diseases	Yes	16	9.19	4.42	0.493
	No	137	8.46	3.96	
Gastrointestinal diseases	Yes	15	8.34	3.91	0.067
	No	138	8.34	3.91	
Neurological diseases	Yes	9	7.00	2.73	0.236
	No	144	8.63	4.05	
Musculoskeletal diseases	Yes	9	7.77	3.46	0.560
	No	144	8.58	4.04	

Note: *p<.05, **p<.01, ARB=Angiotensin II Receptor Blockers; ACE=Angiotensin-Converting Enzyme; NYHA=New York Heart Association; CAD=Coronary Artery Disease; ACS=Acute Coronary Syndrome; HHD=Hypertensive Heart Disease.
p-values were calculated using Independent T-test (2 categories) and One-Way ANOVA (>2 categories), as appropriate

The components and the global score of PSQI participants are available in Table 3.

The Association between Demographic Characteristics, Clinical Variables, Fatigue, and Sleep Quality

The bivariate analysis showed that only the use of massage ($t = -2.18$, $p<0.05$) and dyslipidemia drugs ($t = 2.27$, $p<0.05$) were significantly associated with sleep quality. Among cardiovascular prob-

Table 6. The Association between Continuous Data of Demographic Characteristics, Clinical Variables, Fatigue, and Sleep Quality (n=153)

Characteristics	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Age	1																	
2. BMI	-0.07	1																
3. Duration of HF diagnosis	0.06	0.03	1															
4. Number of prescribed CV medications	0.14	0.08	0.09	1														
5. Number of comorbidities	0.16	0.18*	0.15	0.03	1													
6. Global Fatigue Index	-0.07	0.02	0.09	0.05	0.08	1												
7. MAF-Severity	-0.06	-0.01	0.08	0.01	0.06	0.94**	1											
8. MAF-Distress	-0.03	0.08	0.11	0.05	0.07	0.85**	0.77**	1										
9. MAF-Degree of interference in ADL	-0.06	0.09	0.06	-0.16	0.17*	0.40**	0.40**	0.15	1									
10. MAF-Timing	-0.18*	0.04	0.09	-0.02	0.05	0.74**	0.64**	0.61**	0.29**	1								
11. Global PSQI	-0.004	-0.02	0.11	-0.14	0.13	0.39**	0.35**	0.37**	0.12	0.39**	1							
12. PSQI-Subjective sleep quality	-0.06	-0.05	0.12	-0.05	0.08	0.34**	0.27**	0.34**	0.07	0.38**	0.81**	1						
13. PSQI-Sleep latency	-0.12	-0.001	0.11	-0.22**	0.12	0.27**	0.24**	0.23**	0.07	0.32**	0.74**	0.52**	1					
14. PSQI-Sleep duration	0.06	-0.05	0.09	-0.08	0.10	0.15	0.16	0.17*	0.01	0.18*	0.79**	0.62**	0.42**	1				
15. PSQI-Habitual sleep efficiency	-0.01	-0.003	0.05	-0.09	0.09	0.24**	0.24*	0.19*	0.05	0.23**	0.81**	0.58**	0.53**	0.68**	1			

Note: *p<.05; **p<.v01 level (2-tailed); CV=Cardiovascular; PSQI=Pittsburgh Sleep Quality Index; ADL=Activity Daily Living. p-values were calculated using Pearson Correlation

Table 7. Hierarchical Multiple Regression Model of Determinants on Sleep Quality (n=153)

Variables	B	SE	ß	F	t	R^2	Adjusted R^2	R^2 Change
(Constant)	8.20	0.34		6.86*		0.043	0.037	0.043*
Use of massage	2.42	0.92	0.21		2.62*			
(Constant)	8.55	0.58		6.58***		0.183	0.155	0.139***
Use of Massage	1.98	0.87	0.17		2.28*			
Dyslipidemia drugs	-1.19	0.62	-0.14		-1.91			
Hypertension	-0.86	0.66	-0.10		-1.31			
HHD	2.06	0.79	0.20		2.59*			
Renal diseases	2.25	0.81	0.21		2.78**			
(Constant)	3.09	1.39		7.29***		0.288	0.249	0.105***
Use of Massage	1.19	0.84	0.10		1.41			
Dyslipidemia drugs	-1.07	0.60	-0.13		-1.78			
Hypertension	-0.49	0.63	-0.06		-0.79			
HHD	1.82	0.76	0.18		2.41*			
Renal diseases	1.94	0.77	0.18		2.51*			
Severity	0.21	0.29	0.08		0.72			
Distress	0.25	0.29	0.10		0.86			
Timing	1.17	0.57	0.19		2.06*			

Note: Analyzed by enter method; *p<0.05 level; **p<0.01 level; ***p<0.001 level (2-tailed); HHD=Hypertensive Heart Disease lems, only hypertension ($t = 2.35$, $p<.05$), and hypertensive heart diseases (HHD) ($t = -3.21$, $p<0.01$) had a highly significant association with sleep quality. Regarding comorbidity non-cardiovascular problems, the result revealed that only renal diseases ($t = -2.95$, $p<0.01$) was significantly associated with sleep quality (Table 4 & 5).

Table 6 presents the association between continuous data of demographic characteristics, clinical variables, fatigue, and sleep quality. These associations were presented with Pearson's correlation coefficient. None of the continuous data of demographic characteristics and clinical variables were associated with sleep quality and only duration of HF diagnosis along with number of comorbidities showed positive associations.

Regarding the association between fatigue and sleep quality, the strongest association was found between global PSQI score with Global Fatigue Index (GFI) and timing domain (both $r = 0.39$, $p<0.01$). Conversely, the weakest association was between the global PSQI and domain of degree interference in ADL ($r = 0.12$, $p>0.05$). Subjective sleep quality had associations with the GFI score ($r = 0.34$, $p<0.01$), severity ($r = 0.27$, $p<0.01$), distress ($r = 0.34$, $p<0.01$), and timing domain as the highest associated domain ($r = 0.38$, $p<0.01$). Among all domains of MAF, only degree of interference in ADL ($r = 0.07$, $p>0.05$) did not have association with subjective sleep quality.

Sleep latency was associated with GFI ($r = 0.27$, $p<0.01$) along with 3 domains of MAF: severity ($r = 0.24$, $p<0.01$), distress ($r = 0.23$, $p<0.01$), and timing ($r = 0.38$, $p<0.01$) as the strongest associated domain. The same as subjective sleep quality, only domain of degree of interference in ADL ($r = 0.07$, $p>0.05$) had no association with sleep latency. Sleep duration only had a low positively association with 2 domains of MAF: distress ($r = 0.17$, $p<0.05$) and timing ($r = 0.18$, $p<0.05$). This component was not associated with the GFI score ($r = 0.15$, $p>0.05$) and another 2 domains of MAF: severity ($r = 0.16$, $p>0.05$) and degree of interference in ADL ($r = 0.01$, $p>0.05$). Habitual sleep efficiency did not have an association with domain of degree of interference in ADL ($r = 0.05$, $p>0.05$). GFI score, severity, and timing were found as the highest associated domains with habitual sleep efficiency, all with the same strength and significance ($r = 0.24$, $p<0.01$). The association of habitual sleep efficiency and domain of distress also was found, even though it was relatively lower than the other domains ($r = 0.19$, $p<0.05$).

Sleep disturbances showed significant associations with all domains of MAF and GFI score. The strongest association was found with GFI ($r = 0.37$, $p<0.01$). Severity was the second highest associated domain with sleep disturbances ($r = 0.34$, $p<0.01$), then timing ($r = 0.31$, $p<0.01$), and distress ($r = 0.29$, $p<0.05$). The lowest association was found with domain of degree of interference in ADL ($r = 0.21$, $p<0.01$).

The use of sleeping medications was not associated with domain of severity ($r = 0.13$, $p>0.05$) and degree in ADL ($r = 0.03$, $p>0.05$). However, it had association with GFI score ($r = 0.19$, $p<0.05$), timing ($r = 0.17$, $p<0.01$), and distress ($r = 0.27$, $p<0.05$. The last component, daytime dysfunction was associated with all domains of MAF. Daytime dysfunction had the strongest association with GFI scores ($r = 0.44$, $p<0.01$). Consistently, degree of interference in ADL had the lowest associated domain with daytime dysfunction ($r = 0.20$, $p<0.05$) among the MAF domains.

Overall, three domains of the MAF were correlated with global PSQI score, consisting of severity, distress, and timing. Pearson correlation coefficients ranged from 0.35 (severity) to 0.39 (timing). According to the results of the MAF and the PSQI, participants who suffered more severe fatigue, had higher distress, and more often fatigued reported poorer sleep quality.

Determinants of Sleep Quality

As bivariate analysis in this study has shown, the use of massage, dyslipidemia drugs, hypertension, HHD, renal diseases, three domains of MAF (severity, distress, and timing) were associated with sleep quality. Then a hierarchical multiple regression with the enter method analysis was performed with these eight variables to identify the significant determinants of sleep quality. All significant variables entered into the regression model were based on the conceptual model. The use of massage was the first variable to enter the first model as a determinant. The finding revealed the use of massage ($ß = 0.21$) accounted for 4.3% of the variance in sleep quality ($p<0.05$) with an adjusted R-square of 3.7% for the model. Participants who used massage had a better sleep quality.

Dyslipidemia drugs, hypertension, HHD, and renal diseases were entered as the second step. These variables accounted for an additional 13.9% of the variance in sleep quality ($p<0.001$). HHD ($ß = 0.20$) and renal diseases ($ß = 0.21$) were the significant determinants of sleep quality among these five variables. Participants who had HHD and renal diseases had poor sleep quality.

When the three domains of MAF (severity, distress, and timing) were added to generate model 3, they accounted for an additional 10.5% of the variance in sleep quality (p<.001). Only timing domain (ß = 0.19) was a significant determinant of sleep quality. Participants who had experienced fatigue more often reported better sleep quality.

In general, the total variance explained by the final model was 24.9%. After controlling for the use of massage, dyslipidemia drugs, hypertension, HHD, and renal diseases, the analysis revealed that fatigue severity, distress, and timing domain accounted for 10.5% of the variance in sleep quality. Table 7 provides the summary for the hierarchical multiple regression of determinant variables on sleep quality.

DISCUSSION

The age in this study participants tended to be younger than two recent studies in different countries with the average age of 66.2 years old (Freedland et al., 2016) and 68.68 (Gathright et al., 2016). In Indonesia, some of the major risk factors for CVD such as diabetes and hypertension have attacked the young population beginning to increase at age 45 (Novartis, 2012).

Most participants were male (66%), similar to studies of patients with HF living in northern Sulawesi, Indonesia (Rampengan et al., 2017, Rampengan et al., 2015). The risk and incidence of hypertension and CVD are lower in premenopausal women because the role of sexual hormones acting as cardioprotective, but this benefit slowly fades after menopause (Yang and Reckelhoff, 2011).

A large proportion of HF populations in this study were Christian (75.2%) due to the area of study in the eastern part of Indonesia, when in fact, Indonesia is the most populous Muslim majority country in the world (Hefner, 2016). This study may reflect the condition of patients with HF among Christian population, since most studies in Indonesia were conducted with mostly Muslim participants.

Only 36.6% participants regularly exercised every week. The study by Ferreira et al. (2015), also showed a low percentage of participation in exercise among patients with HF (12.88%). Increasing physical activity is a suggested lifestyle intervention for patients, especially those with stable HF (Wexler et al., 2009). There is a need to increase the adherence of exercise, which cannot be done by education solely, but also intervening through cognitive behavioral therapy and strategies (De Maeyer et al., 2013).

Massage, as one of the traditional practice, was found relatively low in this study. Approximately, below one-third of participants took it as an alternative and complementary therapy. However, some studies mentioned that massage, particularly in the back, was found to significantly reduce systolic BP, especially in the male patients, increase pulmonary function, stimulate circulation (Chen et al., 2013b), improve anxiety (Ramezanli et al., 2016), and to stabilize vital signs (Jamali et al., 2016).

The mean number of CV medications used in this study was slightly higher than the Chen et al. (2009) study, with antiplatelets appeared as the most used CV medication (78.4%). A study by Altay et al. (2012) also found antiplatelets as the highest medication used among patients, where the majority of HF was caused by Ischemic heart disease. The study suggests that a high use of antiplatelet might be due to the etiology, developmental of HF, and comorbidities (DeJongh et al., 2015).

In this study, most of the participants were in NYHA class II (90.2%). Friedmann et al. (2014) found that majority of participants in NYHA class II (70.3%) visited the HF outpatient department. Patients in advanced NYHA class were not a regular visitor in OPD, possibly caused by their limitation of physical activity and higher mortality rate (Mirra et al., 2015).

The average duration of HF was 4.26 years, ranging from 0-24 years. Most participants could not state the exact month they were diagnosed with HF, only the year. Several participants said that they did not fully understand and pay attention to this diagnosis due to the limited information delivered by their physician and the inability to comprehend the complex medical explanation. The length of their HF diagnosis, therefore, might not be accurate and tend to be longer than reported. The duration of HF diagnosis in this current study was less than in Maeda et al. (2013) study (65.47 months, approximately 5.45 years) but similar to the Javadi et al. (2015) study (55.37 months, about 4.61 years).

The study showed the mean score for the number of comorbidities was 2.4, ranging from 1-6 diseases. It was lower than in the Chen et al. (2010) study, with a mean of 4.88 comorbidity conditions. Comorbidity of HF was divided into CV and non-CV problems. The mean of comorbidity CV was 1.5, ranging from zero to four diseases. CAD/ACS problems were the most prevalent underlying CV problem among participants (43.1%). This finding was similar to study Falk et al. (2009) where participants having CAD as the highest comorbidity (67%). In contrast, many studies showed that hypertension was the main comorbidity of patients with HF (Lum et al., 2016, Ramos et al., 2016, Reeves et al., 2015, Parisot et al., 2015). The high proportion of CAD may explain why the antiplatelets appeared as the most common medication used in this current study.

The mean of comorbidity non-CV problems was 0.9, ranging from 0-3 problems. Diabetes was the most frequent of the non-CV problem, affecting almost one-third of the participants in this study. Some studies also showed diabetes was the highest non-CV problem in the USA, Sweden, and South Korea (Lum et al., 2016, Song et al., 2015, Nahlén Bose et al., 2016). On the contrary, studies in some European countries found that renal diseases were higher than diabetes in their study among non-CV problems of patients (Mommersteeg et al., 2016, van Deursen et al., 2014, Faller et al., 2015).

All participants in the current study had fatigue. Some studies showed that fatigue was prevalent among patients with HF, ranging from 45.8 to 100% (Austin et al., 2011, Perez-Moreno et al., 2014, Nasiri et al., 2016, Tang et al., 2010). The participants in this study seemed to have a lower mean global fatigue index/GFI (22.99), ranging from 10 - 44 on the MAF than several studies in USA (29.8 to 35.08) (Jeon and Redeker, 2016, Redeker et al., 2010b, Redeker et al., 2012, Fritschi and Redeker, 2015). Findings from another study by Nasiri et al. (2016) revealed a lower score of GFI among patients with HF in Iran (5.92). This study also had different scores on the domains. In the study, the participants received a greater mean of severity (4.77 vs. 1.52) and distress (4.31 vs. 1.73), but lower in degree of interference in ADL (2.16 vs. 2.58) and timing (2.88 vs. 5.92) than those in the Nasiri et al. (2016) study.

Majority of participants were poor sleepers in this study. The mean global PSQI score (8.54) was lower than scores for 278 patients with HF in the clinic (9.23) (Balcha and Nemera, 2015) and 240 hospitalized patients with HF (11.61) (Javadi et al., 2015). However, the mean global PSQI score was similar with 173 patients who were recruited from five HF disease management programs in the Northeastern United States (8.7) (Jeon and Redeker, 2016) and 133 patients with HF from cardiovascular outpatient in Southern Taiwan (8.55) (Chen et al., 2013a). Religion was found not associated with global PSQI score among participants. A study by Wang et al. (2010) also showed a similar result. Another study found that among poor and good sleepers group, participants who had religion had bigger proportion than their non-religion counterparts (Liu et al., 2011), whereas in Chang et al. (2016) study, there were no significant differences found regarding religion in sleep quality among participants who did not have religion vs. Taoism/Buddhism/ Christianity group. In religion, hope is one of the important aspects. People who are hopeful feel that everything will be good and think that their condition will improve, resulting in less likely to be afraid. Krause and Ironson (2017) suggested that those who have fewer feeling of fear tend to get a better sleep quality. However, not all of religious people will have good religious coping practices, especially when they are suffering from diseases.

Massage played an important role in sleep quality, accounted for 4.3% of the variance in the global PSQI score. Some previous studies stated that massage as a complementary therapy might help patients to stabilize their vitals signs (Jamali et al., 2016), reduce anxiety and increase comfort (Chen et al., 2013b), and promote sleep (Evangelista et al., 2008).

Hypertension, HHD, and renal diseases were related to sleep quality in the current study. However, hypertension was not a determinant of global sleep quality when other variables including HHD and renal diseases were entered into the regression model, indicating that these two comorbidities (HHD and renal diseases) might take a role in diminishing the effects of hypertension on sleep. These findings supported that there is a benefit to treat associated comorbidity while taking care of patients with HF.

In this study, the more fatigue is perceived, the poorer the sleep quality experienced by participants, similar to the finding from the previous study by Nasiri et al. (2016). Some studies also confirmed the associations of fatigue and global PSQI score using different kind of fatigue measurements (Dos Santos et al., 2011, Fink et al., 2012, Riegel, 2012).

This study showed that the higher the daytime dysfunction, the more severity, distress, interference in ADL, and longer fatigue participants had. Riegel (2012) found that patients with HF with worse daytime dysfunction are more likely to have fatigue. The findings suggest that daytime dysfunction may result in altered daily activities and recreational life. Understanding daytime dysfunction is required to guide the treatment of sleep problems in patients with HF (Redeker et al., 2010a). Participants who had longer sleep latency and poorer habitual sleep efficiency also had more severity, distress, and frequent fatigue. Habitual sleep efficiency is a critical component and needs to improve due to a possibility of affecting other symptoms and lead to impaired health outcomes of patients with HF. However, the lack of information about sleep latency and fatigue may suggest that sleep latency is a component that has been less considered in HF care.

Participants who used more sleeping medications experienced more distress and frequent fatigue. The results imply that the participants did not get adequate or proper therapy for their sleep problem. Not all patients may need sleeping medication, thus complementary therapies should be suggested, such as massage (Chen et al., 2013b, Nerbass et al., 2010) and aromatherapy (Cho et al., 2013, Hajibagheri et al., 2014). On the other hand, the longer sleep duration achieved, the greater distress and the longer fatigue participants suffered. The findings suggest that longer sleep duration might contribute to increase stress condition and the length of fatigue among patients with HF.

Some studies mentioned that worsening condition of HF such as fatigue, increased with the prevalence of sleep problems (Chen et al., 2010). However, sleep problems could establish a cycle that increases the severity of disease, for instances, patients with fatigue might need more daytime sleep and longer nocturnal sleep to restore energy and vice versa. Not to mention, the use of certain medications can also contribute to complaints of unpleasant responses including fatigue that deplete physical energy and force patients to spend more time in bed (Chen et al., 2013a). Fatigue can also increase the need of nap taking, which can reduce the possibility of having a good night sleep quality (Chen et al., 2010).

Study findings showed that the worse sleep quality, the more severity and distress fatigue participants experienced (see Table 6). This result was supported by a study by Momayyezi et al. (2015). Research regarding relevant information about the association between another fatigue domains and sleep quality in HF is limited. However, severity and distress were not determinants of global PSQI score when other variables including distress and timing domains were entered into the regression model.

After controlling for the use of massage, dyslipidemia drugs, hypertension, HHD, and renal diseases, the three domains of fatigue, severity, distress, and timing, accounted for 10.5% of the variance in sleep quality. However, only fatigue-timing domain was the determinant of sleep quality. In the final regression model, HHD, renal diseases, and timing were found as the significant determinants of sleep quality. The use of massage, which was significant in the first and second model, was not the determinant when domains of fatigue entered in the final model. It might be because of the possibility of fatigue as the mediator of massage and sleep quality.

Fatigued participants usually have sudden arousal in their first stage of sleep, which can lead to unrefreshing sleep. Fatigue also increases the propensity to wake in the later hours of sleep, resulting in disruption of the REM sleep (Kishi et al., 2008). Altered nervous system that perceived in patients with fatigue is not only happening during waking hours, but also continue to occur during sleep. These mechanisms may explain why fatigue has a large contribution in patient's poor sleep quality.

The association between fatigue and sleep quality was expected since fatigue is a prominent symptom of HF and considered to contribute to sleep problems (Chen et al., 2013a). Accordingly, a proper management of fatigue is needed to overcome sleep problems. By early detection and controlling frequency of fatigue as part of HF management, it is possible to improve sleep quality in patients with HF, with appropriate monitoring and modification of caring according to the needs of the patient.

CONCLUSION

Fatigue and poor sleep quality were prevalent in Indonesian patients with HF. In this study, participants with greater fatigue had poorer sleep quality. Among the components of sleep quality, sleep latency was the highest problem of the participants. Several factors were significantly associated with sleep quality such as the use of massage, dyslipidemia drugs, comorbidities (hypertension, HHD, renal diseases), three domain of fatigue (severity, distress, timing), and the GFI. However, only three variables were found as significant determinants (HHD, renal diseases, and fatigue-timing domain). These results highlight the importance of monitoring fatigue and improving sleep quality. Thus, providing an appropriate management to patients with HF related to those two factors is indeed necessary.

RECOMMENDATION

The current study revealed some factors of sleep quality, implying a concept of sleep quality among patients with HF is multifactorial and complex. Nurses should use a greater perspective to look and to cope the effect of HF on patients' daily lives. The knowledge regarding fatigue and sleep quality in patients with HF in Indonesia is relatively weak. Thus, the current study contributes some facts and help nurses get a better view about fatigue and sleep quality. Nurses should deepen the necessary information and stimulate patients to portray specific conditions regarding fatigue and sleep quality felt, especially those who used massage, had HHD and renal diseases and experienced more frequent fatigue. Also, nurses can help early recognition of fatigue and sleep problems to reduce or delay poor outcomes in patients.

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