The Efficacy of Using Self-Monitoring Diaries in a Weight Loss Program for Chronically Ill Obese Adults in a Rural Area

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ABSTRACT

Background: Self-monitoring is part of many weight-loss programs and is widely accepted as effective. However, there is a lack of research related to the efficacy of various self-monitoring instruments in meeting the needs of individuals with limited mobility or access to healthcare providers, especially those with limited education living in rural settings.

Purpose: This study examined the efficacy of using self-monitoring diaries in a weight loss program targeting chronically ill and obese rural-dwelling adults.

Methods: A community-based intervention program using a pretest and posttest design examined the effect of using self-monitoring diaries on weight loss. Fifty participants were enrolled from the chronic disease clinic of a district health center with limited medical resources in a remote village in southwestern Taiwan. All participants were diagnosed with diabetes and/or hypertension, had body mass indices between 27 and 32 kg/m², and had a minimum educational level of junior high school. Mean participant age was 43.7 years. Participants were randomly assigned to the intervention or control group. All attended a mandatory 12-week weight loss program. The intervention group received instructions on how to record diet and exercise details in a structured, graphics-based diary provided by the researchers. Body weight and percentage of body fat were measured before and after the program, and data were analyzed by chi-square and ANCOVA.

Results: The intervention group significantly lost more weight than the control group (5.7 kg vs. 2.1 kg; p < .05). The participants of 88% in the intervention group lost 5% or more of their baseline weight greater than the 23% in the control group. Both groups achieved the mean of body fat reductions by comparing pretest and posttest.

Conclusions/Implications for Practice: Self-monitoring diaries can have a significant impact on weight loss in individuals living in rural communities. Healthcare providers and health promotion agencies can use the suggested checklist method to improve weight loss promotion programs in isolated rural communities with limited medical resources.

KEY WORDS: obesity, weight loss, self-monitoring, diary, rural area.

Introduction

The prevalence of obesity and obesity-related diseases has increased dramatically in recent years; these issues are now widely recognized as serious public health problems (World Health Organization, 2012). Being overweight or obese is associated with increased rates of multiple comorbidities, including Type II diabetes and cardiovascular diseases such as hypertension and coronary heart disease (Guh et al., 2009), which can lead to further morbidity and mortality (McTigue, Hess, & Ziouras, 2006; Pi-Sunyer, 1999). Studies show that moderate weight loss (5%–10% of initial body weight) has a beneficial effect on cardiovascular risk factors associated with obesity (Elia-Adar, Eldar, & Goldbourt, 2005; Goldstein, 1992) and that maintenance of a healthy weight can be important in the prevention of conditions such as hypertension and Type II diabetes (Guh et al., 2009).

The etiology of obesity is multidimensional and includes genetic, metabolic, cultural, locational, and psychosocial factors (Bouchard, 2008). Patterson, Moore, Probst, and Shinogle (2004) found higher rates of obesity in people living in rural settings. Demographics may play some role in this difference, as people living in rural areas tend to be older and less educated and have lower incomes than urban residents. Age, education, and income level have all been shown to influence the level of obesity.
As multiple determinants influence obesity, relying solely on willpower or individual control is rarely an effective approach to weight loss. Thus, population-based strategies that improve social and physical environments to promote healthy weight loss behaviors are essential (Kumanyika et al., 2008). Moreover, obese individuals who fail to lose weight despite multiple attempts require access to a variety of effective weight control programs.

Dietary changes combined with weight loss behaviors can lead to an average loss of 5%–10% of initial weight during the first 3–12 months (Levy, Finch, Crowell, Talley, & Jeffery, 2007; Samuel-Hodge et al., 2009). A goal of 5% weight loss is considered appropriate to avoid unintentional weight loss, with intentional weight loss being an effort to improve fitness, health, and/or appearance (Eilat-Adar et al., 2005; Goldstein, 1992). Behavioral treatment programs are considered appropriate as a primary intervention for weight loss (Levy et al., 2007). The components of such programs may vary, but all include the common basic elements of nutrition education, lifestyle change, physical activity, problem solving, cognitive restructuring, social support, and self-monitoring (Kumanyika et al., 2008; Pryke & Docherty, 2008; Sacks et al., 2009). Self-monitoring is a key element in behavioral weight loss programs that have been used successfully in treating overweight and obese patients (Jeffery, Wing, Sherwood, & Tate, 2003; Wing & Phelan, 2005).

Self-monitoring includes systematic self-observation, periodic measurement, and target behavior recording (Wilde & Garvin, 2007). While self-report is one method of self-monitoring, concerns regarding its reliability have been raised in the literature because of the tendency of overweight and obese individuals to underreport their consumption of food and drink (Johnson, Friedman, Harvey-Berino, Gold, & McKenzie, 2005; Lara, Scott, & Lean, 2004). Early studies that relied solely on self-report may not have provided a true estimate of actual behaviors (Donaldson & Grant-Vallone, 2002). However, although self-report has some inherent weaknesses, there is clear evidence of its importance in weight loss programs (Boutelle, Kirschenbaum, Baker, & Mitchell, 1999; Johnson et al., 2005; Lombard, Deeks, Ball, Jolley, & Teede, 2009).

The challenge is to develop appropriate tools to enhance self-monitoring to help participants become aware of their behaviors during weight loss attempts. A variety of ways to record dietary and related behaviors have been used, including electronic devices (personal digital assistants, online clubs, or telephone voice messages; Tate, Wing, & Winett, 2001) and paper (paper-and-pencil documentation and booklets) methods (Burke et al., 2008). Diaries are a common tool in weight loss programs that can provide a real-time method of self-monitoring food intake if used correctly. Burke et al. (2008) used instrumental paper diaries (IPD) to document self-monitoring patterns in weight loss and compared IPD with electronically documented self-monitoring data. Results showed a positive correlation between weight loss and IPD use.

In summary, although self-monitoring is part of many weight loss programs and is widely accepted as effective, there is a lack of related research on individuals with limited abilities or access to healthcare providers, especially those with limited education from rural environments. Individuals living in remote areas also have less access to technological resources. Therefore, this study was designed to examine the effects of using self-monitoring diaries to promote a weight loss program in a remote and rural community. We hypothesized that including a self-monitoring diary in a weight loss program would increase weight loss and decrease the percentage of body fat more than not including it.

### Methods

A community-based intervention using a pretest and posttest design examined the effects of including a self-monitoring diary in a weight loss program for chronically ill obese adults in a rural area.

### Participants

Participants were recruited from a district health center clinic in a rural area in southwestern Taiwan. The health center was the only medical resource available for chronic disease care in the community. Inclusion criteria were diagnosis of either Type II diabetes or hypertension, a body mass index (BMI = [weight / height²] × 100%) between 27 and 32, and a self-reported minimum educational level of junior high school. Participants who were physically unable to handle daily living activities and thus were dependent on others were excluded from the sample. Information was obtained from the clinic’s registration list. Eligible individuals were contacted by phone and invited to participate. We reviewed the clinic’s medical records for each participant after obtaining approval from the institutional review board.

An initial 60 participants were recruited. A permuted block design with matching by gender and educational level was used to randomly assign 30 patients into the intervention and control groups. Ten participants withdrew from the study. Reasons for withdrawal that were provided by phone included lack of time, scheduling conflicts, and other surpassing needs such as caring for sick relatives. In comparing the 50 participants completing the study to those who withdrew, we found no significant differences in terms of demographics or body mass index.

Twenty-four participants in the intervention group and 26 in the control group completed the 12-week weight control program (Figure 1). The sample power was .99, as evaluated by the Power and Precision version 4 (Biosoft, Inc., Englewood, NJ, USA) based on mean weight loss after the program in the intervention group (mean = 5.6 kg, SD = 2.6 kg) and control group (mean = 2.7 kg, SD = 1.4 kg), with an alpha level set at .05.
**Intervention Program**

We designed a 12-week weight loss program with lifestyle changes to modify behaviors related to nutrition and exercise. The program included weight loss educational classes, with the participants expected to put what they had been taught into practice for 9 weeks. Program performance was evaluated in Week 12. The educational classes were six 2-hour educational talks that focused on obesity, weight loss, behavior modification, and other similar topics (Table 1), delivered over a 3-week period. After each class, participants were expected to apply what they had learned to their weight loss programs. Both groups received these educational classes, but only the intervention group was taught how to use the self-monitoring diary (Appendix 1).

**Procedure**

The 12-week weight loss program was implemented in the district health center of a rural community. All participants attended the six classes taught by the researcher, a public health nurse, physician, nutritionist, and exercise physiologist. Physiological measurements were obtained during the first weekly visit, and participants returned to the clinic each week for regular visits. Team members addressed participant questions and concerns directly at these visit sessions.

Participants in the intervention group reviewed information and instructions on how to record diet and exercise behavior details in the provided diaries (Appendix 2). The researcher and a public health nurse reviewed participant diaries at each weekly clinic visit and discussed progress in meeting behavior modification guidelines with each participant. At Week 12, all the participants returned to the clinic for an evaluation of physiological parameters.

**Instrument**

Before the weight loss program, we obtained participant physiological measurements, had participants fill in a structured

**TABLE 1. Outline of the 3-Week Weight Loss Educational Classes**

<table>
<thead>
<tr>
<th>Class</th>
<th>Topic</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What do overweight and obesity mean? – definition, measurement</td>
<td>Public health nurse</td>
</tr>
<tr>
<td></td>
<td>indicators, and healthy weight</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>The causes of obesity and related disorders – understand your</td>
<td>Family medicine physician</td>
</tr>
<tr>
<td></td>
<td>physical condition</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>How to lose weight? – healthy weight loss and management</td>
<td>Nutritionist</td>
</tr>
<tr>
<td>4</td>
<td>Dieting and calories – knowing the calories in food and calculating</td>
<td>Nutritionist</td>
</tr>
<tr>
<td></td>
<td>your daily needs</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Exercise and weight loss – how to exercise</td>
<td>Exercise physiologist</td>
</tr>
<tr>
<td>6</td>
<td>Behavior modification and weight loss – selecting weight loss</td>
<td>Researcher</td>
</tr>
<tr>
<td></td>
<td>strategies</td>
<td></td>
</tr>
</tbody>
</table>
demographic data questionnaire, and asked participants, “How confident are you in your ability to lose weight?” with confidence ranked on a 0–100 visual analog scale.

Six experts established questionnaire content validity. Four were senior community health nurses, and two had doctoral degrees in community health nursing. The experts provided an evaluation score for each questionnaire item ranging from 1 (not appropriate) to 4 (appropriate). The mean score for each item ranged from 2.9 to 3.5. The overall Scale Content Validity Index (S-CVI/ Ave) was .82. We used an intracorrelation coefficient to examine test–retest reliability with 10 adult residents in the target community. Resultant intracorrelation coefficient values ranged from .68 to .82 for the 10 questionnaire items.

We used an electronic body composition analyzer (TBF-410 in-body, Tanita Corp., Arlington Heights, IL, USA) to measure body weight and percentage of body fat at Weeks 1 and 12. To minimize error, participants were measured at 8:00 AM on an empty stomach, wearing light clothing, and after morning voiding and defecation.

Data Analysis
We used a paired \( t \) test to analyze pre–post changes within the two groups; a pretest adjusted ANCOVA to compare the posttest results between the two groups; and chi-square analysis to identify the percentage of individuals who had lost at least 5% of their initial weight at posttest, with a significance level set at \( p < .05 \).

Results

Participants
There were no significant differences in age, gender, educational level, and employment status between intervention and control groups (Table 2). There were no significant differences between the groups in pretest physiological parameters. Both groups reported similar levels of self-confidence related to weight loss ability.

Physiological Changes
Both groups decreased their percentage of body fat significantly. There was no significant difference between the two groups in the percentage change in body fat between pretest and posttest (Table 3). The difference in pretest and posttest weight change was significant for both groups, with intervention and control groups achieving 7.3% and 3.8% decreases in body weight, respectively. A comparison of mean weight loss significantly showed more weight loss in the intervention group compared with the control group (5.6 kg vs. 2.7 kg).

Determinations of \( \geq 5\% \) weight loss referenced each participant’s preprogram weight. Significantly, more participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre Mean</th>
<th>Pre SD</th>
<th>Post Mean</th>
<th>Post SD</th>
<th>Difference Mean</th>
<th>Difference SD</th>
<th>Paired ( t )</th>
<th>ANCOVA ( F )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight (kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>76.1</td>
<td>8.6</td>
<td>70.5</td>
<td>9.2</td>
<td>-5.6</td>
<td>2.6</td>
<td>-10.6**</td>
<td>21.3**</td>
</tr>
<tr>
<td>Control</td>
<td>70.9</td>
<td>9.4</td>
<td>68.2</td>
<td>9.1</td>
<td>-2.7</td>
<td>1.4</td>
<td>-9.9**</td>
<td></td>
</tr>
<tr>
<td>Percentage of body fat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>38.3</td>
<td>8.0</td>
<td>37.2</td>
<td>3.7</td>
<td>-1.1</td>
<td>1.6</td>
<td>-3.1*</td>
<td>0.04</td>
</tr>
<tr>
<td>Control</td>
<td>37.9</td>
<td>5.8</td>
<td>36.9</td>
<td>4.7</td>
<td>-1.0</td>
<td>1.6</td>
<td>-3.5*</td>
<td></td>
</tr>
</tbody>
</table>

\( *p < .01 \)  \( **p < .001 \).
in the intervention group were able to lose 5% of their body weight than in the control group (Table 4).

**Discussion**

This study explored the use of self-monitoring diaries during a 12-week weight loss program for overweight and obese adults with chronic illness in a rural area. The significant reduction in body weight in the combined sample reflects the effectiveness of the weight loss program used. We further showed the effectiveness of using self-monitoring diaries to make the weight loss even more effective. Areas with limited access to computers and medical resources require an easy and affordable way to promote weight loss. Paper diaries represent one effective tool for achieving effective weight loss. Moreover, compliance with the self-monitoring diaries was high despite participants’ generally low level of education.

The 7.3% decrease in initial body weight achieved by study participants is similar to other weight loss programs of similar duration, with reported mean weight losses ranging from 3 to 6 kg (Johnson et al., 2005; Leslie, Lean, Baillie, & Hankey, 2002).

Percentage of body fat decreased significantly in both groups. This finding may reflect the inclusion of both groups in the same weight loss education classes, which asked participants to restrict caloric intake during the first 3 weeks to 1,200–1,500 kcal based on their individual requirements. This lack of between-group differences indicates that the weight loss program contributed to loss of percentage of body fat. We elicited no evidence that the self-monitoring diaries contributed to any additional loss.

Significantly, more participants in the intervention group lost at least 5% of their baseline weight than in the control group. It is possible that the effects of writing the self-monitoring diaries reminded the intervention group to comply with recommended behavioral modification steps. All intervention group participants who lost more than 5% of their baseline weight submitted complete diaries; three who did not submit their diaries, which had incomplete entries, suggesting incomplete adherence. Adherence is a factor that influences self-monitoring in weight control programs (Johnson et al., 2005). Burke, Music, Styn, and Warziski (2006) investigated the use of electronic diaries and found a positive correlation between adherence to self-monitoring and weight loss. In the current study of rural adults, self-monitoring diaries recorded only eating frequency and were not used to calculate calories consumed. The easy-to-comprehend pictorial checklist format may have also contributed to the diaries’ high participant adherence rate.

**Limitations and Suggestions**

The participants in this rural sample were middle-aged and had limited formal education. Thus, findings should not be generalized to other populations. By definition, a diary is a self-reporting tool with potential limitations to its validity. However, education followed by self-monitoring promoted successful weight loss in our randomly assigned groups. Results also show adherence to diet and physical activity recommendations to be crucial to achieving effective weight loss results.

**Practical Implications**

The self-monitoring checklist method is an effective tool for achieving weight loss. On the basis of the results of this study, we suggest community health professionals use this approach as a strategy to promote weight loss in chronically ill obese adults.

**References**


APPENDIX 1

Sample Page of a Self-Monitoring Diary

<table>
<thead>
<tr>
<th>Food Category</th>
<th>Bread / Rice</th>
<th>Milk</th>
<th>Fish, Meat &amp; Egg</th>
<th>Vegetable</th>
<th>Fruit</th>
<th>Kcal/meal</th>
<th>Kcal/ day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Meal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>xx/xx</td>
<td>Breakfast</td>
<td>2 units</td>
<td>0 unit</td>
<td>1 unit</td>
<td>1 unit</td>
<td>1 unit</td>
<td>275</td>
</tr>
<tr>
<td></td>
<td>Lunch</td>
<td>2 units</td>
<td>0 unit</td>
<td>2 unit</td>
<td>1 unit</td>
<td>1 unit</td>
<td>440</td>
</tr>
<tr>
<td></td>
<td>Dinner</td>
<td>6 units</td>
<td>1 unit</td>
<td>2 unit</td>
<td>1 unit</td>
<td>0 unit</td>
<td>555</td>
</tr>
</tbody>
</table>

APPENDIX 2

Sample of Self-Monitoring Diet and Exercise Diary

<table>
<thead>
<tr>
<th>Weight Loss Activity</th>
<th>Date Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet (kilocalorie and balance)</td>
<td>3/15</td>
</tr>
<tr>
<td>1200–500 kcal/day</td>
<td>✓</td>
</tr>
<tr>
<td>Nutrition intake balance per day based on healthy diet guidance</td>
<td>✓</td>
</tr>
<tr>
<td>Reason objective was not achieved</td>
<td>Dinner eaten out</td>
</tr>
<tr>
<td>Exercise (frequency and amount)</td>
<td>3/15</td>
</tr>
<tr>
<td>Frequency: Check if exercised two or three times a week</td>
<td>✓</td>
</tr>
<tr>
<td>Amount: Exercise each time for at least 30 minutes</td>
<td>✓</td>
</tr>
</tbody>
</table>

Note. ✓ = yes; ✗ = no.
於偏遠地區使用自我監測日誌於慢性病併有肥胖成人之減重方案成效

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背 景
自我監測應用在減重的成效已廣被接受並成為減重方案中的一部份，然而較少有研究
根據自我監測來設計一有用的方法，以應用在能力有限或不易獲得健康照護提供者的
民眾上，特別是這些人來自低教育程度偏遠地區。

目 的
本研究目的欲檢驗於偏遠地區使用自我監測日誌於慢性病肥胖成人減重方案之成效。

方 法
採前後測介入對照設計，檢驗自我監測日誌在減重方案中的效果。研究對象來自台灣
西南部醫療資源有限之偏遠地區衛所慢性病門診，有糖尿病或高血壓，身體質量數
在27至32 kg/m²，國中畢以上，共五十位，年齡平均43.7歲，全程參與本研究。以隨機
分派至介入組與對照組，兩組須參與12週減重方案，惟介入組致教導如何使用結構式
的圖畫自我監測日誌，記錄日常飲食與運動。在方案前後測量體重與體脂百分比，
以卡方檢定及共變數分析其成效。

結 果
介入組的體重減少顯著多於對照組（5.7公斤vs. 2.1公斤; p < .05），介入組減少的體重
達到原始體重5%或以上者明顯多於對照組，兩組的體脂肪百分比均顯著減少，但未達
組間差異。

結 論／實務應用
減重方案若輔以使用自我監測日誌，有助於减少體重。在醫療資源不足之偏遠地區進
行減重方案，使用結構化與引導式方法來記錄飲食與運動，可有效促進體重的減少。

關鍵詞：肥胖、減重、自我監測、日誌、偏遠地區。