

The effect of fluid restriction monitoring guidelines using the Heart Failure Self-Care Application (*Aplikasi Perawatan Mandiri Heart Failure/ATRIA*) on reducing risk of fluid retention in heart failure patients at Dr. Saiful Anwar Hospital Malang

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<https://doi.org/10.22146/inajbcs.v56i4.13534>

ABSTRACT

Submitted: 2024-05-26
Accepted : 2024-09-23

Heart failure patients are often at risk of rehospitalization due to recurrent symptoms such as dyspnea, edema, pulmonary congestion, and rapid weight gain resulting from fluid retention. This study aimed to analyze the impact of guided fluid restriction using the ATRIA application on risk of fluid retention in heart failure patients. The quasi-experimental method was used with a posttest-only control group design. Simple random sampling was carried out to select respondents, with the intervention group given the ATRIA application and the control group receiving a booklet intervention. The study duration was four weeks, with 16 respondents in the intervention group and 15 respondents in the control from Dr. Saiful Anwar Hospital, Malang. Data analysis used an independent sample t-test to assess differences in body and weekly weight changes. The results showed no significant difference in body weight between the intervention and control groups each week ($p > 0.05$). Similarly, there was no significant difference change in body weight between the two groups ($p > 0.05$). In conclusion, there is no distinction observed between the ATRIA application and booklet concerning fluid restriction guidelines for reducing risk of fluid retention in heart failure patients. The results suggested that nurses could provide educational services and monitor the condition of heart failure patients using either application or booklet. Future studies are recommended to analyze factors that might impact fluid retention in heart failure patient.

ABSTRAK

Pasien gagal jantung berisiko dirawat kembali di rumah sakit karena gejala berulang seperti dispnea, edema, kongesti paru, dan penambahan berat badan yang cepat akibat retensi cairan. Penelitian ini bertujuan untuk menganalisis dampak pembatasan cairan terpandu menggunakan aplikasi ATRIA terhadap risiko retensi cairan pada pasien gagal jantung. Metode yang digunakan adalah quasi eksperimen dengan desain *posttest only control group design*. Pengambilan sampel dilakukan secara sampling acak sederhana dengan kelompok intervensi diberikan aplikasi ATRIA dan kelompok kontrol diberikan intervensi booklet. Durasi penelitian adalah empat minggu, dengan 16 responden pada kelompok intervensi dan 15 responden pada kelompok control dari RSUP Dr. Saiful Anwar Malang. Analisis data menggunakan uji t independen untuk menilai perbedaan perubahan berat badan dan berat badan mingguan. Hasil penelitian menunjukkan tidak terdapat perbedaan bermakna berat badan antara kelompok intervensi dan kontrol setiap minggunya ($p > 0,05$). Demikian pula tidak terdapat perbedaan perubahan berat badan yang signifikan antara kedua kelompok ($p > 0,05$). Simpulan, tidak ada perbedaan yang diamati antara aplikasi ATRIA dan booklet mengenai pedoman pembatasan cairan untuk mengurangi risiko retensi cairan pada pasien gagal jantung. Hasil penelitian menyarankan agar perawat dapat memberikan layanan edukasi dan memantau kondisi pasien gagal jantung baik menggunakan aplikasi maupun booklet. Penelitian selanjutnya direkomendasikan untuk menganalisis faktor-faktor yang berhubungan dengan retensi cairan pada pasien gagal jantung.

Keywords:

Heart Failure;
Application;
Fluid Retention;
Fluid Restrictions;
Weight Monitoring

INTRODUCTION

Heart failure is a health issue that tends to progress over time and is associated with high morbidity and mortality rates in Indonesia and other developing countries.¹ According to the Ministry of Health in 2018, Indonesia ranks second in Asia after Taiwan for the incidence of heart failure.² Hospitalization is often necessary for patients with heart failure. Previous studies have reported a global rehospitalization rate within 30 d ranging from 19 to 25%.³

Rehospitalization is often necessitated by the recurrence of complex symptoms in heart failure patients, including dyspnea, edema indicating fluid retention, congestive heart failure, and rapid weight gain.⁴ The accumulation of fluids in various parts of the body, as well as the lungs, is a direct consequence of the heart's reduced ability to pump blood effectively, resulting in swelling. This accumulation of excess fluid and subsequent swelling can lead to a sudden or unusually rapid increase in the body weight of individuals with heart failure.⁵ Therefore, proper management by limiting fluid intake is crucial.

The guidelines from the European Societies of Cardiology recommend fluid restriction in patients with moderate to severe heart failure.⁶ Limiting fluid intake can help reduce risk of fluid retention, such as the occurrence of edema and abnormal weight gain over time. Lefler *et al.*⁷ reported that the use of telehealth and remote monitoring affects fluid balance and reduces dyspnea symptoms in heart failure. However, this study does not investigate the effect on fluid retention, which can be monitored by tracking body weight.⁸

To address this gap, an android-based telemonitoring application called

ATRIA (*Aplikasi Perawatan Mandiri Heart Failure* or Heart Failure Self-Care Application) was introduced. ATRIA assists patients in meeting the needs and monitoring self-care, such as providing guidance on fluid restriction according to the clinical condition, monitoring weight, shortness of breath, and edema. Previous studies reported a high rate of rehospitalization for heart failure patients in 30 d after discharge from the hospital, with most readmissions occurring due to signs and symptoms of congestion caused by fluid and sodium retention.⁹ Risk of fluid retention can be observed by monitoring the body weight every week. Given the high risk of fluid retention in heart failure patients, it is necessary to investigate the impact of fluid restriction guidance with ATRIA on reducing this risk. Respondents were divided into 2 groups namely ATRIA application and booklet. Therefore, this study aimed to determine the weekly weight changes over 4 wk in ATRIA application group, identify the weekly weight changes over 4 wk in booklet intervention group, and analyze the difference in weekly weight changes between ATRIA and booklet groups.

MATERIAL AND METHODS

Subjects and design

A posttest-only control group design with a quasi-experimental method was employed in this study. Respondents were divided into two groups namely intervention using ATRIA application and control given booklet. Samples were randomly selected from Dr. Saiful Anwar General Hospital, Malang, using the simple random sampling method. This research has ethical clearance from the Ethics Commission of Dr. Saiful Anwar Malang Hospital with letter number

400/1281K.3/302/2021. The inclusion criteria in this study include, clients with heart failure aged 25-75 yr, clients with NYHA class 1-3, clients with congestive or restrictive heart failure, clients with diuretic therapy, hemodynamics stable clients (systolic blood pressure above 100 mmHg, normal pulse (60-100 x/min), normal respiratory rate (14-20 x/min), clients who can use an android smartphone independently, clients who are willing to be respondents and have agreed to informed consent, clients who can communicate well. The exclusion criteria for this study are clients who are not willing to be respondents and clients with comorbid kidney failure.

Procedure

The primary data collection was conducted at the homes of respondents from December 2022 to March 2023, and the study spanned over 4 wk for each respondent. The population consisted of 40, with 31 samples meeting the inclusion criteria and 9 excluded (4 from intervention group and 5 from control group) due to lack of cooperation and death during the study. Finally, the study included 16 and 15 respondents in application and booklet groups, respectively. Data collection entailed weighing each respondent weekly for 4 wk or 28 d. Based on the AHA guidelines, to determine the occurrence of fluid retention in heart failure patients, body measurements can be used because the initial sign of worsening or fluid retention in heart failure patients is a weight gain of 2.5 kg per week.¹⁰

Statistical analysis

The weight data were entered into the monitoring feature of ATRIA and booklet sheet, while data analysis was performed using the unpaired t-test.

RESULTS

The characteristics of respondents are presented in TABLE 1. A total of 16 respondents in application and 15 in booklet groups were involved in this study. Respondents in application group comprised 9 females (56.3%) and 7 males (43.8%), while in booklet group, there were 9 males (60%) and 6 females (40%). The average age was 55.38 yr and 63.27 yr in the respective group. Respondents with a high school education level were more in application group, with 6 (37.5%), compared to booklet group with 4 (26.7%). Furthermore, there were more married respondents in application group, with 15 (93.8%), compared to booklet group with 10 (66.7%). The majority in application group was unemployed, with 9 (56.3%), and in booklet group, there were 8 (53.3%). Respondents classified as NYHA class 1 were more in application group, with 8 (50%), while in booklet group most of respondents were classified as NYHA class 2 (46.7%). NYHA classification is carried out by medical personnel and documented in e-medical records. Most respondents in application group had no comorbidities, while in booklet group, there were comorbidities such as hypertension, obesity and diabetes mellitus.

TABLE 1. Characteristics of respondents of application (n=16) and booklet (n=15) groups

Characteristics	Application n (%)	Booklet n (%)
Gender		
• Male	7 (43.8)	9 (60.0)
• Female	9 (56.3)	6 (40.0)
Education		
• No school	0 (0.0)	1 (6.7)
• Elementary school	4 (25.0)	3 (20.0)
• Junior high school	0 (0.0)	3 (20.0)
• Senior high school	6 (37.5)	4 (26.7)
• Bachelor	5 (31.5)	4 (26.7)
• Master	1 (6.3)	0 (0.0)
Marriage status		
• Married	15 (93.8)	10 (66.7)
• Widower	0 (0.0)	1 (6.7)
• Widow	1 (6.3)	4 (26.7)
Occupation		
• Unemployed	9 (56.3)	8 (53.3)
• Employed	7 (43.8)	7 (46.7)
NHYA class		
• Class 1	8 (50.0)	4 (26.7)
• Class 2	3 (18.8)	7 (46.7)
• Class 3	5 (31.3)	4 (26.7)
Comorbidity		
• No	6 (37.5)	4 (26.0)
• Hypertension	4 (25.0)	6 (36.5)
• DM	3 (18.8)	3 (20.)
• Hypertension & DM	2 (12.6)	2 (13.4)
• Obesity	0 (0.0)	1 (6.7)
• Others	1 (6.3)	0 (0.0)

In application group, a decrease in the average body weight every week from 63.76 ± 15.2 kg to 62.97 ± 15.1 kg on day 28 was observed (TABLE 2). Meanwhile, in booklet group, an increase in the average body weight on day 7 occurred, from 62.34 ± 14.7 kg to 62.51 ± 14.8 kg. In the following weeks, from day 14 to day 28, the average body weight decreased to 60.61 ± 14.5 kg.

The body weight changes between dry and weight on days 7, 14, 21, and

28 in application and booklet groups were different (TABLE 3). A decrease in the average weight change every week was observed in the application group, starting from -0.44 ± 1.61 kg to -0.79 ± 1.41 kg on day 28. Meanwhile, in booklet group, the average weight change on day 7 increased from 0.17 ± 1.85 kg to -0.62 ± 1.90 kg. In the following weeks, from day 14 to 28, the average weight decreased to -1.73 ± 2.74 kg on day 28.

The statistical analysis of body

weight differences between application and booklet groups on days 7, 14, 21, and 28 are presented in TABLE 4. No significant difference in weight between both groups was observed ($p > 0.05$).

The statistical analysis of body

weight change differences between application and booklet groups on days 7, 14, 21, and 28 are presented in TABLE 5. No significant difference in body weight change between both groups was observed ($p > 0.05$).

TABLE 2. Weekly body weight of application (n=16) and booklet (n=15) groups

Body weight data	Application group (mean \pm SD kg)	Booklet group (mean \pm SD kg)
Dry	63.76 \pm 15.2	62.34 \pm 14.7
Day 7	63.33 \pm 14.8	62.51 \pm 14.8
Day 14	63.26 \pm 14.6	61.72 \pm 14.6
Day 21	63.00 \pm 14.8	60.57 \pm 14.6
Day 28	62.97 \pm 15.1	60.61 \pm 14.5

TABLE 3. Weekly body weight change data application (n=16) and booklet (n=15) groups

Body weight change data	Application group (mean \pm SD kg)	Booklet group (mean \pm SD kg)
Day 7	-0.44 \pm 1.61	0.17 \pm 1.85
Day 14	-0.50 \pm 1.72	-0.62 \pm 1.90
Day 21	-0.75 \pm 1.57	-1.76 \pm 2.67
Day 28	-0.79 \pm 1.41	-1.73 \pm 2.74

TABLE 4. Analysis of body weight differences every week between application and booklet groups

Analysis of body weight differences	Application group (mean \pm SD kg)	Booklet group (mean \pm SD kg)	p
Day 7	63.33 \pm 14.8	62.51 \pm 14.8	0.880
Day 14	63.26 \pm 14.6	61.72 \pm 14.6	0.770
Day 21	63.00 \pm 14.8	60.57 \pm 14.6	0.648
Day 28	62.97 \pm 15.1	60.61 \pm 14.5	0.660

TABLE 5. Analysis of body weight change differences every week between application and booklet groups

Analysis of difference	Application group (mean \pm SD kg)	Booklet group (mean \pm SD kg)	p
Day 7	-0.45 \pm 1.61	0.17 \pm 1.85	0.332
Day 14	-0.50 \pm 1.72	-0.62 \pm 1.90	0.855
Day 21	-0.75 \pm 1.57	-1.76 \pm 2.67	0.214
Day 28	-0.79 \pm 1.41	-1.73 \pm 2.74	0.249

DISCUSSION

Changes in body weight every week for 4 weeks after the provision of ATRIA

The use of ATRIA in application group aimed to provide guidance for self-care at home. In ATRIA, there was guidance on fluid restriction and a weight monitoring feature. The body weight measurement is one of the indicators to determine risk of fluid overload. Feijen *et al.*¹¹ stated that monitoring the increase in weight among heart failure patients could serve as an early detection method for fluid retention using telemonitoring.

TABLE 2 shows a decrease in the average weight every week, starting from 0.44 kg on day 7 and decreasing to 0.5 kg (day 14), 0.75 kg (day 21), and 0.79 kg (day 28), respectively. Satou *et al.* also reported weight loss in patients using a self-care heart failure application.¹² This could help reduce fluid retention in the body by monitoring weight and recording it in application. The weight loss showed that there was no fluid overload in application group, identified by a weight gain of > 2 kg/wk from dry weight after discharge from the hospital.¹³

Body weight changes each week for 4 weeks after providing booklet

Booklet intervention designed to provide guidance on fluid restriction and to monitor the weight was also given weekly for 4 wk. Respondents could read the fluid restriction guidelines and fill in the weight monitoring sheet in booklet. Regular weight monitoring was one of the indicators used to determine excess fluid.¹⁴

TABLE 5 showed weight changes over 4 wk in the booklet group. On day 7, the average weight tended to increase from dry weight by 0.17 ± 1.85 kg, but this did not show fluid overload. Furthermore, on days 14, 21, and 28, the average body weight tended to decrease with values

of 0.62 ± 1.90 kg, 1.76 ± 2.67 kg, and 1.73 ± 2.74 kg, respectively. Delaney *et al.*¹⁵ also reported weight loss in heart failure patients given booklet for weight monitoring.

The average body weight change in booklet group did not exceed 2 kg/wk from dry body weight after returning home from the hospital. This showed that there was no fluid overload, consistent with the signs in heart failure patients.¹⁶

Differences in body weight each week for 4 weeks

No significant differences in weight each week on days 7, 14, 21, and 28 between application and booklet groups ($p > 0.05$) was observed as presented in TABLE 4. Radhakrishnan & Jacelon, comparing weight monitoring results in a group given telemonitoring and control, found no difference in the study.¹⁶ Kiyarosta *et al.*¹⁷ obtained similar results, showing no difference in weight between the group given a self-care application for heart failure and control.

Based on the results, there was no difference in body weight each week between application and booklet groups, but the weight in the second week for both groups did not show risk of fluid retention. This was shown by the absence of a weight increase of >2 kg/wk in both groups. When the body weight increases significantly, >2 kg/wk, attention should be given to fluid accumulation in heart failure patients.¹⁸

Difference in weekly body weight changes over 4 weeks

No difference in weekly body weight changes on days 7, 14, 21, and 28 between application and booklet groups was observed ($p > 0.05$) as presented in TABLE 5. The lack of difference could be influenced by several factors, including frequency, duration, and the ability of patients to use technology. Heiney *et*

al.¹⁸ several respondents may not have adequate knowledge of inputting weight measurements into application and booklet, which is one way to monitor the signs of fluid overload in heart failure patients.

In this study, there was no significant difference in body weight changes between application and booklet groups in heart failure patients. However, the weekly body weight changes showed no increase, which suggested the potential for fluid retention in respondents. This was evident from the average weight in application and booklet groups, which did not increase by >2 kg/wk.¹⁶ The absence of difference in weekly body weight changes between application and booklet groups implied that ATRIA had no significant effect in reducing risk of fluid retention in heart failure patients.

Although ATRIA does not significantly reduce the risk of fluid retention in heart failure patients, the results of the study showed that respondents who were given ATRIA had a tendency for the average weight in the respondent group to decrease and did not lead to fluid retention. In addition, there are several factors that influence the success of ATRIA in monitoring fluid retention, namely respondent compliance in carrying out the recommended diet.

The limitations of this study include respondents who were difficult to contact for follow-up to monitor their weight every week, and several patients died in the middle of the study, which caused respondents to drop out of the study.

CONCLUSION

In conclusion, the findings of this research highlight the effects of ATRIA and booklet interventions on weekly body weight changes over a span of four weeks. The ATRIA group has a gradual weight loss every week which did not fluctuate as in the booklet group. These findings underscore the need for further

exploration of intervention strategies to better understand their efficacy and implications for managing body weight over time.

ACKNOWLEDGMENT

The author would like to thank the Ministry of Education and Culture, the Republic of Indonesia and Faculty of Medicine, Universitas Brawijaya, for funding the experiment through the non-competitive research grant program PNB No. 161 in 2023.

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