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ORIGINAL ARTICLE

Thirst in stable heart failure patients; time to reconsider fluid restriction and prescribed diuretics

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Abstract

Aims One of the bothersome symptoms that heart failure (HF) patients can experience is thirst. There are limited data on the association between thirst and fluid intake and clinical variables. Therefore, the aim of this study was to describe severe thirst in stable HF patients and assess factors related to severe thirst, including actual fluid intake and sodium intake.

Methods and results The study had a cross-sectional design. Stable HF patients from two HF clinics in the Netherlands were included and assessed thirst by a visual analogue scale ranging from 0 to 100. They also completed questionnaires on thirst distress, self-care behaviour, and HF symptoms. A 3 day food diary was completed to assess actual fluid intake and sodium intake. Finally, patients collected urine for 24 h. Patients were divided into severe and low thirst based on thirst score and thirst distress. *T*-tests, Mann–Whitney tests, and χ^2 tests were conducted to assess differences between both groups. Multivariable logistic regression analysis was performed to assess factors associated with severe thirst. A total of 100 patients were included (40% female, mean age 72 ± 12) of which 68 completed the food diary. The mean thirst score was 28 ± 25, and 25% experienced severe thirst. The majority of patients (94%) were prescribed a fluid restriction, 37% had a restriction between 1500 and 2000 mL, and 32% a restriction of 1500 mL. Severe thirst in the total group with 100 patients was associated with a higher dose of loop diuretics [odds ratio (OR) 3.25; 95% confidence interval (CI) 1.01–10.45; P = 0.048] and a higher urine output over 24 h (OR 1.002; 95% CI 1.00–1.003; P = 0.010). In the group of patients who completed the food diary (N = 68), severe thirst was associated with a higher sodium intake (OR 1.002; 95% CI 1.001–1.003; P = 0.003), a higher dose of loop diuretics (OR 22.69; 95% CI 2.78–185.04; P = 0.004), and more fatigue (OR 11.2; 95% CI 1.54–82.12; P = 0.017).

Conclusions A quarter of all stable HF patients experienced severe thirst. A higher dose of loop diuretics was associated with more thirst; therefore, it might be important to review the dose of loop diuretics critically and try to decrease it in order to relieve severe thirst. Because all patients were prescribed a fluid restriction, a reconsideration of this restriction is also suggested.

Keywords Thirst; Heart failure; Fluid restriction; Sodium intake

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Introduction

Treatment of patients with heart failure (HF) has improved substantially and resulted in improved survival rates.[1] However, many HF patients experience poor quality of life with symptoms of fatigue, dyspnoea, and periods of fluid retention.[1–3] In addition, bothersome symptoms that HF patients may experience are for example depressive symptoms, lack of appetite, and thirst.[4–6] Thirst can be described as 'a deep sensation or desire for water that cannot be ignored and causes a powerful behavioural strive to drink water'.[7] Severe thirst is a troublesome symptom, which can decrease the quality of life and can cause distress.[5,8,9]

From limited data in small studies on thirst in HF patients, it is found that thirst can be related to the HF treatment, for example the HF regimen (dose of diuretics or prescribed fluid restriction) and the severity of the disease.[5] Furthermore, stable HF patients experienced less thirst compared with patients with worsening HF, and their thirst intensity might change in different stages of optimization of HF medication.[10]

It is also described that thirst can be related to other HF symptoms, and in one small study, thirst was related to the level of anxiety.[5] There is an ongoing debate on the role of a fluid restriction in HF management.[11] However, in most of the studies on thirst, the prescribed fluid restriction was taken into account, and only in a limited number of studies, the actual fluid intake was assessed.[12,13]

There is only scarce data about the relationship between (severe) thirst, actual fluid intake, and other variables that can be related to thirst in a stable HF population.

Therefore, the aim of the present study was (1) to describe severe thirst in stable, ambulatory HF patients and (2) to assess factors related to severe thirst, including fluid intake and sodium intake in a stable HF outpatient population. In addition, urinary 24 h volumes and sodium were analysed.

Methods

A cross-sectional study was conducted in two outpatient HF clinics (Hospital Group Twente in Almelo and Hengelo) in the Netherlands. Patients were recruited from January 2017 to November 2018. Inclusion criteria were having a diagnosis of chronic HF in New York Heart Association (NYHA) functional classes II–IV, in a stable condition (defined as no admission, Emergency Room visit, or change in loop diuretics 4 weeks before inclusion), older than 18 years, and able to read and write in Dutch. Important exclusion criteria were included in another (medication) trial, on haemodialysis, or on the waiting list for heart transplantation.

Patients received written information about the study a week before their visit at the HF clinic. After further oral information at the HF clinic, they signed written informed consent.

All patients assessed thirst on a visual analogue scale (VAS) ranging from 0 (*no thirst*) to 100 (*worst possible thirst*). Thirst distress was measured with the Thirst Distress Scale-HF, a validated questionnaire consisting of nine statements about thirst.[14] Patients were asked to rate the items from 1 (*strongly disagree*) to 5 (*strongly agree*).

The 9-item European Heart Failure Self-care Behaviour Scale was used to measure self-care behaviour, including behaviours like restricting fluid intake, regular exercise, or consulting behaviour.[15] Patients also assessed whether or not they experienced the following HF symptoms (yes/no): oedema, dyspnoea, fatigue, sleeping problems, and cough.

For the assessment of fluid intake and sodium intake, patients were asked to complete a food diary for three consecutive days (with 1 day during the weekend), writing down everything they ate or drank. Finally, they were asked to collect urine for 24 h.

Baseline characteristics were collected from the patients' medical chart, and HF symptoms were self-reported by the patient. The dose of loop diuretics was calculated as an equivalent dose of furosemide.

The Medical Ethical Committee of the University Medical Centre Groningen in the Netherland stated that no additional approval of the committee was needed (METC 2016/229).

Analysis

Descriptive statistics were used to characterize the study population. Patients were divided into severe thirst and low thirst, where severe thirst was defined as a VAS score on thirst above 49 (mean theoretical score of the scale) and/or if patients (strongly) agreed with statement 8 of the Thirst Distress Scale ('I am so thirsty I could drink water uncontrollably').

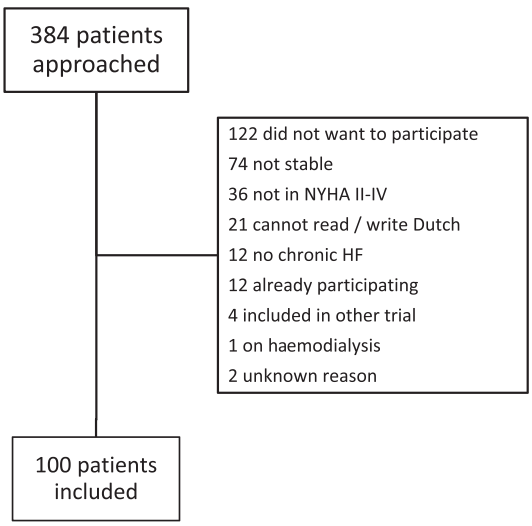
The food diary was analysed by one of the co-authors (LJ) using a special programme of the Dutch Nutrition Centre ('Eetmeter') to calculate nutrients.

Normality of continuous variables was assessed by Kolmogorov–Smirnov. To assess differences between patients with severe and low thirst, χ^2 tests and *t*-tests were conducted. For continuous variables that were not normally distributed, Mann–Whitney tests were used. Multivariable logistic regression analyses were performed to assess which variables were independently related to severe thirst. Variables with a $P < 0.05$ were inserted in the regression model.

SPSS Statistics 23 was used for all analyses

Because there was limited time for the study, we decided with both HF clinics that 100 patients should be included in

Figure 1 Approached and included patients in the study.



this observational study. Therefore no formal power calculation was performed.

All analyses were performed for the total group of patients (N = 100) and separately for patients who completed a food diary (N = 68).

Results

A total of 384 patients were approached to participate in the study of which 100 gave informed consent and were included in the study. The main reasons for exclusion were that patients did not want to participate (43%), were not in a stable condition (26%), or were not in NYHA-functional classes II–IV (13%) (*Figure 1*).

The mean age of the study population was 72 ± (standard deviation) 12 years, 40% were female and most of the patients were in NYHA-functional class II (74%; N = 74). The mean dose of loop diuretics was 63 ± 51 mg of furosemide; one-third of the patients were prescribed more than 40 mg of furosemide/day. The mean dose of mineralocorticoid receptor antagonist was 21 ± 11 mg. There were only two patients who used another diuretic.

In total, 68 patients completed a food diary. There were no significant differences in age, gender, and NYHA-functional

Table 1 Characteristics of all HF patients in the study (N = 100)

	All patients (N = 100)	Severe thirst (N = 25)	Low thirst (N = 75)	P value
Age ± SD	72 ± 12	72 ± 13	72 ± 11	NS
Female sex	40% (40)	32% (8)	43% (32)	NS
Thirst score ± SD	28 ± 25	53 ± 29	18 ± 15	<0.01
NYHA class				
II	74% (74)	68% (17)	76% (57)	NS
III–IV (>NYHA II)	23% (23)	28% (7)	21% (16)	
LVEF ± SD	39 ± 13	40 ± 18.2	39 ± 11.8	NS
LVEF < 40%	53%	48% (12)	55% (41)	NS
LVEF > 40%	38%	40% (10)	37% (28)	
Ischaemic heart disease	45% (45)	36% (9)	48% (36)	NS
HF symptoms				
Dyspnoea at rest	20% (20)	36% (9)	15% (11)	NS
Dyspnoea exercise	67% (67)	80% (20)	63% (47)	NS
Fatigue	39% (39)	64% (16)	31% (23)	0.015
Sleeping problems	26% (26)	36% (9)	23% (17)	NS
Total HF symptoms ± SD	2.0 ± 1.5	2.5 ± 1.5	1.8 ± 1.5	0.058
BMI (kg/m^2) ± SD	27.8 ± 4.9	28.1 ± 5.4	27.6 ± 4.8	NS
Diabetes type 1	8% (8)	12% (3)	7% (5)	NS
Diabetes type 2	30% (30)	36% (9)	28% (17)	NS
COPD	17% (17)	20% (5)	16% (12)	NS
Stroke	10% (10)	4% (1)	12% (9)	NS
Dose furosemide				
Total dose (mg) ± SD	63 ± 51	86 ± 81	53 ± 26	0.049
≤40 mg/day	65% (65)	44% (11)	72% (54)	0.014
>40 mg/day	34% (34)	56% (14)	27% (20)	
Total dose MRA (mg)	21 ± 11	21 ± 12	20 ± 11	NS
Prescribed ARB/ARNI	38% (39)	32% (8)	41% (31)	NS
Prescribed fluid restriction	94% (94)	96% (24)	93% (70)	NS
Fluid restriction 1500 mL	32% (32)	32% (8)	32% (24)	NS
Fluid restriction 1500–2000 mL	37% (37)	36% (9)	37% (28)	NS
I limit my fluid intake (EHFSCBS-5)				
Totally agree/agree	79% (79)	76% (19)	80% (60)	NS
Prescribed sodium restriction	97% (97)	100% (25)	96% (72)	NS
I eat a low salt diet (EHFSCBS-7)				
Totally agree/agree	79% (79)	80% (20)	79% (59)	NS
Glucose (blood) (mmol/L) ± SD	7.0 ± 3.3	7.6 ± 4.4	6.8 ± 2.9	NS
Sodium (blood) (mmol/L) ± SD	140 ± 2.8	140 ± 2.8	140 ± 2.7	NS
Potassium (blood) (mmol/L) ± SD	4.6 ± 0.6	4.4 ± 0.6	4.6 ± 0.6	NS
Creatinine (blood) (μmol/L) ± SD	111.4 ± 39.9	108.8 ± 40.3	112.3 ± 40	NS
Urea (blood) (mmol/L) ± SD	10.7 ± 5.7	11.5 ± 7.1	10.4 ± 5.2	NS
NT-proBNP (blood) (pmol/L) ± SD	209 ± 243	203 ± 205	211 ± 256	NS
eGFR (blood) (mL/min/1.73 m$^{2)}$ ± SD	55.1 ± 18.3	58.7 ± 19.7	54 ± 18	NS
Urine total mL/24 h ± SD	1755 ± 534	2043 ± 599	1655 ± 474	<0.01
Sodium (urine) mmol/24 h ± SD	121.6 ± 55.1	134 ± 64	117.3 ± 51.4	NS

ARB, angiotensin receptor blocker; ARNI, angiotensin receptor neprilysin inhibitor; BMI, body mass index; COPD, chronic obstructive pulmonary disease; eGFR, estimated glomerular filtration; EHFSCB, European Heart Failure Self-Care Behaviour Scale; HF, heart failure; LVEF, left ventricular ejection fraction; MRA, mineralocorticoid receptor antagonist; NT-proBNP, amino-terminal-pro brain natriuretic peptide; NYHA, New York Heart Association Functional class; SD, standard deviation.

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class between patients who completed the food diary and those who did not. The mean thirst score of the 100 patients in the study was 28 ± 25 (VAS 0–100); patients who had severe thirst had a mean score of 53 ± 29 (*Table 1*).

The majority of patients (94%) were prescribed a fluid restriction; 37% had a restriction between 1500–2000 mL and 32% a restriction of 1500 mL. Almost all of them (97%) also were prescribed a sodium restriction. Most of the patients (79%) reported to adhere to these prescriptions and reported to limit their fluid intake and eat a low salt diet (*Table* 1). Data of the HF patients who completed the food diary (*N* = 68) are presented in *Table* 2.

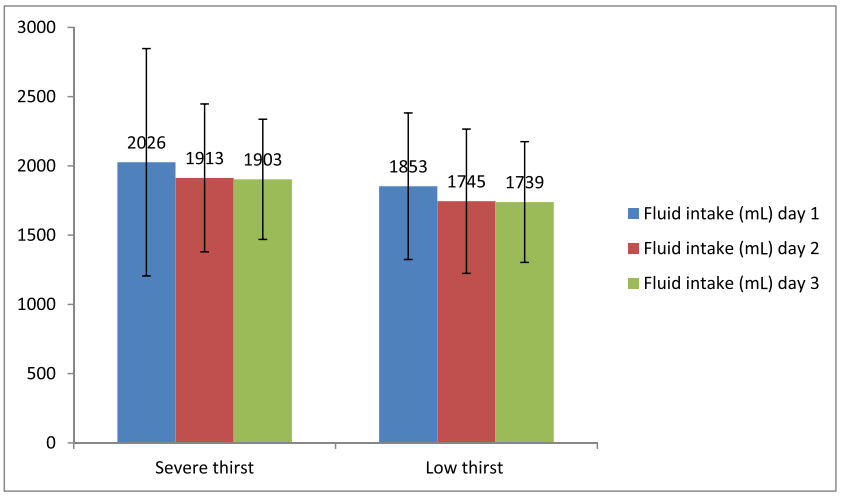
The mean fluid intake of patients who completed a food diary (*N* = 68) was 1823 ± 459 mL and the mean sodium intake was 2168 ± 958 mg. The mean fluid intake of patients with severe and low thirst is presented in *Figure 2*.

Table 2 Characteristics of HF patients who completed a food diary (*N* = 68)

	All patients (*N* = 68)	Severe thirst (*N* = 16)	Low thirst (*N* = 52)	
Age ± SD	72 ± 11	71 ± 14	72 ± 11	NS
Female sex	38% (26)	25% (4)	42% (22)	NS
Thirst score ± SD	28 ± 23	50 ± 27	20 ± 15	<0.01
NYHA class				
II	77% (52)	75% (12)	77% (40)	NS
III–IV (>NYHA II)	21% (14)	19% (3)	21% (11)	
BMI (kg/m^2) ± SD	27.8 ± 5.3	27.6 ± 5.9	27.9 ± 5.1	NS
LVEF ± SD	39 ± 13.5	38 ± 15.3	39 ± 13.1	NS
LVEF < 40%	50% (34)	50% (34)	56% (9)	NS
LVEF > 40%	43% (29)	43% (29)	37% (6)	
Ischaemic heart disease	47% (32)	44% (7)	48% (25)	NS
HF symptoms				
Dyspnoea at rest	16% (11)	38% (6)	10% (5)	0.020
Dyspnoea exercise	75% (51)	88% (14)	71% (37)	NS
Fatigue	38% (26)	63% (10)	31% (16)	0.030
Sleeping problems	31% (21)	38% (6)	26% (15)	NS
Total HF symptoms ± SD	1.9 ± 1.3	2.5 ± 1.5	1.7 ± 1.2	NS
Diabetes type 1	4% (3)	0% (0)	6% (3)	NS
Diabetes type 2	26% (18)	31% (5)	25% (13)	NS
COPD	13% (9)	19% (3)	12% (6)	NS
Stroke	10% (7)	6% (1)	12% (6)	NS
Dose furosemide				
Total dose (mg) ± SD	64 ± 57	95 ± 93	51 ± 26	0.014
<40 mg/day	69% (47)	38% (6)	79% (41)	0.004
>40 mg/day	31% (21)	63% (10)	21% (11)	
Total dose MRA (mg) ± SD	20 ± 10	20 ± 6	21 ± 11	NS
Prescribed ARB/ARNI (yes)	44% (30)	38% (6)	46% (24)	NS
Prescribed fluid restriction	97% (66)	100% (16)	96% (50)	NS
Fluid restriction 1500 mL	37% (25)	44% (7)	35% (18)	NS
Fluid restriction 1500–2000	38% (26)	37% (6)	38% (20)	NS
I limit my fluid intake (HFSCBS-5)				
Totally agree/agree	88% (60)	88% (14)	88% (46)	NS
Fluid intake Day 1 ± SD	1894 ± 608	2026 ± 821	1853 ± 529	NS
Fluid intake Day 2 ± SD	1785 ± 525	1913 ± 534	1745 ± 521	NS
Fluid intake Day 3 ± SD	1777 ± 438	1903 ± 434	1739 ± 436	NS
Mean fluid intake in mL/24 h (3 days) ± SD	1823 ± 459	1944 ± 475	1785 ± 451	NS
Prescribed sodium restriction	99% (67)	100% (16)	98% (51)	NS
Sodium intake Day 1 ± SD	2214 ± 1214	2221 ± 908	2211 ± 1301	NS
Sodium intake Day 2 ± SD	2174 ± 905	2345 ± 765	2120 ± 944	NS
Sodium intake Day 3 ± SD	2168 ± 958	2773 ± 1072	1987 ± 852	0.004
Mean sodium intake in mg/24 h (3 days) ± SD	2180 ± 691	2435 ± 666	2100 ± 686	0.048
I eat a low salt diet (HFSCBS-7)				
Totally agree/agree	85% (58)	87% (14)	85% (58)	NS
Glucose (blood) (mmol/L) ± SD	6.6 ± 2.6	6.5 ± 2.3	6.6 ± 2.7	NS
Sodium (blood) (mmol/L) ± SD	140 ± 2.8	140.7 ± 2.5	139.7 ± 2.8	NS
Creatinine (blood) (μmol/L) ± SD	109 ± 38	100 ± 25	112 ± 41	NS
Potassium (blood) (mmol/L) ± SD	4.6 ± 0.6	4.4 ± 0.5	4.7 ± 0.5	0.046
Urea (blood) (mmol/L) ± SD	10.4 ± 4.8	10.3 ± 4.5	10.2 ± 5.0	NS
NT-proBNP (blood) (pmol/L) ± SD	184 ± 170	200 ± 209	180 ± 158	NS
eGFR (blood) (mL/min/1.73 m^2) ± SD	56 ± 18	64 ± 17	54 ± 18	NS
Urine total mL/24 h ± SD	1824 ± 549	2216 ± 589	1700 ± 478	0.003
Sodium (urine) (mmol/24 h) ± SD	127.4 ± 57.2	148.1 ± 68	120.8 ± 52	NS

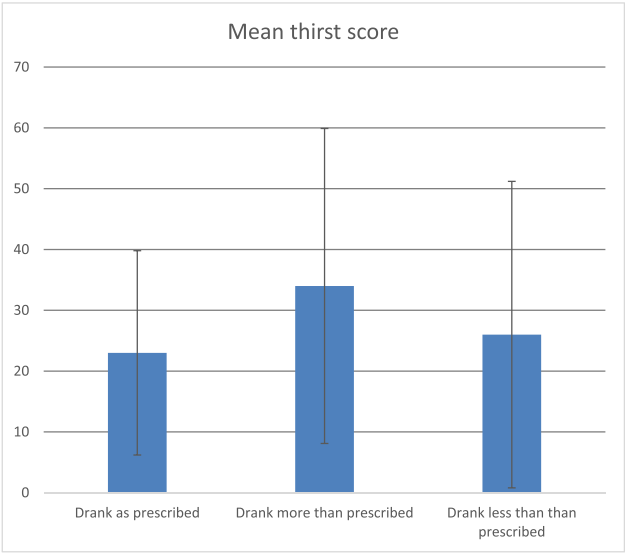
ARB, angiotensin receptor blocker; ARNI, angiotensin receptor neprilysin inhibitor; BMI, body mass index; COPD, chronic obstructive pulmonary disease; eGFR, estimated glomerular filtration; EHFSCB, European Heart Failure Self-Care Behaviour Scale; HF, heart failure; LVEF, left ventricular ejection fraction; MRA, mineralocorticoid receptor antagonist; NT-proBNP, amino-terminal-pro brain natriuretic peptide; NYHA, New York Heart Association Functional class; SD, standard deviation.

Figure 2 Mean fluid intake of heart failure patients with severe and low thirst (*N* = 68). Severe thirst = thirst grading > 50 or agreed with statement 'I am so thirsty I could drink water uncontrollably'; Low thirst = thirst grading < 50 or disagreed with 'I am so thirsty I could drink water uncontrollably'.



Severe thirst = thirst grading ≥ 50 or agreed with statement 'I am s thirsty I could drink I am so thirsty I could drink water uncontrollably'; *Low thirst = thirst grading < 50 or disagreed with 'I am s thirsty I could drink* I am so thirsty I could drink water uncontrollably'

Figure 3 Mean thirst score of heart failure patients who were adherent and non-adherent to the prescribed fluid restriction.



We compared the mean fluid intake with the prescribed restriction and found that 62% (*N* = 42) of the patients were non-adherent to their prescribed restriction, 43% (*N* = 29) drank more than their restriction, and 19% (*N* = 13) drank less than the prescription (refer to *Figure 3*). Patients who drank more than the prescribed fluid restriction were more thirsty compared with patients who were adherent or drank less than their prescription. Patients who were adherent (*N* = 23) had a mean thirst score of 23 ± 17. Non-adherent patients who drank more than the prescribed fluid restriction had a thirst score of 34 ± 26, and those who drank less than their restriction had a score of 26 ± 25. These differences however were not statistically significant.

Finally, we compared the mean sodium intake with the prescribed restriction, which was a maximum of 2400 mg sodium for all patients in the study. Most of the patients (77%) were adherent to this restriction. Adherent patients had a mean thirst score of 29 ± 25 compared with 28 ± 25 of patients who were non-adherent, which was not statistically significant.

Factors associated with severe thirst in the total study population (*N* = 100)

Patients with severe thirst had a significantly higher thirst score 53 ± 29 compared with patients with low thirst (28 ± 23). Patients with severe thirst also were prescribed with a higher dose of loop diuretics and suffered more often from fatigue (64% vs. 31%; *P* = 0.015). Finally, they had a higher amount of urine output over 24 h (2043 ± 599 mL; vs. 1655 ± 474 mL; *P* < 0.01) There were no significant differences in 24 h urinary sodium excretion and other clinical variables between the two groups.

In a multivariable logistic regression analysis, only a higher dose of loop diuretics [odds ratio 3.25; 95% confidence interval (CI) 1.01–10.45; *P* = 0.048] and the total amount of urine output (odds ratio 1.002; 95% CI 1.000–1.003; *P* = 0.010) remained statistically significant (*Table 3*), meaning that

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Table 3 Variables independently associated with severe thirst in patients with heart failure ($N = 100$)

	Odds ratio	95% Confidence interval	*P* value
Higher dose of loop diuretics	3.25	1.01–10.45	0.048
Total amount of urine/24 h	1.002	1.000–1.003	0.010
Fatigue	3.33	0.99–11.09	0.051

Table 4 Variables independently associated with severe thirst in patients with heart failure ($N = 68$)

	Odds ratio	95% Confidence interval	*P* value
Higher dose of loop diuretics	22.69	2.78–185.04	0.004
Sodium intake	1.002	1.001–1.003	0.003
Fatigue	11.2	1.54–82.12	0.017

'Dyspnoea at rest' and 'Total amount of urine/24 h' were not significant in multivariable analysis.

patients with severe thirst were prescribed more loop diuretics and urinated more compared with patients with a low thirst score.

Factors associated with real thirst in patients who completed the food diary ($N = 68$)

There were 68 patients who completed a food diary. Patients with severe thirst had a higher dose of loop diuretics and a higher sodium intake on one of the 3 days (2773 vs. 1987; $P < 0.01$). They also experienced more often dyspnoea at rest (38% vs. 10%; $P = 0.020$) and fatigue (63% vs. 31%; $P = 0.03$). Twenty-four hours urinary sodium excretion was higher in patients with severe thirst, although urinary sodium excretion was not significantly different between the two groups.

In a multivariable logistic regression analysis, severe thirst remains independently associated with a higher dose of loop diuretic (odds ratio 22.7; 95% CI 2.78–185.0; $P = 0.004$), a higher sodium intake (odds ratio 1.002; 95% CI 1.001–1.003; $P = 0.003$) and more fatigue (odds ratio 11.2; 95% CI 1.54–82.12; $P = 0.017$) (*Table 4*).

Discussion

This is the first study that examines thirst in HF patients and the association with registered fluid intake and sodium intake as well as with other clinical and demographic characteristics.

We found that a quarter of all patients suffered from severe thirst. A study of Eng *et al.*[16] even found a higher percentage of HF patients (47%) that were frequently thirsty with a median thirst score on the VAS scale of 50, although patients in that study were younger (mean age 67 compared with 72 in our study) and were recruited in a Mediterranean area. Patients in our study were included in 23 months, so there was not a specific season in which data were collected. Therefore, a seasonal or weather effect in our study is not expected.

Patients with severe thirst in our study were prescribed a higher dose of loop diuretics, produced a higher amount of urine in 24 h, had a higher sodium intake on 1 day and more often suffered from fatigue then patients with low thirst. Also urinary sodium excretion was higher, although not statistically significant.

Higher dose of diuretics might be an indication for more severe HF, although we did not find differences in NYHA-functional class or renal function between both groups. The association between thirst and dose of diuretics was also found in other studies.[16,17]

We found an association between severe thirst and actual sodium intake, although this was only for 1 day of the food diary. All patients in the study were advised to restrict their sodium intake, mostly to a maximum of 6 g salt (2400 mg sodium). The majority of patients (85%) reported to eat a low salt diet. The recommended sodium intake and the self-reported restriction of sodium in the food did correspond to the mean sodium intake in patients who completed the food diary for 3 days, which was 2180 mg per day. This is lower compared with the mean sodium intake of the total Dutch population of 9 g salt (3600 mg sodium).[18]

In a study on thirst in three different countries, Japanese patients reported that the intake of salt and spicy food was the main reason for their thirst.[17] The mean salt intake in Japan however, was much higher (10–14 g salt/day) than in the Netherlands.[19]

We also found that patients with severe thirst less often were prescribed an angiotensin receptor blocker (ARB) or angiotensin receptor neprilysin inhibitor, although these differences were not statistically significant. It is suggested that an ARB, leading to an inhibition of the angiotensin-II, also inhibits the thirst centre in the brain, leading to less thirst. Eng *et al.*[16] found this association between thirst and prescribed ARB.

We expected to find an association between fluid restriction and thirst, because we previously described such a relationship that was also found in other studies.[12,13,16,17] However, almost all patients in our study (97%) were advised to limit their fluid intake. The majority of the patients (79%) also reported to limit their fluid intake although data of the food diary showed that many patients did not adhere to the prescription. Patients with severe thirst did have a higher mean fluid intake, probably because of their thirst, compared with those with low thirst (1785 mL vs. 1944 mL). This difference, however, was not statistically significant. There were also no significant differences in thirst between adherent and non-adherent patients, but this was probably due to the small sample size.

Although all patients in our study were in a stable condition due to the inclusion criteria and 74% of the patients were in NYHA-functional class II, remarkably, almost all patients were prescribed a fluid restriction.

In the ESC Heart Failure Guidelines at the time of this study,[1] a fluid restriction of 1500–2000 mL is not recommended routinely but could be considered, only in those patients with severe HF to relieve symptoms and congestion. In daily practice, however, a fluid restriction is still often prescribed, and moreover, many stable HF patients are still advised to limit their fluid intake.

We did not find an association between severe thirst and other demographic or clinical variables, for example age, diabetes, or renal function, which also can cause more thirst.

We realize that there could be other variables that might influence the severity of thirst in HF patients. However, this is the first study in which the actual fluid and sodium intake is related to thirst in HF patients. In future studies, it will be important to verify our findings in other populations, where food intake and weather conditions should be taken into account.

Although we found some associations with severe thirst in HF patients, notably, there is not a specific profile of the 'severe thirsty patient'. Only the dose of loop diuretics was significantly related to thirst. When we aim to decrease this severe thirst in a stable HF population, it is advocated to review critically the dose of prescribed diuretics and try to decrease the dose if possible. Another option to decrease severe thirst is to consider whether a fluid restriction is necessary for all stable patients. If a fluid restriction is really needed, a more liberal intake of 30 to 35 mL/kg of body weight might cause less thirst as was found in the study of Waldréus *et al*.[10] Although a stringent sodium restriction did not prevent fluid overload and adverse outcomes in patients with HF as was recently found in the SODIUM-HF study,[20] some restriction of sodium intake and spicy food can be an intervention to prevent symptoms of thirst as some patients themselves suggested in another study.[18]

Strengths and limitations

This observational study has provided detailed clinical and laboratory data, including analysis of 24 h urine collection. In the majority of HF patients, also food diaries for three consecutive days were collected. Thirst distress and self-care behaviour were quantified by specific scales. However, several limitations should be mentioned. The cross-sectional study did not provide follow-up data on HF management and outcomes. Finally, the sample size of patients who completed the food diary was rather small (68), and therefore, it is possible that we did not found all factors associated with severe thirst.

Conclusion and implications for daily practice

In this study, we found that a quarter of HF patients experienced severe thirst, which was associated with a higher dose of diuretics, HF symptoms, and more urine production.

In daily practice, it is important to realize that thirst is an important problem for HF patients. To decrease this troublesome symptom, it might be advocated to review timely the dose of diuretics. It is also suggested to reconsider a fluid restriction and adapt it to a more liberal intake.

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Conflict of interest

All authors declared no conflict of interest.

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