Published in final edited form as:

J Card Fail. 2006 October ; 12(8): 628. doi:10.1016/j.cardfail.2006.07.007.

Gender differences in adherence to the sodium-restricted diet in patients with heart failure

Misook L. Chung, PhD, RN,

Assistant Professor, University of Kentucky, College of Nursing, Lexington, Kentucky

Debra K. Moser, DNSc, RN, FAAN,

Professor and Gill Chair of Nursing, University of Kentucky, College of Nursing, Lexington, Kentucky

Terry A. Lennie, PhD, RN,

Associate Professor, University of Kentucky, College of Nursing, Lexington, Kentucky

Linda Worrall-Carter, PhD, RN,

Senior Research Fellow, Deakin University School of Nursing/ Box Hill Hospital Partnership, Melbourne, Australia

Brooke Bentley, MSN, RN,

Doctoral student, University of Kentucky, College of Nursing, Lexington, Kentucky

Robin Trupp, MSN, APRN, BC, CCRC, CCRN, and

Doctoral student, Ohio State University, College of Nursing, Columbus, Ohio

Deborah S. Armentano, MS, RN, CNS, CCRN

Outcome Manager, Riverside Methodist Hospital, Columbus, Ohio

Abstract

Background—Despite the importance of the sodium restricted diet (SRD) to heart failure (HF) management, patient adherence is poor. Little is known about gender differences in adherence or factors that affect patients' ability to follow SRD recommendations. The purposes of this study were to determine whether there were gender differences in (1) adherence to the SRD; (2) knowledge about SRD and HF self-care; and (3) perceived barriers to following the SRD.

Methods and Results—Forty-one men and twenty-seven women completed the Heart Failure Attitudes and Barriers questionnaire that measured HF self-care, knowledge and perceived barriers to following a SRD. Diet adherence was measured by 24-hour urinary sodium excretion (UNa). Women were more adherent to the SRD than men as reflected by 24-hour urine excretion (2713 vs. 3859 mg UNa, $p=.01$). Women recognized signs of excess sodium intake such as fluid build-up ($p=.001$) and edema ($p=.01$) more often than men and had better understanding of appropriate actions to take related to following a SRD. There were no gender differences in perceived barriers to following a SRD.

Conclusions—Although men and women perceived similar barriers, women were more adherent to the SRD and had greater knowledge about following a SRD. Further investigation of this phenomenon is warranted to determine if better adherence contributes to improved outcomes in women.

Keywords

Women; Knowledge; Barrier

Introduction

Despite advances in the medical management of heart failure (HF) in the past two decades, readmission rates remain high. Rehospitalization rates for HF exacerbations range from 25% to 60% within 3 to 12 months of discharge.¹⁻³ Investigators who have examined reasons for HF rehospitalizations consistently have demonstrated that sodium retention related to excess sodium intake is a major precursor to hospitalization.⁴⁻¹⁰

Although adherence to the recommended HF regimen is important for better HF patient outcomes, many patients find adherence difficult.¹¹ Adherence to the sodium restricted diet (SRD) recommendation has been reported to be as low as 22% to 55%.^{6, 7, 12} There are gender differences in many aspects of HF, including possibly better outcomes in women.^{13, 14} Little is known, however, about gender differences in adherence or factors that affect patients' ability to follow recommendations for a SRD. Accordingly, the purposes of this study were to determine whether there were gender differences in (1) adherence to the SRD; (2) knowledge about SRD and HF self-care; and (3) perceived barriers to following the SRD.

Method

Study design, participants, and setting

This was a comparative examination of gender differences in adherence to the SRD among patients with HF. The participants were recruited using a non-random, convenience sampling method. Patients were referred to the study by clinicians practicing in the two HF outpatient clinics in the medical centers of the University of Kentucky and the Ohio State University in United States and one HF outpatient clinic in the medical center in Australia. These sites are selected in convenience sampling but clinicians at these sites routinely recommended a 2000mg SRD. Eligible patients had a confirmed diagnosis of chronic HF, no history of acute myocardial infarction within 3 months of enrollment, no cognitive impairment, and were on stable doses of HF medications. Heart failure patients who had poorly controlled diabetes, cancer, severe thyroid, liver or renal disease were excluded.

Procedure

The study was approved by the Institutional Review Boards at each site. When patients were referred to the investigators by cardiologists and nurse practitioners, the research assistant contacted and explained the study to the eligible patient in the clinic. Since patients in this study also collected information about nutrition using a food diary, after receiving permission to visit her home, investigators traveled to patients' homes to obtain a signed informed consent and to provide detailed instruction of 24-urine collection and food diary. When patients who lived in long distance or who don't want a home visit, they signed the consent form and received detailed instruction of the study in the clinic and took the equipments home. When patients completed the collection of 24-hour urine, patients visited to the participating General Clinical Research Center in the morning with a collected urine jug. During the GCRC visit, patients completed a series of questionnaires and a research assistant reviewed questionnaires to assure completeness and confirmed the 24-hour urine collection. Patients' medical records were reviewed to obtain clinical characteristics.

Measures

Adherence to the SRD—Objective evidence of adherence to a SRD was determined by 24-hour urinary sodium excretion (24-h UNa). The 24-h UNa reflects a dietary sodium intake within 24-hours. The 24-hour urine collection has been shown as an unbiased, reliable and validated measure of sodium intake when it was verified for their completeness by urine recovery of oral doses of para-amino benzoic acid method.^{15, 16} It's been also reported that within individuals daily variation of sodium excretion is 30% in a 24-hour urine¹⁷ and the sodium excretion may be affected by diuretics and angiotensin-converting enzyme inhibitor.^{18, 19} Although there is lack of independence of the measurement errors in diary record, the sodium excretion in 24-hour urine collection was moderately correlated with sodium intake in food diary ($r = 0.30 - 0.45$).^{20, 21} The 24-h UNa has been used as a validated measure of adherence of low sodium diet^{20, 22} and a predictor of cardiovascular mortality and the effect of SRD intervention.²³⁻²⁵ To reduce measurement errors in this study, patients received a detailed instruction with a written instruction form and asked to write down the time of urination and amount of urine. During the urine collection, the urine was kept in the container in cool area. When patients brought the urine container, a research assistant reviewed the completed 24-hour urine collection with patients. A normal urinary sodium level is 40 to 120 mEq/L/day. In order to compare urine sodium to recommend 2000 mg sodium intake, urine sodium excretion in mmol was converted to mg ($\text{mg} = \text{mmol} \times 22.99$). Adherence was defined as a 24-hour urine sodium level of 86 mmol which is equivalent to 2000 mg.

Knowledge and barriers—Patients' knowledge about HF and self-care strategy and perceived barriers of adherence to a SRD was assessed using the Dietary Sodium Restriction Questionnaire (DSRQ).²⁶ The DSRQ solicits information about knowledge, attitudes, barriers related to following the SRD, along with additional information about adherence and prescription of the SRD from healthcare providers. In this study, we used individual items from the DSRQ to assess knowledge about HF, HF self-care, and patients' perceived barriers to following a SRD. Each item is rated on a 5-response scale with referent anchors of strongly agree and strongly disagree or not at all to a lot. Using the DSRQ patients indicate their perceptions of the type of diet they were prescribed and the instructions received from health care providers, and their frequency (4-response; never, sometimes, most times, and always) and difficulty following a SRD (4-response; very hard, hard, easy, and very easy). The DSRQ is a reliable and valid measure that can be used as individual items as we did in this study.

Sociodemographic and clinical characteristics—Sociodemographic and clinical characteristics including gender, age, marital status, education level, presence of co-morbidities, medications, New York Heart Association (NYHA) functional classification, and left ventricular ejection fraction were collected using patient interview and medical record review.

Data Analysis

All data were analyzed using SPSS software, version 11.5. Sociodemographic and clinical characteristics were compared between men and women using independent t-tests, ANOVA, or chi-square appropriate to the level of measurement. An independent t-test was used to determine whether there were gender differences in adherence to the SRD. Mann-Whitney U was used to determine whether there were gender differences in knowledge and barriers to following a SRD. Because all knowledge and barriers were assessed on 5-response scale, we use separated non-parametric statistics of Mann-Whitney U tests for each barrier. To further explore potential gender differences in adherence, 2×2 factorial ANOVA was used to determine whether gender interacted with knowledge and barriers to following the SRD to produce a differential effect on adherence to the SRD. The dependent variable was the 24-hour UNa. Individual knowledge variables were regrouped into the knowledgeable and the not-

knowledgeable groups and entered as independent variables with gender in the separated 2×2 factorial ANOVA. Individual barrier variables were regrouped into no barrier (score =1) and yes barrier (score>1) and were entered as independent variable with gender in the separated 2×2 factorial ANOVA.

With the sample size of 68 in this study, the power of the independent sample t-test to detect the mean differences of 24-h UNa at alpha = 0.05 was 77% based on unequal variance.²⁷

Results

Participant characteristics

A total of 68 patients (53 Americans and 15 Australians) were enrolled in this study. Patients' sociodemographic characteristics (i.e. age, gender, marital status, and education) did not differ among sites. American participants (n = 53) were not different from Australian (n=15) in gender, marital status, education, and hypertension history but American were younger (60 vs. 72 years, $p < .05$) and had more diabetes (41% vs. 13%, $p < .05$). The 24-h UNa were similar in American and Australian (3470 ± 1817 vs. 3168 ± 1710 mg, $p = .57$). Mean ejection fraction was 30% (SD = 12.9%) and 49% of patients were rated as New York Heart Association (NYHA) functional class III and IV. Women (n = 27) and men (n = 41) had similar sociodemographic (i.e., age, education, marital status, ethnicity) and clinical characteristics (i.e., history of hypertension and diabetes, body mass index, and drugs), with the exception that women had a higher ejection fraction than men (35.3 % vs. 27.8 %, $p < .01$) (Table 1).

Adherence to the SRD

Mean 24-hour urinary sodium excretion was 3404 ± 1786 mg. As determined by urine sodium excretion, 28% had sodium intakes at or below 2000 mg per day (Figure 1), while 35% had urine sodium that indicated a daily sodium intake of more than 4000 mg.

SRD recommendations

Seventy-nine percents of patients reported they received a recommendation to follow a SRD from their health care providers. Of those who received a SRD recommendation, only 26% responded that they followed the diet all the time; 58% followed it most of the time, and 17% reported sometimes or never following it. About half of the patients reported that following a SRD was difficult (9.1% very hard to follow a SRD; 40% hard; 36.4% easy; 14.5% very easy).

After we regrouped patients based on the information of recommendation (yes vs. no), frequency of following a SRD (never or sometimes vs. most or always), and difficulty of following a SRD (hard vs. easy), we compared their adherence level using 24-h UNa. There was no difference adherence level between those who stated they received a recommendation to follow a SRD from health care providers and those who did not (3560 ± 1502 mg vs. 3363 ± 1863 mg, $p > .05$) and between those who perceived following a SRD hard and those who perceived it easy (3323 ± 2285 mg vs. 3612 ± 1411 mg, $p > .05$). However, patients who reported following a SRD sometimes or never had 1.7g more sodium in their urine than patients who reported following it always or most of the time (4765 ± 1783 mg vs. 3095 ± 1748 mg, $p < .05$).

Knowledge about HF worsening symptoms and HF self-care strategies

At least one-fourth of participants did not recognize signs of worsening HF that could be related to sodium intake: breathing difficulty (20%), weight gain (24%), increase in coughing (24%), fluid build-up (34%), and swelling (30%) (Table 2). A similar number of patients did not recognize the importance of the following HF self-care strategies that are related to consequences of high sodium intake: weighing self daily (28%), monitoring symptoms daily

(21%), maintaining dry weight (17%), eating fresh food (9%), avoiding commercially prepared and convenience foods (23%). A majority (59%) of patients believed that drinking large amounts of liquids everyday was appropriate for management of HF.

Perceived barriers to following a SRD

Only 49% of patients reported they understood or knew how to follow a SRD. Most patients had difficulty picking out low-salt foods at restaurants (75%) and at the grocery store (52%) (Table 3). The majority of patients reported difficulty following a SRD because low-salt foods did not taste good (69%) and their favorite foods were not low in salt (72%). They also reported social and environmental barriers such as restaurants not serving low-sodium foods, family or friends not eating or cooking low-salt foods (54%), cost of low salt foods (47%) and time to prepare low-salt foods (38%).

Gender difference

Adherence to SRD—Women had better adherence to SRD than men that men excreted 1100mg of sodium more than women (3859 ± 1731 mg vs. 2714 ± 1670 mg, $p < .05$) (Figure 2).

SRD recommendation—More women reported receiving a SRD recommendation from health care providers than men (93% VS. 71%, $p < .05$) and more women perceived following a SRD difficult than men (65% vs. 33%, $p < .05$). There was no gender difference in the frequency of following a SRD.

Knowledge and barriers—We compared individual knowledge about HF worsening symptoms and HF self-care strategies between men and women using separated Mann-Whitney U tests. Women were better than men at recognizing signs and symptoms of excess sodium intake, including fluid build-up ($Z = -2.7$, $p < .01$) and increasing swelling ($Z = -2.7$, $p < .01$). Women had a better understanding of appropriate actions for following a SRD, including need to eat fresh food ($Z = -2.9$, $p < .01$), maintain dry weight ($Z = -1.9$, $p = 0.05$), and avoid convenience foods ($Z = -2.9$, $p < .01$). However, there were no gender differences in perceived barriers of following a SRD. Using the separated 2×2 factorial ANOVA test, we found that there were no interaction effects of gender and knowledge on adherence and no interaction effects of gender and perceived barriers on adherence.

Discussion

The main finding in this study was that women demonstrated better adherence to a SRD than men. One possible reason for the better adherence among women in our study was that women were more knowledgeable about HF management than men. Ni found that patient adherence was associated with self-care knowledge and that women had better knowledge about HF self-care than men.²⁸ Another possible reason is that lifestyle alterations that involve shopping for, and preparing meals might be harder for men to make, particularly if they do not have the full support of their spouse or if their spouse is ill-informed about the SRD. Traditional domestic rolls call for the wife to prepare meals. If the wife or other female caregiver does not need to follow a SRD or has not been educated about the SRD, it will be difficult for men to change their eating habits. On the other hand, women may be better able to adapt meals to the SRD because they are responsible for preparing meals. Further investigation will be necessary to identify whether person who does the shopping and the meal preparation is another key factor in diet adherence. This reason for gender differences in adherence is speculative and further research is required to determine why women might be more adherent to the SRD. These findings however, suggest that dietary adherence may be improved by targeting spouses of male patients and the intervention should be based on gender.

The second important finding emerged from this study is the level of adherence to SRD recommendation among all patients was poor. Urinary sodium excretion indicated that only 28% of patients consumed the recommended daily sodium intake, 2000 mg or less per day, and 35% consumed more than twice of the recommended sodium intake, over 4000 mg per day. The overall adherence rate in this study was similar to previous studies that have used self-reported adherence.^{7, 12} The poor adherence result in this study reveals that adherence in SRD in HF patients is still problematic and health care providers need to attend to dietary sodium adherence to improve health outcome of HF patients. According to DiMatteo,²⁹ who recently compared adherence rates among different patient populations to their prescribed regimens, patients with cardiovascular disease had the 8th worst adherence rate among 17 disease conditions ranking lower than patients with HIV infection and cancer, who have more difficult treatment regimens.²⁹ Furthermore, dietary adherence rate was the lowest among other treatment regimens including medication, exercise, health behavior, and attending follow up appointments in all other health conditions.²⁹ Therefore, while poor adherence in general is high, dietary adherence is most problematic in cardiovascular disease.

One of major contributing factor in continuing poor adherence to a SRD is lack of knowledge. Although majority of patients in this study received a recommendation and information of SRD from health care providers, adherence remained poor. Moreover, there was no difference in adherence level regardless receiving a SRD recommendation. This indicates that health care provider's simple recommendation may not be enough to motivate patient's adherence behavior. Researchers suggested that lack of knowledge is a key barrier in diet adherence.^{28, 30} For example, Neily et al.³⁰ found that 86% of HF patients were not aware of a SRD guideline, 42% could not determine sodium content from a nutrition label, and 56% could not distinguish high and low sodium foods. Similarly, in our study, most patients had a difficulty selecting low sodium foods in store and in restaurants. Although knowledge is not sufficient to insure adherence, it is necessary. Diet education should be included strategies of how to follow a SRD in daily life and strategies of how to overcome barriers of adherence to SRD. Patient's education should be focused on understating how SRD adherence contributes their HF management. Therefore, assessment of knowledge level is pivotal in improving adherence outcome and knowledge related to self-care in HF management and strategies of adherence to SRD should be essential components of patients' education intervention. Further investigation is needed to determine whether such education will improve patients' adherence and other long-term outcomes such as rehospitalization and mortality.

Following a SRD diet requires life-long effort to overcome multiple barriers. We identified that social environment such as restaurants not serving low-sodium foods, and family or friends not eating or cooking low-sodium foods were other key barriers to following a SRD. According to Stromberg et al.³¹ lack of adequate social support is associated with nonadherence. Considering that family members often are not included in HF patient education and counseling,^{32, 33} these data suggest that education should be expanded to significant others who interact with patients socially as well as family members.

This study was among the first studies in HF patients to use both objective and subjective measure of adherence to a SRD. In this study, men and women were not different in self-reporting about frequency of following a SRD but women were better in adherence using objective measure of the 24-h UNa. Self-report is one of the most feasible measure to assess diet adherence level.^{12, 28, 34} However, this study showed that there may be a gap between self-reporting and objective evidence. Further investigation is needed whether patients' self-report of diet adherence is reliable and patients' judgment of diet adherence is not overestimated.

In this study, the adherence of SRD was measured using the 24-h UNa that is the most validated biomarker for measuring adherence of SRD.^{15, 16} Although it has been reported that the 24-hour urine sodium excretion may be affected by drug use (i.e. diuretics and ACEI),^{18, 19} or body mass index (BMI),³⁵⁻³⁷ there was no differences of drug use and the BMI scores between women and men in this study. All patients in this study were on the stable dose of the medications. Thus, gender difference in adherence of the SRD in this study was not affected by drug use and BMI.

Many clinicians underestimate the importance of dietary sodium adherence or place less emphasis on prescribing a SRD³⁸ in the belief that diuretic therapy alone will control congestion in patients with HF. This approach may be misguided, given evidence that dietary sodium indiscretion with subsequent fluid overload precedes many hospitalizations for decompensated HF. Indeed, current evidence suggests that fluid overload may be the most common factor precipitating a HF hospitalization.^{4, 6, 7} A recommendation from the healthcare provider to follow a SRD, along with effective education and counseling are fundamental to patient adherence, yet such recommendations will not be made by clinicians unconvinced of the impact of a SRD on rehospitalizations.

Several investigators have reported that women differ from men in many HF outcomes,^{14, 39-41} but little is known regarding whether these gender differences are due to adherence rates. Only two groups of investigators have compared gender differences in adherence to medication among patients with HF^{8, 42} but neither examined gender differences in adherence to a SRD. Furthermore, reports of gender difference on adherence to medication were mixed results. Rich et al.⁴² reported no gender difference in medication adherence in HF patients, while Monane et al.⁸ reported that elderly women with HF were more adherent to their digoxin prescription than men. This study was first study in HF to examine gender difference in adherence to SRD. In this study, we found that women are better in adherence and better in the knowledge of self-care strategies and SRD. Additional research is needed to determine whether differences in adherence to all aspects of HF self-management can account for gender differences observed in clinical outcomes including mortality and morbidity.

Limitations

Although urinary sodium excretion has been shown to be a good measure of diet adherence, urine in this study was collected in only one time point. Thus, the results may not reflect patient's long-term diet adherence. Further investigation is needed whether there is gender difference in a long-term diet adherence using repeated assessments of 24-h UNa and whether long-term diet adherence contributes patient's clinical outcomes differently. The participated patients in this study were relatively small and most were not having advanced disease compared to general HF population. Therefore, the generalizability of this study may be limited. Although this study showed that American subjects were similar with Australian in sociodemographics and clinical characteristic, it is limited to represent that there is gender difference in adherence regardless two difference cultures due to small sample size. Further investigation is needed whether there is gender difference in adherence regardless cultures with a large sample size.

Summary

In summary, adherence to a SRD in HF patients remains poor but women were more adherent to a SRD than men even though women perceived similar barriers to doing so. One reason may be that women were more knowledgeable about HF management than men. In this study, lack of knowledge about SRD and how to follow SRD was the most common barrier in following SRD. The brief recommendation to follow a SRD that is common practice likely is not sufficient to promote adherence. The study findings suggest that we should pay attention to

male patients and the assessment of knowledge is essential component in improving diet adherence. The diet intervention should consider components of gender and patients' knowledge about and skills to follow a SRD.

Acknowledgments

This study was funded by an American Heart Association Established Investigator Award to Debra Moser, the University of Kentucky General Clinical Research Center (M01RR02602), and Gill Endowment, and the Ohio State University General Clinical Research Center (M01RR00034)

Reference cited

1. Formiga F, Chivite D, Manito N, Osma V, Miravet S, Pujol R. One-year follow-up of heart failure patients after their first admission. *Qjm* Feb;2004 97(2):81–86. [PubMed: 14747622]
2. Krumholz HM, Chen YT, Wang Y, Vaccarino V, Radford MJ, Horwitz RI. Predictors of readmission among elderly survivors of admission with heart failure. *Am Heart J* Jan;2000 139(1 Pt 1):72–77. [PubMed: 10618565]
3. Starling RC. The heart failure pandemic: changing patterns, costs, and treatment strategies. *Cleve Clin J Med* Jul-Aug;1998 65(7):351–358. [PubMed: 9679390]
4. Bennett SJ, Huster GA, Baker SL, et al. Characterization of the precipitants of hospitalization for heart failure decompensation. *Am J Crit Care* May;1998 7(3):168–174. [PubMed: 9579241]
5. Chin MH, Goldman L. Correlates of early hospital readmission or death in patients with congestive heart failure. *Am J Cardiol* Jun 15;1997 79(12):1640–1644. [PubMed: 9202355]
6. Ghali JK, Kadakia S, Cooper R, Ferlinz J. Precipitating factors leading to decompensation of heart failure. Traits among urban blacks. *Arch Intern Med* Sep;1988 148(9):2013–2016. [PubMed: 3046541]
7. Michalsen A, Konig G, Thimme W. Preventable causative factors leading to hospital admission with decompensated heart failure. *Heart* Nov;1998 80(5):437–441. [PubMed: 9930040]
8. Monane M, Bohn RL, Gurwitz JH, Glynn RJ, Avorn J. Noncompliance with congestive heart failure therapy in the elderly. *Arch Intern Med* Feb 28;1994 154(4):433–437. [PubMed: 8117176]
9. Tsuyuki RT, McKelvie RS, Arnold JM, et al. Acute precipitants of congestive heart failure exacerbations. *Arch Intern Med* Oct 22;2001 161(19):2337–2342. [PubMed: 11606149]
10. Vinson JM, Rich MW, Sperry JC, Shah AS, McNamara T. Early readmission of elderly patients with congestive heart failure. *J Am Geriatr Soc* Dec;1990 38(12):1290–1295. [PubMed: 2254567]
11. Moser DK, Doering LV, Chung ML. Vulnerabilities of patients recovering from an exacerbation of chronic heart failure. *Am Heart J* Nov;2005 150(5):984. [PubMed: 16290979]
12. Evangelista LS, Berg J, Dracup K. Relationship between psychosocial variables and compliance in patients with heart failure. *Heart Lung* Jul-Aug;2001 30(4):294–301. [PubMed: 11449216]
13. Burns RB, McCarthy EP, Moskowitz MA, Ash A, Kane RL, Finch M. Outcomes for older men and women with congestive heart failure. *J Am Geriatr Soc* Mar;1997 45(3):276–280. [PubMed: 9063271]
14. Vaccarino V, Chen YT, Wang Y, Radford MJ, Krumholz HM. Sex differences in the clinical care and outcomes of congestive heart failure in the elderly. *Am Heart J* Nov;1999 138(5 Pt 1):835–842. [PubMed: 10539813]
15. Intersalt: an international study of electrolyte excretion and blood pressure. Results for 24 hour urinary sodium and potassium excretion. Intersalt Cooperative Research Group. *Bmj* Jul 30;1988 297(6644):319–328. [PubMed: 3416162]
16. Ballenger JC, Davidson JR, Lecrubier Y, et al. Consensus statement on transcultural issues in depression and anxiety from the International Consensus Group on Depression and Anxiety. *J Clin Psychiatry* 2001;62(Suppl 13):47–55. [PubMed: 11434419]
17. Bingham SA, Williams R, Cole TJ, Price CP, Cummings JH. Reference values for analytes of 24-h urine collections known to be complete. *Ann Clin Biochem* Nov;1988 25(Pt 6):610–619. [PubMed: 3267076]
18. Leary WP, Reyes AJ, Van der Byl K. Effects of angiotensin-converting enzyme inhibitors on urinary excretions: interactions with diuretics. *Am J Med* Apr 27;1992 92(4B):64S–68S. [PubMed: 1580282]

19. Reyes AJ. Effects of diuretics on outputs and flows of urine and urinary solutes in healthy subjects. *Drugs* 1991;41(Suppl 3):35–59. [PubMed: 1712714]
20. Korhonen MH, Litmanen H, Rauramaa R, Vaisanen SB, Niskanen L, Uusitupa M. Adherence to the salt restriction diet among people with mildly elevated blood pressure. *Eur J Clin Nutr* Nov;1999 53 (11):880–885. [PubMed: 10557001]
21. McKeown NM, Day NE, Welch AA, et al. Use of biological markers to validate self-reported dietary intake in a random sample of the European Prospective Investigation into Cancer United Kingdom Norfolk cohort. *Am J Clin Nutr* Aug;2001 74(2):188–196. [PubMed: 11470719]
22. Forrester T, Adeyemo A, Soarres-Wynter S, et al. A randomized trial on sodium reduction in two developing countries. *J Hum Hypertens* Jan;2005 19(1):55–60. [PubMed: 15470483]
23. Alderman MH, Cohen H, Madhavan S. Dietary sodium intake and mortality: the National Health and Nutrition Examination Survey (NHANES I). *Lancet* Mar 14;1998 351(9105):781–785. [PubMed: 9519949]
24. Alderman MH, Madhavan S, Cohen H, Sealey JE, Laragh JH. Low urinary sodium is associated with greater risk of myocardial infarction among treated hypertensive men. *Hypertension* Jun;1995 25(6):1144–1152. [PubMed: 7768554]
25. Tuomilehto J, Jousilahti P, Rastenyte D, et al. Urinary sodium excretion and cardiovascular mortality in Finland: a prospective study. *Lancet* Mar 17;2001 357(9259):848–851. [PubMed: 11265954]
26. Bently B, Lennie TA, Biddle M, Chung ML, Moser DK. Demonstration of psychometric soundness of the dietary sodium restriction questionnaire in patients with heart failure. 2006
27. nQuery Advisor [computer program]. Version Version 6.0. Sangus, MA: Statistical Solutions; 19952005.
28. Ni H, Nauman D, Burgess D, Wise K, Crispell K, Hershberger RE. Factors influencing knowledge of and adherence to self-care among patients with heart failure. *Arch Intern Med* Jul 26;1999 159 (14):1613–1619. [PubMed: 10421285]
29. DiMatteo MR. Variations in patients' adherence to medical recommendations: a quantitative review of 50 years of research. *Med Care* Mar;2004 42(3):200–209. [PubMed: 15076819]
30. Neily JB, Toto KH, Gardner EB, et al. Potential contributing factors to noncompliance with dietary sodium restriction in patients with heart failure. *Am Heart J* Jan;2002 143(1):29–33. [PubMed: 11773909]
31. Stromberg A, Brostrom A, Dahlstrom U, Fridlund B. Factors influencing patient compliance with therapeutic regimens in chronic heart failure: A critical incident technique analysis. *Heart Lung Sep-Oct;1999 28(5):334–341. [PubMed: 10486450]*
32. Horlick L, Cameron R, Firor W, Bhalerao U, Baltzan R. The effects of education and group discussion in the post myocardial infarction patient. *J Psychosom Res* 1984;28(6):485–492. [PubMed: 6520804]
33. Leider HL. Heart failure and disease management. *Am J Manag Care* Jun;1998 4(6 Suppl):S343–348. [PubMed: 10184927]
34. Evangelista L, Doering LV, Dracup K, Westlake C, Hamilton M, Fonarow GC. Compliance behaviors of elderly patients with advanced heart failure. *J Cardiovasc Nurs* Jul-Aug;2003 18(3):197–206. quiz 207–198. [PubMed: 12837010]
35. Zhang J, Temme EH, Sasaki S, Kesteloot H. Under- and overreporting of energy intake using urinary cations as biomarkers: relation to body mass index. *Am J Epidemiol* Sep 1;2000 152(5):453–462. [PubMed: 10981460]
36. Dyer AR, Elliott P, Shipley M, Stamler R, Stamler J. Body mass index and associations of sodium and potassium with blood pressure in INTERSALT. *Hypertension* Jun;1994 23(6 Pt 1):729–736. [PubMed: 8206570]
37. Kikuchi K, Iimura O, Yamaji I, et al. The pathophysiological role of water-sodium balance and renal dopaminergic activity in overweight patients with essential hypertension. *Am J Hypertens* Jan;1988 1(1):31–37. [PubMed: 3285858]
38. Riegel B, Moser DK, Powell M, Rector TS, Havranek EP. Nonpharmacologic care by heart failure experts. *J Card Fail* Mar;2006 12(2):149–153. [PubMed: 16520265]
39. Adams KF Jr, Dunlap SH, Sueta CA, et al. Relation between gender, etiology and survival in patients with symptomatic heart failure. *J Am Coll Cardiol* Dec;1996 28(7):1781–1788. [PubMed: 8962567]

40. Harjai KJ, Nunez E, Stewart Humphrey J, Turgut T, Shah M, Newman J. Does gender bias exist in the medical management of heart failure? *Int J Cardiol* Aug;2000 75(1):65–69. [PubMed: 11054508]
41. Moser DK. Heart failure in women. *Crit Care Nurs Clin North Am* Dec;1997 9(4):511–519. [PubMed: 9444174]
42. Rich MW, Gray DB, Beckham V, Wittenberg C, Luther P. Effect of a multidisciplinary intervention on medication compliance in elderly patients with congestive heart failure. *Am J Med* Sep;1996 101(3):270–276. [PubMed: 8873488]

Figure 1.
24-hour urinary sodium amount (N = 68)

24-Hour Urine Sodium Amount

Figure 2.
24-hour urinary sodium amount between men and women (N =68)

Table 1

Demographic and clinical characteristics of men and women heart failure patients (N=68)

Characteristics	Entire patients (N = 68)	Men (n = 41)	Women (n = 27)
	Mean $\pm$ SD		
Age, years	63 $\pm$ 14	63.5 $\pm$ 14.8	62.6 $\pm$ 13.4
Education, years	11.8 $\pm$ 3	12.0 $\pm$ 3.4	11.6 $\pm$ 2.2
Body mass index	30.6 $\pm$ 7.1	30.8 $\pm$ 7.6	30.4 $\pm$ 6.6
Left ventricular ejection fraction *, %	30 $\pm$ 12.9	27.8 $\pm$ 12.1	35.3 $\pm$ 13.0
	N (%)		
Marital status			
Married/co-habitants	44 (64.7)	28(68.3)	16(59.3)
Other	23 (33.8)	12(29.3)	11(40.7)
Ethnicity			
Caucasian	43 (63.2)	28 (68.3)	15 (55.6)
African-American	8 (11.8)	2 (4.9)	6 (22.2)
Other	17 (25.0)	11 (26.8)	6 (22.2)
Drinks any alcohol	18 (26.9)	13 (31.7)	5 (18.5)
Current smoker	2 (3)	1 (2.4)	1 (3.7)
Hypertension	43 (64.2)	24 (58.5)	19 (70.4)
Diabetes mellitus	24 (35.3)	13 (31.7)	11 (40.7)
Chronic obstructive pulmonary disease	8 (11.8)	3 (7.3)	5 (18.5)
History of stroke	9 (13.2)	4 (9.8)	5 (18.5)
Prior myocardial infarction, coronary artery bypass graft surgery or angioplasty	39 (57.4)	26 (63.4)	13 (48.1)
NYHA class			
II	31 (45.6)	20 (48.8)	11 (40.7)
III/IV	33 (48.5)	19 (46.3)	14 (51.8)
Medication			
ACE Inhibitors	42 (61.8%)	26 (63.4%)	16 (59.3%)
Digoxin	31 (45.6%)	19 (46.4%)	12 (44.4%)
Beta blockers	53 (77.9%)	31 (75.6%)	23 (81.5%)
Diuretics	57 (83.8%)	34 (82.9%)	23 (85.2%)

Legend: ACE = angiotensin converting enzyme; NYHA = New York Heart Association

*
p = .006, all other gender comparison p > .05.

Table 2

Percent of patients recognizing importance of symptoms and self-care strategies in HF (N =68)

	All patients (%)	Men (%)	Women (%)
Fluid build-up in my body is a sign of worsening HF**	66.0	51.6	86.4
An increase in swelling in my legs or feet is a sign of worsening HF**	69.8	58.1	86.4
Breathing easier is good	79.2	80.6	77.3
Gaining weight is a sign of worsening HF	77.5	74.2	81.8
Increasing in coughing is a sign of worsening HF	77.4	74.2	81.8
Weighing myself everyday is important	71.7	71.0	72.7
Remaining active is important	79.2	77.4	81.8
Drinking lots of liquid everyday is good	39.6	41.9	40.9
Monitoring symptoms everyday is important	77.4	67.7	90.9
Eating convenience food is not good **	77.4	71.0	86.4
Eating fresh food is good **	90.6	83.9	100.0
Smoking is good			
Maintaining my dry weight is important *	82.7	82.7	90.5

*
p < .05,**
p < .01 men vs. women

Table 3

Perceived barriers to following a SRD (N=68)

	Not at all (%)	Somewhat (%)	A lot (%)
Cost of low-salt foods	52.8	34.0	13.2
Time to prepare foods	62.3	24.5	13.2
Taste of low-salt foods	30.8	34.6	34.6
The foods I like to eat are not low-salt	28.3	39.6	32.1
I don't have the will power to change my diet	41.5	30.2	28.3
Don't understand or know how to follow a low-salt diet	50.9	39.6	9.4
Can't pick out low-salt foods in restaurants	25.5	37.3	37.3
Can't pick out low-salt-foods at the grocery	48.1	25.0	26.9
The restaurants I like don't serve low-salt foods	36.0	30.0	34.0
The person who cooks for me, doesn't prepare low-salt foods	69.8	17.0	13.2
The people around me don't eat low-salt foods	46.2	26.9	26.9
I don't cook	60.4	22.6	17.0