Investigating Thirst Dimensions in Heart Failure Patients Using the Theory of Unpleasant Symptoms: A Cross-Sectional Study

Arash Vedad, MSc[1], Mohamad Ali Akbarzadeh, MD[2], Payam Emami, MSc[3], Nana Waldréus, MD[4], Mahsa Boozari Pour, PhD[1*]

[1] Department of Medical-Surgical Nursing, School of Nursing & Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
[2] Cardiovascular Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
[3] Department of Emergency Medical Sciences, Faculty of Paramedical Sciences, Kurdistan University of Medical Sciences, Sanandaj, Iran.
[4] Department of Neurobiology, Care Sciences and Society, Karolinska Institutet, Huddinge, Sweden.

Received 18 September 2023; Accepted 23 November 2024

Abstract

Background: *Thirst, a distressing complication in heart failure (HF) patients, arises from factors such as vasoconstriction in the salivary glands, alterations in the sympathetic nervous system, fluid restriction, nursing care practices, and pharmacotherapy. This study aimed to explore the dimensions of thirst in HF patients using the Theory of Unpleasant Symptoms (ToUS).*

Methods: *A descriptive cross-sectional study was conducted on 217 HF patients admitted to hospitals affiliated with Shahid Beheshti University of Medical Sciences, namely Imam Hossein, Luqman Hakim, and Shahid Modares in Tehran, Iran, from May through November 2020. Participants were selected through purposive sampling based on inclusion criteria. Data were collected using the Demographic Survey Form (DSF), Thirst Intensity Visual Analogue Scale (TI-VAS), Thirst Frequency Scale (TFS), and Thirst Distress Scale (TDS). Descriptive and analytical statistics were employed for data analysis using SPSS (version 20).*

Results: *The mean ± standard deviation scores for thirst intensity and thirst distress were 47.53±26.37 (moderate level) and 25.92±8.13 (high level), respectively. A significant proportion of patients (35.9%) experienced high levels of thirst distress. Additionally, 61% of participants reported feeling thirsty almost daily over the past month, with thirst persisting throughout the day. Key predictors of thirst intensity and distress included educational level; HF class; living conditions; fluid restriction; use of angiotensin-converting enzyme inhibitors, β-blockers, aldosterone antagonists, and diuretics; and the presence of diabetes.*

Conclusion: *Given the high prevalence and distressing nature of thirst in HF patients, nurses should prioritize assessing thirst during care delivery. Identifying contributing factors and predicting thirst intensity during patient history-taking can enhance management strategies.*

J Teh Univ Heart Ctr 2024;19(S1):1-11

This paper should be cited as: Vedad A, Akbarzadeh MA, Emami P, Waldréus N, Boozari Pour M. Investigating Thirst Dimensions in Heart Failure Patients Using the Theory of Unpleasant Symptoms: A Cross-Sectional Study. J Teh Univ Heart Ctr 2024;19(S1):1-11.
DOI: 10.18502/jthc.v19is1.18473

Keywords: Thirst, Heart Failure, Symptoms

***Corresponding Author:** **Mahsa Boozari Pour,** Assistant Professor of Nursing, Department of Medical Surgical Nursing, School of Nursing & Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Tel: +982188202511. Email: m.boozaripour@sbmu.ac.ir.*

Copyright © 2024 Tehran University of Medical Sciences. Published by Tehran University of Medical Sciences.
This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International license (https://creativecommons.org/licenses/by-nc/4.0/)
Noncommercial uses of the work are permitted, provided the original work is properly cited.

DOI: 10.18502/jthc.v19is1.18473

Introduction

Heart failure (HF) is a chronic, progressive condition characterized by a wide range of symptoms resulting from impaired heart function. Typically, the heart's abnormal activity disrupts its ability to pump blood effectively, leading to inadequate oxygen delivery to body tissues.[1] Several factors contribute to the rising prevalence of HF, including uncontrolled risk factors such as diabetes, obesity, and hypertension, as well as population aging and improved survival rates among patients with cardiovascular disease due to evidence-based practices.[2] Previous studies have highlighted that cardiovascular disease is the leading cause of death in Iran, accounting for 39% of all recorded cases.[3] Further, research has shown that HF patients experience a significantly lower quality of life (QoL) than those with other chronic conditions, including cancer, underscoring the need for greater attention to this population.[4, 5] To definitively diagnose HF with reduced left ventricular ejection fraction, the presence of clinical signs and symptoms, combined with an ejection fraction below 50%, is essential. Moreover, NT-proBNP concentration testing is utilized to diagnose heart disease and assess the efficacy of therapeutic interventions.[6] Thirst has been identified as one of the most prominent complications among the symptoms experienced by HF patients.[7] This condition is often linked to the activation of the sympathetic nervous system, which reduces saliva production due to vasoconstriction in the salivary glands, leading to dry mouth.[8] Furthermore, HF patients are often required to restrict their daily fluid intake to manage symptom severity, and certain medications they take may exacerbate their sensation of thirst.[9, 10]

Nurses and other healthcare professionals frequently encounter HF patients experiencing persistent thirst in hospital and outpatient settings.[11] This issue is often highlighted when patients discuss the challenges of adhering to fluid restrictions.[10] Similarly, prior research has identified thirst as a significant stressor for HF patients,[11] negatively impacting their QoL as one of the most distressing symptoms.[2, 3] Similar to pain, thirst should be addressed proactively to prevent its occurrence.[7] Although the primary factors driving thirst remain incompletely understood, several studies have identified 3 key contributors: fluid shifts within the body, increased sympathetic nervous system activity, and pharmacotherapy.[12, 13]

According to the Theory of Unpleasant Symptoms (ToUS), each symptom can possess distinct dimensions that may influence one another. Symptoms can manifest either simultaneously or in isolation. For instance, pain is often accompanied by nausea, dyspnea, and fatigue in patients.[7] When a symptom occurs in isolation, it is relatively easier to assess and measure. Nonetheless, when symptoms occur simultaneously, the process becomes more complex, as symptoms can interact with and alter one another, potentially obscuring their individual effects on the patient.[10, 14]

Another critical aspect of the ToUS is the identification of factors—physiological, psychological, and situational (ie, physical or environmental)—that shape symptoms. These factors are interconnected and can e–ven overlap, influencing symptom dimensions either individually or collectively.[15]

The ToUS provides a framework for categorizing the factors that affect symptoms. Previous research has identified several factors contributing to thirst in HF patients, including medication use and fluid intake. By way of example, a 2016 randomized clinical trial involving 4133 participants in Sweden linked thirst to the use of tolvaptan.[10] Similarly, a qualitative study found that many patients attributed their thirst sensation to fluid loss caused by medications such as aldosterone antagonists or diuretics.[16]

Given the progressive nature of chronic conditions such as HF, preventing and managing complications, including thirst distress, is crucial. In this context, nurses play a vital role in providing care and helping patients manage challenging symptoms to enhance their overall well-being.[17, 18]

In line with research on HF and the ToUS, it is essential for nurses to reflect on the various factors influencing these symptoms and work toward resolving them.[19] Due to differences in local environments, climates, and lifestyles across countries, thirst dimensions must be thoroughly investigated before implementing any interventions. Recognizing the significant impact of thirst on QoL, treatment adherence, and re-hospitalization rates, standardized procedures have been developed to identify thirst risk factors in both hospital and outpatient settings.

To the best of our knowledge, no studies have yet been conducted in Iran on this topic, nor are there specialized outpatient clinics for HF patients. In view of Iran's diverse climate and varying lifestyles, this study aimed to investigate thirst dimensions using the ToUS as a framework in HF patients.

Methods

Design

Using the ToUS as a framework, this cross-sectional, descriptive study was conducted to explore thirst dimensions in HF patients.

Participants

The study population consisted of patients admitted to cardiac-related inpatient wards (eg, cardiology and cardiac care units [CCUs]) at hospitals affiliated with Shahid Beheshti University of Medical Sciences, namely Imam Hossein, Luqman Hakim, and Shahid Modares in Tehran, Iran, between May and November 2020. The inclusion criteria were age over 18 years, a definitive diagnosis of HF by a physician (with or without reduced ejection fraction), stable HF (no need for significant adjustments to diuretic dosage), full consciousness, thirst due to chronic renal failure in patients on hemodialysis and fluid restriction, and sufficient cognitive awareness (knowledge of person, time, and place) to complete the questionnaire.

The sample size (n=217) was determined based on a 2018 study by Waldreus et al,[19] using the infinite sample size estimation formula ($n=\frac{z^2_{\alpha/2}\sigma^2}{d^2}$) with a 95% confidence interval (α=0.05), a Z-score of 1.96, σ =1.5, and an accuracy (d) of 0.2. An additional 10% was included to account for

potential incomplete questionnaires. In total, 238 questionnaires were distributed, 222 were returned, and 16 incomplete responses were excluded. Ultimately, 217 questionnaires were completed by patients and included in the analysis.

Data Collection

HF patients were selected using convenience sampling based on the inclusion criteria following a review of their medical records. For hospitalized patients, the questionnaire was administered in the relevant department after obtaining permission from the department head. After securing informed consent, the questionnaires were distributed to patients under the researcher's supervision.

The process began with patients completing the demographic questionnaire. Next, the thirst intensity scale was provided, accompanied by necessary instructions. Once the thirst intensity scale was completed, the researcher read out the scales related to thirst distress and frequency and recorded the patients' responses. If patients preferred, they were given the option to complete these scales independently. For patients unable to complete the questionnaire by themselves, the researcher remained present to assist them throughout the process.

Ethical Considerations

Participation in the study was voluntary. Participants were informed about the research objectives, the voluntary nature of their involvement, the anonymity of their responses, and the confidentiality of their personal information. Written informed consent was obtained from each participant before their enrollment in the study.

Data Analysis

Data were analyzed using SPSS, version 20. Descriptive statistics, including frequency, percentage, mean, and standard deviation (SD), were employed to summarize the data. Inferential statistical tests, such as independent t-tests, one-way ANOVA, and Pearson's correlation coefficient, were also conducted. All statistical tests were 2-tailed, with an α level of 0.05, and a P-value of less than 0.05 was considered statistically significant.

Validity and Reliability

Data collection tools were the Demographic Survey Form (DSF), the Thirst Intensity Visual Analogue Scale (TI-VAS), the Thirst Distress Scale (TDS), and the Thirst Frequency Scale (TFS).

The DSF

The demographic survey collected information on participants' gender, age, height, weight, body mass index (BMI), living conditions, hospital care received over the past 3 days, educational level, smoking status, addiction history, chronic diseases, fluid and sodium restrictions, HF class, ejection fraction, presence of an implantable cardioverter-defibrillator (ICD) or cardiac resynchronization therapy, frequency of hospitalizations due to HF per year, duration of HF, medications (retrieved from medical records), and climatic conditions of their place of residence. This form was developed and customized by the research team.

The TDS

The TDS was developed by Waldreus et al[20] in 2018, and has been utilized in various studies since. Given its alignment with the research objectives, the scale was cross-culturally adapted and translated into Persian in Iran, following the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) checklist. This process was conducted after obtaining permission from the original designer. The translated version of the TDS was subsequently uploaded to the official website of the working group (www.thirststudies.com) under the name of the Iranian research team, and an official translation certificate was provided by the designer.

The TDS asks patients to report their thirst experiences over the past 2 to 3 days. To assess content validity, the questionnaire was reviewed by 5 members of the scientific team, who evaluated the relevance, simplicity, and clarity of each item. Reliability was determined using Cronbach's α coefficient and test-retest methods with 50 HF patients. The interval between tests was 2 weeks, and all patients were included in the study. The Cronbach's α coefficient for thirst assessment was 0.85, and the test-retest reliability yielded an intra-class correlation coefficient of 0.89.

The TDS consists of 8 statements, with responses scored on a 5-point Likert-type scale (ranging from "completely agree" to "completely disagree"). Total scores range from 8 to 40, with higher scores indicating greater thirst. Scores of 8 to 16 represent mild thirst, 17 to 24 indicate moderate thirst, 25 to 32 denote high thirst, and 33 to 40 signify severe thirst.[22]

The TI-VAS

The TI-VAS has been widely used in various studies across different diseases[23, 25] to assess thirst intensity. In this scale, patients are asked to mark their perceived thirst intensity on a 100 mm line, ranging from "no thirst" on one end to "the most severe thirst imaginable" on the other. For this study, the researcher categorized the scores as follows: 1 to 30 indicated low thirst intensity, 31 to 60 represented moderate thirst intensity, and 61 to 100 reflected high thirst intensity.

The TFS

This questionnaire is composed of 3 multiple-choice items addressing the frequency of thirst during the day, the duration of the thirst sensation, and the time of peak thirst. Responses to each item were reported as numbers and percentages. For instance, the questionnaire assessed how many patients (percentage) experienced thirst daily. The TFS was developed by the research team and completed by the patients. It was translated by the research team and reviewed by 5 faculty members to confirm its validity. As the questionnaire had been used in prior studies,[26] its ronbach's α coefficient (α=0.78) was included for reliability.

Data Analysis

The number and percentage of patients were calculated based on their scores (0–100) on the TI-VAS, while the mean ± SD of the TDS was calculated using its corresponding score range (8–40). For the TFS, the number and percentage of responses for each option were determined. Regression analysis was subsequently employed to explore the relationship between demographic characteristics and thirst sensation.

After data collection, the information was entered into SPSS, version 20, for analysis. Descriptive statistics, including mean ± SD values for all items and total scores, were calculated. Regression analysis was further utilized to examine the association between demographic characteristics and thirst sensation.

Results

Table 1 presents the demographic characteristics of the participants. The study population consisted of 217 patients, with 64.7% being male. The average age of the participants was 67.69±12.98 years, and nearly half (49.8%) were aged between 51 and 70 years. The majority had a BMI ranging from 25 to 29.9, indicating they were overweight. Approximately 41% had an educational level below a diploma, and most (63.6%) lived with their spouse.

In terms of substance use, 37.3% of patients were tobacco users, and 23.5% used opioids, including prescribed narcotics, opium, and opium sap. Among opioid users, 18.90% reported using opium. The average duration of HF was 60.72±53.87 months. Most patients (25.8%) were classified as New York Heart Association functional classes II and III. The most common underlying conditions were ischemic heart disease (49.8%) and type 2 diabetes (35.9%).

Regarding dietary restrictions, 40.1% of patients had fluid intake restrictions, with most adhering to a daily limit of 1000 to 1500 mL. In addition, 47% had sodium intake restrictions, with a significant portion (37.2%) limiting their sodium intake to 2000 mg per day. A considerable number of patients (96.8%) were taking diuretic medications, with furosemide being the most commonly used (85.48%).

Table 1. The demographic characteristics of the studied participants

Variables			Frequency	Percentage
Gender	Male		138	63.6
	Female		79	36.4
Age (y)	25-50		19	8.7
	51-70		108	49.8
	>70		90	41.5
Height (cm)	150-160		36	16.6
	161-170		106	48.8
	>170		75	34.6
Weight (kg)	45-70		90	41.5
	71-100		118	54.4
	>100		9	4.1
Body mass index	Underweight	<18.5	5	2.3
	Normal	18.5-24.9	74	34.1
	Overweight	25-29.9	98	45.2
	Obesity	30-34.9	32	14.7
	Obesity clinic	>35	8	3.7
Level of education	Under high school diploma		89	41
	High school diploma		72	33.2
	Higher education		56	25.8
Heart failure class	I		52	24
	II		56	25.8
	III		56	25.8
	IV		53	24.4
Ejection fraction (%)	10-20		33	15.2
	25-40		143	65.9
	> 40		41	18.9
Systolic blood pressure (mm Hg)	80-100		48	22.1
	101-120		87	40.1
	>120		82	37.8
Diastolic blood pressure (mm Hg)	40-60		72	33.2

	61-80		101	46.5
	>80		44	20.3
	35-60		23	10.6
Heart rate (bpm)	61-90		162	74.6
	>90		32	14.8
Hospital care over the past 3 days	Yes		214	96.8
	No		3	1.4
	Alone		23	10.6
Living conditions	Living with one's spouse		138	63.6
	Living with others		56	25.8
	26-30		95	43.8
Air temperature (°C)	31-35		44	20.3
	36-40		78	35.9
Smoking	Yes		81	37.3
	No		136	62.7
Opiate	Yes	Opium	41	18.90
		Methadone	10	4.6
	No		166	76.5
Implantable cardioverter-defibrillator	Yes		10	4.6
	No		207	95.4
Cardiac resynchronization therapy	Yes		11	5.1
	No		206	94.9
Chronic diseases	Type 1 diabetes		1	0.5
	Type 2 diabetes		78	35.9
	Anemia		28	12.9
	Chronic obstructive pulmonary disease		24	11.1
	Kidney disease		54	24.9
	Hypertension		54	24.9
	Atrial fibrillation		44	20.3
	Ischemic heart disease		108	49.8
	Stroke		26	12
Disease duration (mon)	1-12		49	22.6
	13-60		96	44.2
	61-120		48	22.1
	>120		24	11.1
Fluid restriction	Yes		87	40.1
	No		130	59.9
Amount of fluid intake restriction (mL)	100		1	1.2
	300		1	1.2
	500		19	21.8
	800		8	9.2
	1000		27	31
	1200		2	2.3
	1300		2	2.3
	1500		27	31
Sodium restriction	Yes		102	47
	No		115	53
Amount of sodium intake restriction (mg)	100		5	5
	500		6	5.8
	1000		1	1

	1500		3	3
	2000		38	37.2
	2500		17	16.6
	3000		32	31.4
Diuretic use	Yes	Frusemide	187	85.48
		Hydrochlorothiazide	20	9.21
		Metolazone	3	1.38
		Triamterene	14	6.45
	No		7	3.2
Change in diuretic dosing	Yes		65	30
	No		152	70
Mode of change in diuretic use	Increase		29	46.6
	Decrease		36	55.4
Angiotensin-converting enzyme use	Yes	Captopril	66	30.4
		Enalapril	13	5.9
		Lisinopril	10	4.6
	No		128	59
β-blocker use	Yes	Carvedilol	76	35
		Bisoprolol	40	18.4
		Metoprolol	68	31.3
	No		56	25.8
Mineralocorticoid receptor antagonist use	Yes	Spironolactone	117	53.9
		Eplerenone	2	0.9
	No		98	45.2
Antidepressant use	Yes	Sertraline	16	7.3
		Citalopram	1	0.5
	No		200	92.2
Omeprazole	Yes		46	21.2
	No		171	78.8

As shown in Table 2, the mean total thirst intensity among HF patients was 47.53±26.37, with the majority (35%) reporting moderate thirst intensity. The mean thirst distress score was 25.92±8.13, and a significant proportion of patients (35.9%) experienced high levels of thirst distress. Furthermore, the mean thirst frequency score was 9.83±2.44.

Table 2. Thirst distress, thirst intensity, and thirst frequency in the studied patients with heart failure

Variables	**Minimum**	**Maximum**	**Mean±SD**
Thirst distress	9	40	25.9±28.13
	Range	**Number**	**Percentage**
Mild	9-16	35	16.1
Moderate	17-24	53	24.4
High	25-32	78	35.9
Severe	33-40	51	23.5
	Minimum	**Maximum**	**Mean±SD**
Thirst intensity	0	100	47.53±26.37
	Range	**Number**	**Percentage**
Low	1-30	70	32.3
Moderate	31-60	76	35
High	61-100	71	32.7
	Minimum	**Maximum**	**Mean±SD**
Thirst frequency	4	15	9.83±2.44

As shown in Table 3, 82% of HF patients reported experiencing thirst over the past month. Among these patients, the majority (61%) stated that they felt thirsty almost daily, with 35.5% reporting that their thirst lasted for 1 hour or less. Additionally, the highest intensity of thirst occurred throughout the entire day for 32.3% of patients.

Table 3. Thirst frequency items for the studied patients with heart failure

	Items		Every Day	Almost Every Day	Several Times a Week	Several Times a Month	Never
1	How long have you been thirsty over the past month?	**Number**	35	61	39	43	39
		Percentage	16.1	28.1	18	19.8	18
			All day and night	Half a day	Many hours	For hours	One hour or less
2	How long does your thirst last?	**Number**	29	16	39	56	77
		Percentage	13.4	7.4	18	25.8	35.5
			Morning	Noon	Evening	Night	All day long
3	What time of the day do you feel thirsty the most?	**Number**	36	51	20	40	70
		Percentage	16.6	23.5	9.2	18.4	32.3

As presented in Table 4, thirst intensity in HF patients varied based on several factors, including educational level, HF class, living conditions, fluid restriction, use of an ICD, changes in diuretic dosing, mode of diuretic use, use of angiotensin-converting enzyme (ACE) inhibitors, use of β-blockers, use of mineralocorticoid receptor antagonists, substance abuse, and diabetes. Thirst intensity was higher in HF patients with fluid restrictions, ICD use, increased diuretic dosing, and a history of taking ACE inhibitors, β-blockers, and mineralocorticoid receptor antagonists.

To compare groups pairwise for educational level, HF class, and living conditions, Bonferroni's post hoc test was applied. The results indicated that HF patients with educational levels below a high school diploma experienced significantly higher thirst intensity than those with higher education. Class 1 HF patients reported significantly lower thirst intensity than those in other HF classes. Furthermore, HF patients living with their spouses experienced significantly less thirst than those in other living arrangements.

Similarly, thirst distress in HF patients varied based on educational level, HF class, living conditions, fluid restriction, ICD use, changes in diuretic dosing, mode of diuretic use, use of ACE inhibitors, use of β-blockers, use of mineralocorticoid receptor antagonists, diabetes, and substance abuse. Thirst distress was higher in HF patients with diabetes, fluid and sodium restrictions, ICD use, changes in diuretic dosing, and a history of taking ACE inhibitors, β-blockers, and mineralocorticoid receptor antagonists.

For educational level, HF class, and living conditions, Bonferroni's post hoc test was drawn upon to compare groups pairwise. The results showed that HF patients with educational levels below a high school diploma experienced significantly higher thirst distress than those with higher education. Class I HF patients reported significantly lower thirst distress than those in other HF classes. Additionally, HF patients living with their spouses experienced significantly less thirst distress than those in other living arrangements.

In the analysis to determine the relationship between quantitative demographic characteristics and thirst intensity and distress in HF patients using Pearson correlation, thirst intensity correlated with increased age (P=0.001), higher air temperatures (P=0.001), reduced left ventricular ejection fractions (P=0.001), and sodium restriction (P=0.001). Similarly, thirst distress was associated with increased age (P=0.004), higher air temperatures (P=0.001), elevated heart rates (P=0.05), and higher BMIs (P=0.03). Moreover, reduced left ventricular ejection fractions (P<0.001) and sodium restriction (P=0.004) were linked to increased thirst distress. These findings suggest that thirst intensity and distress in HF patients are influenced by factors such as advanced age, higher air temperatures, elevated heart rates, reduced left ventricular ejection fractions, and sodium restriction.

Table 4. Determining the relationship between demographic characteristics and thirst intensity and distress in the studied patients with heart failure

Variables		Frequency	Thirst Intensity M ±SD	Thirst Distress M ±SD
Gender	Male	138	43.22 ±25.38	26.64 8.21
	Female	79	50.00±26.69	24.65±7.88
	Statistical Indicator		P=0.069, t=1.83	P:0.083, t:1.73
Level of education	Under high school diploma	89	53.98±25.70	27.97±7.13
	High school diploma	72	45.62±25.98	24.83±8.00
	Higher education	56	39.73±25.83	24.05±9.15
	Statistical Indicator		P=0.005, F=5.15	P:0.007, F:5.15
Heart failure class	1	52	30.28±23.85	19.90±7.86
	2	56	46.27±23.13	25.39±7.47
	3	56	51.60±25.83	28±7.06
	4	53	61.69±23.16	30.18±6.50
	Statistical Indicator		P=0.001, F=15.66	P=0.001, F=19.71
	Yes	214	47.52±26.50	26.03±8.11

Hospital care over the past 3 days	No	3	48.33±16.07	17.66±4.50
	Statistical Indicator		P=0.95, t=0.052	P=1.77, t=0.07
Living conditions	Alone	23	57.60±24.39	28.73±6.14
	Living with one's spouse	138	41.12±25.65	23.80±8.40
	Living with others	56	59.19±23.85	29.98±6.12
	Statistical Indicator		P=0.001, F=12.42	P=0.001, F=14.68
Smoking	Yes	81	45.30±26.02	25.45±8.15
	No	136	48.86±26.58	26.19±8.14
	Statistical Indicator		P=0.33, t=0.95	P=0.51, t=0.64
Sodium restriction	Yes	102	49.41±26.99	26.70±7.58
	No	115	45.86±25.80	24.42±8.34
	Statistical Indicator		P=0.32. t=0.98	P=0.004, t=2.92
Fluid restriction	Yes	87	63.73±21.36	30.66±6.37
	No	130	36.69±23.76	22.74±7.63
	Statistical Indicator		P<0.001, t=8.55	P<0.001, t=7.98
Cardiac resynchronization therapy	Yes	11	59.54±18.22	28.90±4.82
	NO	206	46.89±26.61	25.76±8.25
	Statistical Indicator		P=0.12, t=1.55	P=0.21, t=1.25
Implantable cardioverter-defibrillator	Yes	10	77.00±14.56	34.40±3.02
	No	207	46.11±25.99	25.51±8.80
	P		P<0.001, t=3.72	P<0.001, t=3.46
Diuretic use	Yes	210	47.95±26.33	26.10±8.10
	No	7	35.00±26.14	20.28±7.38
			P=0.20, t=1.28	P=0.062, t=1.87
Change in diuretic dosing	Yes	65	60.00±23.60	29.98±6.78
	No	145	42.55±25.77	24.37±8.06
	Statistical Indicator		P<0.001, t=4.65	P<0.001, t=4.88
Mode of change in diuretic use	Yes	29	67.06±21.58	31.86±5.05
	No	36	54.30±23.69	28.47±7.64
	Statistical Indicator		P=0.029, t=2.32	P=0.044, t=2.05
Angiotensin-converting enzyme	Yes	89	58.03±24.37	28.86±7.28
	No	128	40.32±25.30	23.87±8.09
	Statistical Indicator		P<0.001, t=5.17	P<0.001, t=4.65
β-blocker use	Yes	161	50.12±26.48	27.01±7.61
	No	56	40.08±24.78	22.76±8.80
	Statistical Indicator		P=0.014, t=2.84	P=0.001, t=3.45
Omeprazole	Yes	46	45.76±29.24	25.54±9.46
	No	171	48.01±25.61	26.02±7.76
	Statistical Indicator		P=0.60, t=0.51	P=0.72, t=0.35
Mineralocorticoid receptor antagonist use	Yes	119	56.17±25.35	28.67±7.67
	No	98	37.04±23.74	22.58±7.42
	Statistical Indicator		P<0.001, t=5.69	P<0.001, t:5.90
Substance abuse	Yes	51	56.86±23.72	29.52±6.88
	No	166	44.66±26.54	24.81±8.18
	Statistical Indicator		P=0.004, t=2.93	P=0.001, t:3.72
Antidepressant use	Yes	17	51.76±25.36	28.52±6.90
	No	200	47.17±26.48	25.70±8.20
	Statistical Indicator		P=0.69, t=0.68	P=0.16, t=1.38
Suffering from diabetes	Yes	78	58.58±21.56	28.44±7.22
	No	139	41.33±26.85	24.50±8.29
	Statistical Indicator		P<0.001, t=4.86	P=0.001, t=3.51
Hypertension	Yes	54	49.81±26.45	26.88±7.41
	No	163	46.77±26.37	25.60±8.35
	Statistical Indicator		P=0.46, t= 0.73	P=0.31. t=1.00
	Age (y)		67.69±12.98	
	Air temperature (°C)		P=0.001, r=0.22 32.82±4.38	P=0.004, r=0.19
			P=0.001, r=0.23	P=0.001, r=0.21

Height (cm)	168.76±7.56	
	P=0.083, r=0.11	P=0.11, r= -0.10
Weight (kg)	75.68±14.35	
	P=0.8, r=0.01	P=0.26, r=0.07
Body mass index	26.54±4.55	
	P=0.18, r=0.09	P=0.03, r=0.14
Duration of disease (mon)	6.72±53.87	
	P=0.72, r=0.02	P=0.27, r=0.07
Left ventricular ejection fraction (%)	33.57±9.31	
	P=0.01, r= -0.35	P<0.001, r= -0.41
Systolic blood pressure (mm Hg)	121.45±21.73	
	P=0.38, r=0.05	P=0.39, r=0.05
Diastolic blood pressure (mm Hg)	70.82±16.10	
	P=0.86, r=0.01	P=0.52, r= -0.04
Heart rate	77.41±14.44	
	P=0.053, r=0.13	P=0.05, r=0.13
Fluid restriction (mL)	1020.69±393.88	
	P=0.65, r=0.04	P=0.15, r= -0.15
Sodium restriction (mg)	2186.27±820.29	
	P=0.01, r= -0.23	P=0.004, r= -0.28

Discussion

The study findings indicated that the mean ± SD of total thirst intensity in HF patients was 47.53±26.37, with the majority of patients (35%) experiencing moderate thirst. These results align with previous research.[20, 21]

For instance, a study conducted across 3 countries—Japan, the Netherlands, and Sweden—by van der Wal et al[27] reported a mean thirst intensity score of 53, also at a moderate level. Similarly, in a 2018 study by Waldreus et al,[22] the mean thirst intensity scores among Swedish patients were moderate, with values of 39 at hospitalization, 36 at discharge, and 42 and 34 at 2 weeks and 4 weeks post-discharge, respectively.

Weight gain, elevated plasma/serum urea levels, fluid restriction, and diuretic use in HF patients can lead to distressing complications, underscoring the importance of addressing thirst as a key responsibility for nurses in care delivery.[23] A commonality between this study and previous research is the use of the 100 mm TI-VAS to assess thirst in HF patients, which helps explain the consistency in results. Be that as it may, differences in healthcare infrastructure, access to facilities, workforce availability, and care delivery models between Iran and countries like Japan, the Netherlands, and Sweden highlight the unique significance of this study in the Iranian context.

In 2021, Negro et al[24] conducted an observational study in Italy on thirst in patients hospitalized in ICUs. They reported a thirst intensity score of 5.6 based on the Numerical Rating Scale (NRS), indicating moderate thirst. Nevertheless, the differences in findings between this study and ours can be attributed to variations in settings and target populations. The ICU patients in Negro and colleagues' study differed from HF patients, as they were often intubated, receiving diverse medications, experiencing swallowing difficulties, or unable to consciously request fluids. In another study conducted in 2018 in Brazil by Pierotti et al,[25] perioperative thirst intensity and discomfort were assessed using the TI-VAS (range: 0–10). The mean thirst intensity score was 6.9. Nonetheless, the study setting and target population differed from those in HF patients, as the participants were under the influence of anesthesia and had fasted before surgery.

The results of our study also revealed that the mean ± SD of thirst distress in HF patients was 25.92±8.13, with the majority (35.9%) experiencing high levels of thirst distress. These findings are consistent with prior research on patients with chronic conditions.[21,23,26]

In 2016, Kara[27] investigated factors influencing thirst in hemodialysis patients in Turkey and found that weight gain during the procedure was associated with higher levels of thirst distress. In addition, thirst distress was directly correlated with plasma sodium levels and noncompliance with salt intake restrictions. Similarly, in 2007, Porcu et al[28] examined thirst distress and weight regain in hemodialysis patients in Italy and reported that most patients experienced high levels of thirst distress. The studies by Kara and Porcu and colleagues focused on hemodialysis patients, whereas the present study examined HF patients, highlighting differences in the target populations and fluid restriction protocols. Additionally, the studies were conducted in Turkey and Italy, settings that differ significantly from Iran. Furthermore, the time gap between the present study and Porcu and colleagues' research exceeds 10 years, during which healthcare conditions and available facilities have evolved.

These differences underscore the significance of addressing thirst and its associated distress in chronic conditions such as HF and kidney disease, emphasizing the need for specialized medical and nursing care. While the use of the TI-VAS is a common feature across these studies, developing disease-specific assessment tools could enhance the generalizability and applicability of future findings.

The study results also indicated that the mean ± SD of thirst frequency in HF patients was 9.83±2.44, with 82% reporting thirst over the past month. Among these patients, the majority (61%) experienced thirst almost daily, with 35.5% stating that each episode lasted 1 hour or less. Moreover, 32.3% reported that their thirst sensation persisted throughout the entire day, aligning with previous research.[20]

In 2021, Eng et al[23] conducted a study on thirst and its associated factors in 302 patients with chronic HF. They found that 47% of participants had experienced thirst over the past month.

Notably, thirst frequency, as an unpleasant experience, can be more distressing than its intensity. Individuals generally possess a degree of tolerance and resilience, and transient conditions such as pain, thirst, or anxiety are often easier to endure or dismiss. Still, when such conditions recur persistently, the lack of relief makes them increasingly difficult to bear. Although thirst in chronic HF patients is

already described as distressing, its recurrence likely amplifies the discomfort, rendering it significantly more burdensome.

The study results indicated that thirst intensity among HF patients varied based on several factors, including educational level, HF class, living conditions, fluid restriction, use of ACE inhibitors, use of β-blockers, use of mineralocorticoid receptor antagonists, substance abuse, and the presence of diabetes. Thirst intensity was notably higher in patients with fluid restrictions, those using ICDs, those experiencing an increase in diuretic dosage, and those with a history of taking ACE inhibitors, β-blockers, and mineralocorticoid receptor antagonists. Conversely, individuals with higher educational levels, class 1 HF, and those living with a spouse reported lower thirst intensity than other patients. In addition, thirst intensity increased with age, elevated air temperatures, reduced left ventricular ejection fractions, and fluid restriction.

According to a study conducted by van der Wal et al[21] in 2020 across 3 countries—Japan, the Netherlands, and Sweden—thirst intensity in HF patients was significantly associated with fluid restriction, diuretic use, and the intake of salty foods.

In epidemiology, predictive factors can be defined in various ways. These factors can significantly influence specific outcomes, which may be either beneficial or detrimental.[29] In the present study, some factors were linked to demographic characteristics, while others were associated with the disease and its conditions. It appears that the body's need for water increases with age, making heightened thirst in the elderly understandable. Additionally, rising air temperatures can exacerbate thirst by promoting the evaporation of bodily fluids, which is a natural response. Fluid restriction, resulting from decreased fluid intake and diuretic use, also typically affects thirst intensity. Consequently, reduced body fluids and increased thirst can be complications arising from certain medications, which should be considered when prescribing. Regarding other factors, the results vary and cannot be generalized.

The results indicated that thirst distress among HF patients varied according to several factors, including educational level, HF class, living conditions, fluid restriction, use of ACE inhibitors, use of β-blockers, use of mineralocorticoid receptor antagonists, diabetes, and substance abuse. Thirst distress was notably higher in patients with fluid and sodium restrictions, those using ICDs, those experiencing changes in diuretic dosing, and those with a history of taking ACE inhibitors, β-blockers, and mineralocorticoid receptor antagonists, as well as those suffering from diabetes.

To compare the groups based on educational level, HF class, and living conditions, we employed Bonferroni's post hoc test. The findings revealed that individuals with educational levels below a high school diploma experienced significantly higher thirst distress than those with higher education. Further, patients classified as class I HF reported significantly less thirst distress than those in other classes.

Moreover, patients living with a spouse reported significantly less thirst distress than others. Thirst distress among HF patients also increased with advancing age, higher air temperatures, elevated heart rates, reduced left ventricular ejection fractions, and fluid restriction.

Upon reviewing the factors associated with thirst distress and intensity, it appears that they are often consistent and share common predictive elements. As patients age, their bodies require more water. Rising air temperatures also exacerbate thirst by promoting fluid loss through the skin, leading to increased thirst intensity and, consequently, greater thirst distress. Furthermore, the frequency of thirst increases, a condition accompanied by an unpleasant sensation. Fluid restriction similarly contributes to this issue, as it fails to satisfy the body's hydration needs. The use of diuretics is also a typical factor, as these medications promote the elimination of bodily fluids, further impacting thirst distress. Concerning the concept of thirst distress, any factor that raises body temperature can lead to increased water loss and reduced fluid intake, which may significantly exacerbate thirst distress. While many demographic characteristics may not have a definitive correlation with thirst distress, their effects can vary depending on the context of time, place, and target populations. Therefore, it is essential to consider demographic characteristics when planning interventions or studies related to thirst distress. Establishing the relationship between these factors within each environment is crucial for effective planning and should be informed by the results obtained. In this context, HF patients living with a spouse reported lower levels of thirst intensity and distress. As previously mentioned, situational factors—such as environmental or physical conditions—can influence the intensity, timing, quality, and severity of thirst distress symptoms. This suggests that having a supportive companion may play a significant role in alleviating thirst distress and intensity. Moreover, psychological factors can further impact symptoms based on the ToUS; for instance, having a spouse may provide beneficial support. Indubitably, these factors warrant further investigation.

During the sampling process, some individuals may have been reluctant to disclose their substance abuse due to sociocultural concerns within the study setting. As a result, certain patients may not have been accurately diagnosed, leading to issues with the data in this regard. Given that the study participants were inpatients requiring hospitalization due to exacerbations of chronic diseases and other disorders, the presence of comorbidities and their associated treatments could have influenced symptoms, including thirst and its intensity.

Limitations

During the patient selection process for this research, some individuals may have been unwilling to disclose their drug use and addiction due to cultural and social factors. This reluctance can result in inaccuracies in identifying patients who use narcotics, leading to issues with the data concerning addiction or narcotic use. Furthermore, since the research samples were drawn from hospitalized patients, these individuals are often admitted due to the exacerbation of chronic diseases or the emergence of other disorders and illnesses. Consequently, these conditions and their associated treatments may influence the symptoms and their severity, including thirst.

Conclusion

The study findings revealed that HF patients experienced moderate thirst, which was highly distressing. Most patients reported feeling thirsty almost daily (61%) over the past month, with thirst persisting throughout the entire day. To

provide optimal care and treatment for these patients, nurses must first accurately diagnose the condition and then assess and measure its symptoms. Given the high prevalence and distressing nature of thirst in HF patients, nurses should prioritize this symptom in care delivery, employing evidence-based interventions to help alleviate thirst sensation.

Additionally, the study identified several demographic factors that contribute to increased thirst intensity and distress. Nurses are encouraged to consider these factors during patient history-taking to enhance the effectiveness of interventions aimed at reducing thirst.

Acknowledgments

We extend our sincere gratitude to Imam Hossein, Luqman Hakim, and Shahid Modares hospitals for their support and collaboration in this study.

References

1. Groenewegen A, Rutten FH, Mosterd A, Hoes AW. Epidemiology of heart failure. European journal of heart failure. 2020;22(8):1342-1356.
2. Rossignol P, Hernandez AF, Solomon SD, Zannad F. Heart failure drug treatment. Lancet. 2019;393(10175):1034-1044.
3. Felker GM, Mann DL. Heart Failure E-Book: A Companion to Braunwald's Heart Disease. Elsevier Health Sciences; 2014.
4. Ifrim M, Bontaş E, Cochior D, Ţintoiu IC. Right Heart Anatomy: A Short Uptodate. Right Heart Pathology: From Mechanism to Management. 2018:25-56.
5. Shofany C. Quality of life among chronic disease patients. Nursing & Care Open Access Journal. 2017;4(2):385-94.
6. Ponikowski P, Voors AA, Anker SD, et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. Kardiologia Polska (Polish Heart Journal). 2016;74(10):1037-1147.
7. Bonow RO, Mann DL, Zipes DP, Libby P. Braunwald's heart disease e-book: A textbook of cardiovascular medicine. Elsevier Health Sciences; 2011.
8. Dassanayaka S, Jones SP. Recent developments in heart failure. Circulation research. 2015;117(7):e58-e63.
9. Eisen H. Heart failure: a comprehensive guide to pathophysiology and clinical care. springer; 2017.
10. McDonagh TA, Metra M, Adamo M, et al. 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: Developed by the Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC) With the special contribution of the Heart Failure Association (HFA) of the ESC. European heart journal. 2021;42(36):3599-3726.
11. Palazzuoli A, Gallotta M, Quatrini I, Nuti R. Natriuretic peptides (BNP and NT-proBNP): measurement and relevance in heart failure. Vascular health and risk management. 2010;6:411.
12. Ahmadi A, Soori H, Mobasheri M, Etemad K, Khaledifar A. Heart failure, the outcomes, predictive and related factors in Iran. Journal of Mazandaran University of Medical Sciences. 2014;24(118):180-188.
13. Benjamin EJ, Muntner P, Alonso A, et al. Heart disease and stroke statistics—2019 update: a report from the American Heart Association. Circulation. 2019;139(10):e56-e528.
14. Dunlay SM, Roger VL. Understanding the epidemic of heart failure: past, present, and future. Current heart failure reports. 2014;11:404-415.
15. Rotunno R, Oppo I, Saetta G, Aveta P, Bruno S. NSAIDs and heart failure: A dangerous relationship. Monaldi Archives for Chest Disease. Monaldi Arch Chest Dis. 2018 ;88(2):950
16. Desai AS, Stevenson LW. Rehospitalization for heart failure: predict or prevent? Circulation. 2012;126(4):501-506.
17. Bader F, Manla Y, Atallah B, Starling RC. Heart failure and COVID-19. Heart failure reviews. 2021;26(1):1-10.
18. Comín-Colet J, Anguita M, Formiga F, et al. Health-related quality of life of patients with chronic systolic heart failure in Spain: results of the VIDA-IC study. Rev Esp Cardiol (Engl Ed). 2016;69(3):256-271.
19. Waldreus N, Jaarsma T, van der Wal MH, Kato NP. Development and psychometric evaluation of the Thirst Distress Scale for patients with heart failure. European Journal of Cardiovascular Nursing. 2018;17(3):226-234.
20. Eng SH, Waldréus N, González B, et al. Thirst distress in outpatients with heart failure in a Mediterranean zone of Spain. ESC heart failure. 2021;8(4):2492-2501.
21. van der Wal MH, Waldréus N, Jaarsma T, Kato NP. Thirst in patients with heart failure in Sweden, the Netherlands, and Japan. Journal of Cardiovascular Nursing. 2020;35(1):19-25.
22. Waldréus N, Chung ML, van der Wal MH, Jaarsma T. Trajectory of thirst intensity and distress from admission to 4-weeks follow up at home in patients with heart failure. Patient Prefer Adherence. 2018; 12:2223-31.
23. Eng SH, Jaarsma T, Lupón J, et al. Thirst and factors associated with frequent thirst in patients with heart failure in Spain. Heart & Lung. 2021;50(1):86-91.
24. Negro A, Villa G, Greco M, Ciriolo E, Luraschi EL, Scaramuzzi J, et al. Thirst in patients admitted to intensive care units: an observational study. Ir J Med Sci. 2022;191(5):2283-9.
25. Pierotti I, Fracarolli IFL, Fonseca LF, Aroni P. Evaluation of the intensity and discomfort of perioperative thirst. Escola Anna Nery. 2018;22
26. Wefer F, Inkrot S, Waldréus N, Jaarsma T, von Cube M, Kugler C. Translation and Psychometric Evaluation of the German Version of the Thirst Distress Scale for Patients With Heart Failure. Journal of Cardiovascular Nursing. 2022;37(4):378-385.
27. Kara B. Determinants of thirst distress in patients on hemodialysis. International urology and nephrology. 2016;48:1525-1532.
28. Porcu M, Fanton E, Zampieron A. Thirst distress and interdialytic weight gain: a study on a sample of haemodialysis patients. Journal of renal care. 2007;33(4):179-181.
29. Schooling CM, Jones HE. Clarifying questions about "risk factors": predictors versus explanation. Emerg Themes Epidemiol. 2018;15:10.