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THE EFFICACY OF ICE CUBES IN PATIENTS WITH HEART FAILURE

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ABSTRACT

Heart failure (HF) as abnormal heart structure and function increases neurohormonal response and sympathetic activity resulting in a renin-angiotensin-aldosterone system (RAAS). Congestion as the result of RAAS, increase signs and symptoms of HF including thirst. Fluid restriction as the recommendation to reduce congestion is increased thirst in patients with HF. The purpose of this study is to evaluate the effectiveness of ice cubes on thirst intensity, thirst distress, hospitalization, and mortality in patients with HF. This research implied quasi-experimental research, with one group pre and post-design. The sample recruited was 13 samples from outpatients and inpatients of a general hospital in Jakarta. Diagnosis must be HF by the cardiologist, over 18 years old, and in stable condition. Thirst intensity was measured by a visual analog score of 0-100, thirst distress was measured by thirst distress scale-heart failure, hospitalization, and mortality were measured by asking the patients or the family. There is a significant difference in thirst intensity before and after intervention ($p < 0.05$); and there is also a significant difference in thirst distress before and after intervention ($p < 0.05$). However, no difference in hospitalization and mortality after the ice cubes intervention. It is important for healthcare professionals or families to apply ice cubes sucking in patients with HF. The inpatients' patients are the most important to use the ice cubes to reduce thirst intensity and thirst distress due to thirst is higher in hospitalized patients with HF.

Keywords: Ice Cubes, Thirst, Heart Failure

INTRODUCTION

Cardiovascular disease is one of the top killers in Indonesia and contributes to 35% of mortality (Ministry of Health Indonesia, 2013). Heart failure (HF) is one of cardiovascular disease as the leading mortality of cardiovascular disease (Siswanto, 2013). Little consensus about HF in Indonesia, only data in 2013 from the Ministry of Health Indonesia that 4.2 million people in Indonesia have cardiovascular disease (Ministry of Health Indonesia, 2013).

HF had a high mortality rate and readmission in 30 days in Indonesia (Siswanto, 2013). This number is related to many signs and symptoms of HF including breathlessness, cough, fatigue, swallowing/edema, jugular vein distention, and thirst (Jering et al., 2021; Ponikowski et

al., 2016; Nana Waldreus et al., 2013). The burden of signs and symptoms in HF is related to congestion as the result of neurohormonal activation (Ponikowski et al., 2016).

Congestion in HF is overcome by medication and fluid restriction (Ponikowski et al., 2016), however, fluid restriction is a difficult recommendation to follow due to thirst (Brannstrom et al., 2006; Falk et al., 2007). Many patients with HF break the rule of fluid restriction due to the desire to drink more water (Falk et al., 2007). This condition led patients to have congestion and admit to the hospital (Brannstrom et al., 2006).

The difficulty of thirst led patients with HF to state thirst is an annoying thing (Falk et al., 2007). Neurohormonal, sympathetic system, medication, and fluid restriction aggravate the sensation of thirst (N. Waldreus et al., 2013). Several strategies were mentioned in the previous studies and found that ice cubes is the most recommended by the healthcare professional to reduce thirst (Allida et al., 2016). However, limited studies about the effects of the ice cubes on thirst intensity and thirst distress, hospitalization, and mortality.

The purpose of this study is to evaluate the effectiveness of ice cubes in thirst intensity and thirst distress. Moreover, this study also identifies the effectiveness of ice cubes in hospitalization and mortality in patients with HF.

Research Hypothesis

1. Thirst intensity and thirst distress are significantly lower after the ice cubes intervention
2. Hospitalization and mortality are significantly lower after ice cubes intervention

LITERATURE REVIEW

HF is a condition with abnormality in the function and structure of the heart resulting in abnormality in pumping blood to the whole body (Malik et al., 2022). HF is caused by several factors including coronary arterial disease, myocardial infarction, hypertension, diabetes mellitus, valvular heart disease, arrhythmia, myocarditis, and congenital heart disease (Malik et al., 2022).

HF generally is classified based on two types of classification. Firstly, it classifies based on left ventricular ejection fraction status which consists of heart failure reduced ejection fraction (HFrEF) with ejection fraction less than 40%, heart failure mid-range ejection fraction (HRmEF) with ejection fraction 40%-50%, and heart failure preserved ejection fraction (HRpEF) with ejection fraction greater than 50% (Malik et al., 2022; McDonagh et al., 2021).

Secondly, it classifies based on signs and symptoms especially functional status called the new york heart association (NYHA) class. It consists of:

Class I: no limitation in doing physical activity. Breathlessness, fatigue, and palpitation are not caused by ordinary activity

Class II: Slight limitation in doing physical activity. Breathlessness, fatigue, and palpitation are caused by ordinary activity, but comfortable at rest

Class III: Marked limitation in doing the activity. Breathlessness, fatigue, and palpitation are caused by less than the ordinary activity, but comfortable at rest

Class IV: Limited in doing physical activity without discomfort. Breathlessness, fatigue, and palpitation are present at rest. Discomfort is worsening during any

physical activity (Malik et al., 2022; McDonagh et al., 2021).

The management of HF is related to the severity of signs and symptoms. Several signs and symptoms reported in patients with HF are breathlessness, orthopnoea, fatigue, congestion, edema, pain, cough, palpitation, and thirst (Allida et al., 2015; Inamdar & Inamdar, 2016; N. Waldreus et al., 2013). Several medications are prescribed to reduce the severity of HF including beta-blockers, mineralocorticoid receptor antagonists, angiotensin-converting enzyme inhibitors, and many more (McDonagh et al., 2021). Moreover, multidisciplinary management is important in the management of HF (McDonagh et al., 2021).

Thirst as a bothersome sign and symptom of HF needs special consideration, due to this condition being underestimated by healthcare professionals and patients (Lumbantoruan & Chen, 2021). Thirst is alleviated by several strategies including ice cubes, cold water, chewing gum, and many more (Allida et al., 2016)

METHODS

This research was quasi-experimental, with one group pre-post design. This research was conducted in September-October 2022 in inpatient and outpatient rooms at the general hospital in Jakarta. The independent variable is ice cubes sucking.

Patients with HF, over 18 years old, able to speak Indonesia, and in a stable condition of the vital sign was included in this study. Patients were excluding include patients with mental issues and carrying thirst due to other conditions (unstable diabetes and chronic kidney disease with dialysis).

Demographic data including age, gender, education, and education is collected in this study. In disease-related factors we collected admission room, left ventricle ejection fraction, HF duration, new york heart association class, comorbidity, medication, fluid restriction adherence, and sodium adherence. The outcome of this study we measured thirst intensity, thirst distress, hospitalization, and mortality.

Demographic and disease-related factors are collected by asking the patients and from the medical record. Hospitalization is asking by “do you have hospitalization after 7 days?”’; mortality is measured if the patients are uncontactable by phone.

Thirst intensity was measured by visual analog score (VAS). Patients marked in a straight-line thirst intensity from 0 mm (no thirst) to 100 mm (very thirsty). This scale is a valid and reliable scale to measure thirst intensity in HF conditions (Holst et al., 2008a, 2008b; Waldreus et al., 2016; Waldreus et al., 2017; Waldreus et al., 2011; Waldreus et al., 2014). Thirst distress was measured by thirst distress scale-heart failure (DS-HF). TDS-HF consists of 8 items with a 1-5 Likert scale. The minimum score was 8 and the maximum score was 40. The higher score means the higher thirst distress in patients. TDS-HF was developed in patients with HF by Waldreus et al., 2017. This scale is valid and reliable to measure thirst distress in patients with HF (Waldreus et al., 2017). The Indonesian version was asked by a previous researcher who translated

the questionnaire into Indonesian (Lumbantoruan & Chen, 2021).

A list of patients was given by the head of each room as inclusion criteria and the data were collected at the hospital admission and 7 days after the intervention. In the baseline, participants completed a questionnaire including demographic data, disease-related factors, thirst intensity, thirst distress, fluid adherence, and sodium adherence After 7 days, patients were called by phone and asked about thirst intensity, thirst distress, fluid adherence, sodium adherence, hospitalization, and mortality.

The study was analyzed using the statistical program for social science (SPSS) version 22. A *p*-value of 0.05 is considered to be significant. The data are presented as mean (SD), median, and n (%). The bivariate analysis was performed on variables associated with thirst intensity and thirst distress. Differences at baseline and exit were analyzed using a t-test (normally distributed). The related factor to thirst intensity and thirst distress using Pearson correlation (normally distributed), and chi-square (categorical variables). If the data was not normally distributed, the data were analyzed using a parametric test according to the assumptions of the parametric test.

The Universitas Esa Unggul obtained the ethical approval with number 0922-09.039/DPKE-KEP/FINAL-EA/UEU/VII/2022. All respondents signed the informed consent before participating in the study.

RESULT

The average age of patients with HF in this study was 62.62 years old, and over half participants is male. Most of the participants were jobless (including retirement) with their educational background was junior or senior high school. This study mostly recruited outpatient patients with HF. The demographic data is performed in Table 1.

The disease-related factor in this study is described in Table 2. Due to incomplete examination of patients, not all the patients had left ventricular ejection fraction (LVEF). The average LVEF was 56.87 (25.96), with the lowest ejection fraction is 16%. Most of the patients were in NYHA class I-II and had hypertension as a comorbidity. The patients receive several medications such as beta-blocker (76.9%), anticoagulants (thrombolytic) (76.9%), dyslipidemia agents (61.5%), and angiotensin antagonists (53.8%). Furthermore, more than half of the patients were adhering to fluid and sodium restriction.

Table 1. Demographic data of the participants (N=13)

Characteristics	*n (%)*	*M* (SD)	Range	Min	Max
Age		62.62 (8.79)	26	50.00	76.00
Gender					
Male	7 (53.8)				
Female	6 (42.6)				
Education					
Primary school or below	1 (7.7)				

Secondary school	9 (62.9)
Higher education	3 (23.1)
Occupation	
Office workers	3 (23.1)
Non-office workers	2 (15.4)
None/retirement	8 (61.5)
Room	
Inpatient	5 (38.5)
Outpatient	8 (61.5)

Table 2. Disease-related factor of the participants (N=13)

Characteristics	*n (%)*	*M* (SD)	Range	Min	Max
LVEF (n=8) (%)		56.87 (25.96)	70.00	16.00	86.00
HF duration		84.98 (158.89)	599.90	0.10	600.00
NYHA Class					
I	6 (46.2)				
II	4 (30.8)				
III	2 (15.4)				
IV	1 (7.7)				
Comorbidity					
Diabetes	3 (23.1)				
Hypertension	9 (69.2)				
Medication					
Betablocker	10 (76.9)				
Dyslipidaemia agents	8 (61.5)				
ACEI	3 (23.1)				
Diuretics	5 (38.5)				
Angiotensin Antagonist	7 (53.8)				
Anticoagulant	10 (76.9)				
Fluid Restriction adherence					
Yes	6 (46.2)				
No	7 (53.8)				
Sodium Restriction adherence					
Yes	5 (38.5)				
No	8 (61.5)				

Note. LVEF (left ventricular ejection fraction), NYHA (new york heart association), ACEI (angiotensin-converting-enzyme inhibitors)

Thirst intensity and thirst distress

The median of thirst intensity before the intervention is 30.00 (min-max = 0-90), and the median after the intervention is 10 (min-max =0-40). Thirst intensity is higher before the ice cubes intervention compared to after the intervention (38.36 (28.82) vs 13.00 (14.18)). The differences in thirst intensity before and after the intervention is shown in Figure 1.

There is a significant difference in thirst intensity before and after intervention in bivariate analysis (Z = -2.20, p <.05). (Table 4.)

Related to thirst distress, the median before the intervention is 10 min max = 8-31), and after the intervention is 8 (min-max = 8-16). The same trend is also found in thirst distress before and after intervention (13.92 (8.18) vs 9.39 (2.58)). The bivariate analysis found a significantly different in thirst distress before and after the ice cubes intervention (Z = -2.20, p <.05) (Table 4.)

Linked to the admission setting of the patient, those admitted in inpatient had higher thirst intensity and thirst distress compared to those admitted to the outpatient room (Table 3). Furthermore, those who had higher thirst intensity and thirst distress in the baseline phase had higher thirst intensity and thirst distress over time.

Table 3. Thirst intensity and thirst distress in the different settings of admission (N=13)

Variable	Room	Mean (SD)	Mean Rank	U	*p*
Thirst Intensity before intervention	Outpatient	28.75 (21.00)	5.75	2.25	0.13
Thirst Intensity before intervention	Inpatient	54.00 (35.07)	9.00		
Thirst Distress before intervention	Outpatient	10.63 (3.33)	5.94	1.61	0.20
Thirst Distress before intervention	Inpatient	19.20 (11.16)	8.70		
Thirst Intensity after intervention	Outpatient	10.00 (11.54)	5.00	0.68	0.40
Thirst Intensity after intervention	Inpatient	20.00 (20.00)	6.67		
Thirst Distress after intervention	Inpatient	8.29 (0.75)	4.57	3.32	0.06
Thirst Distress after intervention	Outpatient	11.67 (4.04)	7.67		

Table 4. The comparison of thirst intensity and thirst distress before and after the intervention

Variable	Mean (SD)	Mean Rank	Sum Ranks	Z	*p*
Thirst Intensity before intervention	38.36 (28.82)	Negative rank 0.00	21.00	-2.20	0.027*
Thirst Intensity after intervention	13.00 (14.18)	Positive rank 3.50			
Thirst Distress before intervention	13.92 (8.18)	Negative rank 0.00	21.00	-2.20	0.027*
Thirst Distress after intervention	9.39 (2.58)	Positive rank 3.50			

Hospitalization and Mortality

After the intervention, there is no hospitalization in patients in this study after seven days of follow-up. According to this condition, the researcher did not investigate the difference in hospitalization before and after the intervention.

Subsequently, there was no mortality of patients in this study after following up. The researcher did not analyze the effect of an ice cubes on mortality.

DISCUSSION

Most of participants in this study are elderly (62.62 years old), male, and unemployed. This finding revealed the same characteristics of patients with HF in Indonesia in a registry study of HF (mean age 60.6) (MacDonald et al., 2020). These characteristics are almost the same after almost a decade in Indonesia in 2013, the average age of patients with HF is 55-64 years old (Kementerian Kesehatan Republik Indonesia, 2014).

Patients in this study had an average of 2 years of HF and were in NYHA class I-II. This condition was related to the fact that the mean LVEF in this study was above 50%. Additionally, most participants are in outpatient or stable HF conditions.

Patients with HF in this study suffered from thirst. As previous study have shown, thirst is becoming an important sign of worsening HF (Allida et al., 2015). The more severe the signs and symptoms of HF, the greater the thirst (Waldreus et al., 2011; Waldreus et al., 2014). Hospitalized patients had higher thirst intensity and thirst distress than outpatients, indicating the severity of their HF condition. It has also been shown from NYHA class is higher in hospitalized patients and the ejection fraction is lower in hospitalized patients.

Thirst is less common in outpatients than in inpatients patients. Outpatients' patient with HF have reduced thirst intensity before and after the intervention. Thirst distress also showed a similar trend to thirst intensity, thirst distress is lower in outpatients. However, the average thirst intensity in this study is higher than in the previous study in the outpatient setting (median baseline 30 vs. 14) (Waldreus et al., 2016). Consistent with this, a previous study also found decreased thirst in stable patients with HF (Waldreus et al., 2014). An unstable HF condition increases the neurohormonal and sympathetic system exacerbating the signs and symptoms of HF including thirst (Allida et al., 2015; Ponikowski et al., 2016; N. Waldreus et al., 2013)

This study found that the effectiveness of ice cubes on thirst intensity was significant. There is no standard consensus in the literature review regarding thirst management in HF. Another method has been suggested by medical professionals, but in practice ice chips are the most commonly (Allida et al., 2016). Thirst intensity drops significantly after ice cube intervention. Ice cubes relieve the intensity of thirst and by cool sensation in a short time (Allida et al., 2016)

Alleviating thirst distress using an ice cubes is also useful in this study. Distress is how annoying the patient's thirst is, as previously reported (Waldreus et al., 2017). Thirst is an annoying symptom stated due to thirst in patients with HF (Falk et al., 2007). Lack of the previous study on the effect of ice cubes on thirst distress. For patients with chronic kidney disease, ice cubes are beneficial in reducing thirst distress (Sacrias et al., 2016).

In Netherland, ice cubes ae considered the recommended thirst-quenching method for patients with HF. This is because they can count the amount of water they have already drunk as recommended by

healthcare professional (van der Wal et al., 2020)

Hospitalization and mortality are not related to ice cubes intervention. However, this may be due to methodological issues. Hospitalization and mortality occurred longer after discharge from the hospital. Consistent with these findings, fluid restriction is not associated with hospital readmission and mortality (Holst et al., 2008b).

CONCLUSION

In conclusion, this is the first study to evaluate the effectiveness of ice cubes on thirst intensity and thirst distress both in inpatient and outpatient settings. Ice cubes is effective in reducing thirst intensity and thirst distress after following up seven days. However, there is no comparison of hospitalization and mortality after the intervention. This strategy can help reduce the signs and symptoms of HF, especially thirst. The bothersome thirst can be quickly quenched with ice cubes. Patients with HF can also control their water intake by measuring how much ice cubes they use.

This study had several limitations. Patients with HF in our research setting are too few, however, the power of the study is considerable enough. In the next research, we recommend bigger sample study can be involved in a similar study. This study findings were more meaningful to inpatient patients with HF, and we recommend for future research to apply ice cubes intervention to discharge patients with HF to reduce 30 days of hospital readmission. Moreover, future research also can utilize the same intervention to reduce thirst in different populations.

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