Self-Monitoring May Be Necessary for Successful Weight Control

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The relationship between self-monitoring and weight control was examined closely by analyzing 18 weeks of data for 56 participants in a long-term cognitive behavioral weight-loss program. The percentage of subjects who monitored consistently, which monitoring variables were most related to weight change, and the effect of variability in monitoring on weight change were examined. Approximately 2/3 of the subjects monitored food consumption for the entire day more than half of the days; approximately 1/4 did not monitor on most days. Monitoring—any food eaten, all foods eaten, time food was eaten, quantity of food eaten, and grams of fat consumed—was positively correlated with weight change. Not monitoring at all was negatively associated with weight change. More consistent monitors lost more weight and participants lost much more weight during their best, compared to their worst, weeks of monitoring. These results support the notions that self-monitoring, and perhaps “obsessive-compulsive self-regulation,” are necessary for successful weight control.

Self-monitoring is the systematic observation and recording of target behaviors (Kanfer, 1970). Self-monitoring is sometimes described as the “cornerstone” (Wadden, 1993, p. 201) and the most effective technique used in behavioral treatments of obesity (Kirschbaum, 1987; Perri, Nezu, & Viegener, 1992, p. 60; Wadden & Foster, 1992). Dramatic support for the effectiveness of self-monitoring was found in a study by the first author under the direction of the second author. It was supported, in part, by grants from the National Institute of Mental Health (R44 MH41663) and the Sandoz Nutrition Corporation. The authors wish to thank Kim Chupurdia and M. Ellen Mitchell for their help on this project. Portions of this study were presented at the annual conferences of the Association for Advancement of Behavior Therapy, November, 1991, and the American Psychological Association, August, 1992.

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of self-monitoring was obtained by Fisher, Lowe, Jeffrey, Levenkron, and Newman (1982). Fisher et al. found that their clients who discontinued self-monitoring during a 3-week holiday season gained 57 times as much weight as their counterparts who sustained self-monitoring. Flanery and Kirschenbaum (1986) found that of 10 eating-habit changes assessed, self-monitoring was the only one that significantly correlated with maintenance of weight losses 1½ years posttreatment. In another study, 73% of the clients reported "always or most always" recording their food intake at posttreatment, but only 8% recorded at this level at 1 year (Guare, Wing, Marcus, Epstein, Burton, & Gooding, 1989). Self-monitoring was one of four behaviors related to weight loss. Similarly, Rosenthal and Marx (1981; cited in Sternberg, 1985) found that 89% of "nonrelapers" reported relying on record keeping and calorie counting as a means of controlling posttreatment regain.

These studies suggest part of the rationale for increasing treatment duration and argue for the corresponding conceptualization of obesity as a chronic condition (Brownell & Jeffery, 1987; Jeffery, 1987; Kirschenbaum, 1988; Perri, 1987). In fact, length of treatment has emerged as a significant factor in weight control based on correlational analyses within treatment programs (e.g., Bellard, Kirschenbaum, & Fitzgibbon, 1992; Sandifer & Buchanan, 1983), meta-analyses (Bennett, 1986; Lindorff, 1987), and an experimental comparison of 20- versus 40-week treatments (Perri, Nezu, Patti, & McCann, 1989). Despite the efficacy of longer term treatment, the active elements responsible for improvement remain poorly understood. For instance, Perri, Shapiro, Ludwig, Twentyman, and McAadoo (1984) speculated that the "content" of client-therapist interactions may have been the critical factor in posttreatment success. However, empirically based models of self-regulatory processes (e.g., Carver, 1979; Kanfer, 1971; Kanfer & Gaelick-Buys, 1991; Kanfer & Karoly, 1972; Kirschenbaum, 1987) suggest that the content of therapist-client interactions may have less impact on weight control than the process of their interactions. That is, frequent contact between therapists and weight controllers probably engages and reinforces self-monitoring, self-evaluation, and related cognitive processes that sustain behavior change. Recent research by Perri and his coworkers also supports this assertion (Perri & Nezu, 1993).

The maintenance of consistent self-monitoring despite competing internal and external demands seems particularly critical (Kirschenbaum & Karoly, 1977). Kirschenbaum and Tomarken (1982, p. 181) suggested that the term "obsessive-compulsive self-regulation" was necessary to describe the degree of persistence at self-monitoring that seems necessary to prevent self-regulatory failure. When people self-monitor a variety of behaviors, such as fingernail biting (Maletzky, 1974), academic performance (Brodin, Hall & Mitts, 1971; Heffernan & Richards, 1981), and effort during athletic training (Hume, Martin, Gonzalez, Cracklen, & Gentthon, 1985), they self-regulate effectively. When people discontinue self-monitoring, self-regulatory failure often follows (Kirschenbaum, 1987, 1992; Kirschenbaum et al., 1992).

Research on the effects of self-awareness on eating behaviors provides further support for the critical role of self-monitoring in self-regulated behavior change (Heatherton & Baumeister, 1991); that is, simply placing a mirror in
front of restrained eaters and/or overweight subjects can decrease consumption of food compared to conditions in which a mirror is not present (Pliner & Iuppa, 1978). Similar effects are observed when other procedures are used to decrease self-awareness (Polivy, Herman, Hackett, & Kuleshnyk, 1986; Schotte, Cools, & McNally, 1990; Wardle & Beales, 1988; Williamson, 1990). Self-monitoring, by definition, heightens self-awareness. Thus, as described in current models of self-regulation (see Carver & Scheier, 1981; Kanfer & Gaelick-Buys, 1991; Kirschenbaum, 1987), self-awareness and, perhaps, self-monitoring seem critical as promoters of effortful behaviors emitted in order to achieve meaningful goals.

Despite direct empirical evidence and indirect theoretical evidence from models of self-regulation, self-monitoring has not been treated by researchers or clinicians as a necessary component of effective weight control. For instance, Sternberg (1985) noted that "no studies have succeeded in demonstrating a relationship between changes in target behaviors, such as record keeping or slowing down rate of eating, and reduction of weight" (p. 522). Self-monitoring has been viewed as a process that may mediate weight change instead of as a vitally important outcome of clinical intervention. The extent to which self-monitoring affects weight control requires further investigation in at least three areas.

First, at a purely descriptive level, it would be helpful to know what percentages of people in weight control treatment programs monitor consistently. Clearly, not all persons in treatment, particularly current treatments that last for many months or even for years, will monitor simply because they are encouraged to do so. Without a clearer understanding of monitoring behavior, therapist and client expectations regarding monitoring behavior are likely to be misaligned (Goldstein & Higginbotham, 1991). This may result in low efficacy and outcome expectancies, poorer therapist-client relationships, and less effective treatment (Bernier & Avard, 1986; Stotland & Zuroff, 1991). We hypothesized that the consistency of participants’ self-monitoring would vary considerably in a long-term obesity treatment program but that a substantial number of participants would monitor very completely and consistently.

Second, it would be helpful to know whether the monitoring of certain variables is more clearly related to weight control than is the monitoring of other variables. For instance, is simply monitoring any food eaten during a given day sufficient, or must food be monitored continuously for the entire day? Is it helpful to monitor additional weight-related variables such as mood? Perhaps there is an optimal number of variables to monitor. Clients may become burdened by the monitoring process, and disengage from it prematurely, when they attempt to attend to too many variables (Kanfer & Stevenson, 1985; McFall, 1976). It may not matter which variables are monitored, because monitoring anything may serve as an attentional prompt toward effortful behavior. We suspected that the monitoring of variables that are most critical physiologically—factors such as food, fat, exercise, and quantity of food consumed—would be related to weight change. The monitoring of less critical variables—those such as water intake, situations, and companions with whom the food was consumed—was not expected to be as directly related to weight change.
Third, the issue of causality remains unclear. Does self-monitoring cause weight loss, or are those who consistently self-monitor more likely to succeed at weight control for other reasons (e.g., stronger commitments, better coping skills)? One way to consider the degree to which self-monitoring can cause behavior change is to conceptualize self-monitoring as either a state or a trait. A trait perspective suggests that some people usually monitor very consistently, whereas others typically monitor inconsistently. A state perspective emphasizes the variability within individuals' monitoring behaviors. That is, under some conditions (or states) most people may monitor consistently, whereas their monitoring may become more inconsistent when they are, for example, sick or emotionally distraught.

Miller (1987) developed a traitlike concept that applies particularly well to the present focus on self-monitoring. This measure has been demonstrated to differentiate individuals into coping style categories based on their self-reported preferences for information and distraction in a variety of imagined stressful situations (Miller, 1987). Miller (1990) described monitors as those individuals who are sensitive to threat-relevant information and who utilize this information in their coping efforts. Blunters were described as those individuals who avoid threat-relevant sources of information under stressful conditions. We speculated that monitors may lose more weight than blunters because monitors would be more likely to sustain self-monitoring and attentional focusing under stressful conditions (a trait hypothesis) than to attempt to escape perceptions of failure or personal inadequacy (Carver & Scheier, 1981; Heatherton & Baumeister, 1991; Kanfer & Schefft, 1988; Kirschenbaum, 1987). We hypothesized, however, that regardless of subjects' coping style, they would lose more weight during weeks in which they monitored more consistently than they would during weeks in which they monitored less consistently (a state hypothesis).

The purpose of the present study was to examine the effect of self-monitoring with a greater level of specificity than has previously characterized the weight-loss literature. Our goal was to investigate the importance of self-monitoring and thereby guide future research and treatment toward a better understanding of the role of self-monitoring in effective weight control.

**Method**

**Subjects**

Fifty-six individuals (48 women and 8 men) who had been participating in a long-term cognitive behavioral treatment program (the People At Risk [PAR] Weight Control Program; Kirschenbaum, 1988, 1992) volunteered to serve as subjects. The subjects had participated in PAR for an average of 40.11 weeks (SD = 60.99) and had lost an average of 21.10 pounds (9.60 kg; SD = 26.37 lb) prior to beginning this study. Forty-one subjects were involved in group treatment and 15 in individual treatment. (For descriptions of subject selection, the PAR program, and its efficacy see Beliard, Kirschenbaum, & Fitzgibbon, 1992; Conviser, Fitzgibbon, & Kirschenbaum, in press; Fitzgibbon & Kirschenbaum, 1992; Kirschenbaum, 1988, 1992).
Subjects' mean weight at the beginning of this study was 246.50 pounds (112.05 kg, $SD = 56.41$ lb) with a mean of 75.54% overweight ($SD = 35.18$). The mean percent overweight was calculated using the 1983 Metropolitan Life Insurance Company's Standard Height-Weight Tables. Forty-eight of the subjects were Caucasian, 6 were African-American, and 2 were of other ethnic backgrounds. Subjects' mean age was 43.82 years ($SD = 12.67$). Forty-five percent of the sample were single; 46% were married, and 9% were separated, divorced, or widowed. They were well educated (16% completed only high school, 23% had attended some college, 30% had completed college, and 30% had obtained graduate degrees). Seventy-five percent of the sample were employed full time, 11% were unemployed, 5% were retired, 5% were homemakers, 2% were students, and 2% were employed part time. All subjects not currently using Optifast or planning to do so were eligible for this study and were encouraged to participate for a minimum of 12 consecutive weeks.

Procedure

Each week each participant was provided with a new self-monitoring booklet in which he or she was strongly encouraged to record all food consumed during the week and to count the calories in these foods. The booklet consisted essentially of blank pages with columns for time, food, and calories; this allowed participants to record data in a relatively free format. Each page of the booklet was approximately 4 inches wide by 6 inches long; the booklet was kept small to make it easily portable. The contents of the booklets were discussed with participants during each of their sessions. Thus, self-monitoring was an integral part of treatment (in addition to behavioral contracting and training in decision making, problem solving, planning, and relapse prevention). Subjects were encouraged to use the booklets in the same manner during this study as they had prior to becoming involved in this project; thus, subjects were encouraged to monitor other variables—such as fat grams and exercise—based on their specific individual treatment issues.

Each subject's daily monitoring was recorded as to the occurrence of the various types and quality of variables monitored. These variables included (1) whether subjects monitored on a given day and (2) whether monitoring included the whole day or only a portion. Other variables monitored and recorded included (3) food, (4) calories, (5) weight, (6) type of situation, (7) where food was consumed, (8) time food was consumed, (9) with whom food was consumed, (10) water consumption, (11) event or (12) situation in which food was consumed, (13) exercise, (14) mood, (15) fat consumption, (16) caloric total, and (17) "other." Reliability for recording of behaviors monitored was calculated by counting the number of agreements/agreements + disagreements. Total reliability, for 2 raters with no training regarding specific rules, was .94 for all 17 variables.

Participants' weights were recorded by therapists at each weekly meeting. When participants missed a session, the mean difference between known weights was recorded. Sixty-three percent of the participants regularly weighed at the treatment site in view of their therapists. In order to improve the accuracy of weight data, weights were verified by therapists via questioning during ses-
sions. Therapists provided retrieval cues, inquired about weekly weight changes, and ensured privacy. These procedures have been suggested as means of improving the accuracy of self-reported weight data (Cameron & Evers, 1990). Furthermore, the investigators corroborated any weight discrepancies with subjects' therapists. Subjects also completed the Miller Behavioral Style Scale (Miller, 1987) at the beginning of their involvement in the study.

Data Analyses

The central focus of this study was the relationship between self-monitoring and weight change. This was examined by calculating the correlations between the monitoring variables and both weight change and change in percent overweight at both 12 and 18 weeks. The correlations between weight change and change in percent overweight were also calculated with ideal weight, initial weight upon entering the program, number of previous weeks in the program, and amount of weight lost during the program.

Results

Descriptions of Weight Change and Self-Monitoring

Weight Change

By week 12, participants \(N = 56\) had lost an average of 4.03 lb (1.83 kg; \(SD = 13.10\) lb) in addition to the 21.01 lb they had lost prior to beginning this study. By week 18, participants \(n = 36\) had lost 2.81 lb (1.28 kg, \(SD = 17.51\) lb). All but one subject began this study within a three-week period. The 20-person difference in sample size between weeks 12 \((N = 56)\) and 18 \((n = 36)\) was due to subjects' entering the study at different times. All 20 subjects were still involved at the time data collection was completed but had not yet completed 18 consecutive weeks, although most subjects had actually completed more than 12 consecutive weeks of monitoring.

Self-Monitoring Behavior

Diversity in monitoring behavior was clearly demonstrated in the percentage of subjects who actually monitored and in the type and frequency of the variables monitored. Specifically, as shown in Figure 1, at 12 weeks 27% of the subjects monitored all foods eaten on between 51% and 75% of the days, and 39% of the subjects monitored all foods eaten on 76% of the days or more; 16% of the subjects monitored all foods eaten on between 26% and 50% of the days, and 18% monitored on fewer than 25% of the days. Similarly, at 18 weeks 72% of the subjects monitored all foods eaten 51% of the time or more, and 14% monitored all foods eaten on fewer than 25% of the days.

Relationship Between Self-Monitoring and Weight Change

Correlational analyses were conducted to describe the relationships between the monitoring of 17 specific variables and weight change (see the Method section for a complete list of variables). These analyses were conducted by summing the number of times each variable was monitored across both 12
and 18 weeks. As shown in Table 1, six variables correlated significantly with weight change after 12 weeks: (1) monitoring of any food consumed, (2) monitoring all foods eaten for the entire day, (3) monitoring time food was eaten, (4) monitoring quantity of food eaten, (5) monitoring grams of fat consumed, and (6) not monitoring. These same variables were also highly correlated with weight change after 18 weeks, *rs* range = .54-.65, *ps* < .001. The correlation between weight change during this study and amount of weight lost prior to beginning this study, *r*(56) = −.31, as well as the correlation between weight change and number of prior weeks in treatment, *r*(56) = −.28, both failed to reach significance. Analyses using change in percent overweight

\[ \begin{array}{cccccccc}
\text{Variable} & 1 & 2 & 3 & 4 & 5 & 6 \\
1 \text{ Weight change} & & & & & & \\
2 \text{ Any food} & .42** & & & & & \\
3 \text{ All foods eaten} & .44** & .98** & & & & \\
4 \text{ Time} & .44** & .90** & .89** & & & \\
5 \text{ Quantity} & .41** & .84** & .85** & .78** & & \\
6 \text{ Fat} & .35* & .36* & .39* & .40 & .37* & \\
7 \text{ No monitoring} & -.41* & -.99** & -.97** & -.90** & -.84** & -.35* \\
\end{array} \]

*p* < .01

** *p* < .001
rather than weight change in pounds revealed the same findings; weight change and change in percent overweight were highly correlated, \( r(56) = .99, p < .001 \).

**Group Analyses**

The preceding correlational analyses clearly demonstrated significant relationships between monitoring and weight change when data were summed across all the weeks of the study. A monitoring index utilizing the six variables that correlated significantly with weight change was calculated to provide a more comprehensive and stringent measure of subjects' monitoring. The index was calculated by summing the number of times each variable occurred during each week. The following formula was used to compute the monitoring index: monitoring all foods eaten + monitoring of any food eaten + monitoring time food was eaten + monitoring quantity of food eaten + monitoring grams of fat consumed – not monitoring. Subjects were divided into two groups utilizing a median-split procedure based on their individual monitoring indexes across 12 weeks, creating a between-subjects factor (Overall Level of Consistency and Completeness of Monitoring — High Versus Low).

The effect of individual subjects' variability in monitoring on weight change was also of interest. To accomplish this within-subjects analysis, subjects' "best" and "worst" weeks of monitoring were calculated using the monitoring index, creating a within-subjects factor (Best Versus Worst Weeks of Monitoring). The best and worst weeks were determined using the upper and lower quartiles (cf. Feldt, 1961) of indexes for 12 weeks (3 best and 3 worst). A priori criteria were set so that when more or fewer than the expected number of best or worst weeks of monitoring were obtained, as in the case of ties, the mean was used. For instance, if there were 5 weeks that all met the criteria for "worst week" during the 12-week analysis, the mean weight change for the 5 weeks was used. When fewer than the necessary number of best and worst weeks were observed—only 2 weeks, for instance—the mean was used. Because of ties, all 12 weeks were used in determining the best and worst weeks of the monitoring index for 20% of the subjects.

A two-way analysis of variance (ANOVA) was computed with two levels of a between-subjects factor (Overall Level of Monitoring—High, Low) and one within-subjects factor (Best Versus Worst Weeks of Monitoring). Average weekly weight change served as the dependent variable. The group with the highest overall level of consistency and completeness of monitoring lost significantly more weight than the group with the lowest overall level of monitoring, \( F(1,54) = 12.11, p < .01 \). Subjects lost significantly more weight during those weeks in which they monitored their best compared to weeks in which they monitored their worst, \( F(1, 54) = 8.60, p < .01 \). The interaction effect between subjects' overall level of monitoring and their best versus worst weeks of monitoring was not significant, \( F(1, 54) = .22, p = .644 \). Figure 2 indicates that participants at the highest level of the monitoring index lost significantly more weight than those at the lower level of monitoring, regardless of whether their best or worst weeks of monitoring were compared.
SELF-MONITORING AND WEIGHT CHANGE

Comparisons Between Subjects at Various Levels of Self-Monitoring

To examine further the main effects demonstrated in the ANOVA, more detailed descriptive analyses were conducted regarding the relationship between self-monitoring and weight change. All subjects were divided into quartiles based on the distribution of the population's actual monitoring indexes. At 12 weeks, 32% and 7% of the subjects monitored at the 3rd and 4th quartiles, respectively, while 30% and 31% monitored at the 1st and 2nd quartiles, respectively. Similarly, at 18 weeks 25% and 8% monitored at the 3rd and 4th quartiles, respectively, while 25% and 41% monitored at the 1st and 2nd quartiles, respectively. Thus, between 33% and 39% of the subjects monitored at the 50th percentile or higher of the distribution of subjects’ monitoring indexes across the 18 weeks.

Figure 3 indicates the percentage of persons who lost weight at each quartile of the monitoring index. Greater percentages of subjects lost weight in the quartiles that reflected greater levels of consistency and completeness of monitoring. Specifically, 41%, 47%, 72%, and 100% lost weight at the respective quartiles at 12 weeks. Figure 4 indicates the corresponding mean weight changes of +1.58, -1.24, -7.90, and -22.13 pounds, respectively. At week 18, 33%, 60%, 78%, and 100% lost weight, respectively (Figure 3). Figure 4 indicates the corresponding mean weight changes of +9.31, -1.73, -5.86, and -31.17 pounds, respectively. A one-way ANOVA demonstrated significant differences in weight change among the subjects at the various quartiles of the monitoring index at both 12 weeks, $F(3, 55) = 5.48, p < .01$, and 18 weeks, $F(3, 32) = 6.16, p < .01$. Newman–Keuls multiple comparisons revealed significant differences only between subjects at the 4th quartile and the first 3 quartiles at both 12 and 18 weeks ($p < .05$).

Another illustration of the importance of consistency of self-monitoring
was obtained by examining weight changes for the 7 subjects who had absolutely no variability in the completeness of their monitoring (e.g., monitored all foods eaten every day). Specifically, six subjects monitored all foods eaten while one never monitored all food consumption for an entire day. The subjects who monitored all foods eaten every day ($n = 6$) lost 19.86 pounds (mean)
compared to the other subjects who also lost weight but had variability in monitoring all foods eaten; those other subjects' average loss was 9.41 pounds, $t(30) = -2.21; p < .05$. Interestingly, the one subject who never monitored all foods eaten gained 6 pounds.

**Regression Analyses**

Regression analyses were computed in an attempt to identify the relative contribution of each of the six monitoring variables associated with weight change. Each of the six variables individually accounted for significant amounts of variance: monitoring of any food consumed, 18%, $F(1,54) = 12.98, p < .001$; monitoring all foods eaten for the entire day, 19%, $F(1,54) = 12.17, p < .001$; monitoring time food was eaten, 20%, $F(1,54) = 13.61, p < .001$; monitoring quantity of food eaten, 17%, $F(1,54) = 11.48, p < .01$; monitoring grams of fat consumed, 12%, $F(1,54) = 7.59, p < .01$; and not monitoring, 17%, $F(1,54) = 11.44, p < .01$. However, multicollinearity existed due to the high degree of intercorrelation among the monitoring variables (see Table 1). Therefore, it was important conceptually to examine how much variance was contributed by all of the variables associated with weight change beyond that accounted for simply by monitoring any food. A forced-entry procedure demonstrated that none of the individual variables contributed significant amounts of variance beyond that accounted for by monitoring any food. However, all six variables entered as a group accounted for 28% of the variance in weight change, $F(6,49) = 3.24, p < .01$.

It was of interest to investigate whether self-monitoring during any given week would be correlated with total weight change at the end of 12 weeks. Twelve separate correlational analyses were conducted to determine if monitoring at each specific week was related to, and therefore representative of, weight change at the end of 12 weeks. The monitoring indexes from all 12 individual weeks, with the exception of week 2, were highly correlated with total weight change and total monitoring index across 12 weeks even when the Bonferroni procedure was applied to correct for multiple comparisons (all $ps < .004$).

It was of further conceptual interest to investigate how soon subjects' overall level of monitoring could be predicted. Stepwise regression analyses were computed in an attempt to determine if any of the monitoring variables during week 1 would predict total monitoring behavior across 12 weeks. None of the individual variables were significant, although the monitoring index at week 1 predicted monitoring all food for the entire day across 12 weeks (Standardized Beta = .53, $t < .001$). Similarly, only the monitoring index at week 1 predicted the total monitoring index across 12 weeks (Standardized Beta = .57, $t < .001$), although monitoring all foods eaten at week 1 approached significance in predicting monitoring all foods eaten across all 12 weeks (Standardized Beta = .56, $t = .059$).

**Dispositional Measures**

Analyses of the Miller Behavioral Style Scale included calculations of three measures derived from this scale (Miller, 1990): (1) The monitoring/blunting
measure is the sum of all of the items endorsed on the monitoring subscale; individuals scoring above the median are considered high monitors and those scoring below the median are low monitors. (2) The blunting measure is the sum of all of the items endorsed on the blunting subscale; subjects scoring above the median are considered high blunters and subjects scoring below the median are low blunters. (3) The monitor/blunter measure is obtained by subtracting the total number of items endorsed on the blunting subscale from the total number of items endorsed on the monitoring subscale. This difference score is used to divide subjects into monitors and blunters.

The monitor/blunter measure did not differentiate weight change, \( t(56) = -0.82, p = .42 \), or the monitoring of all foods eaten, \( t(56) = -1.18, p = .24 \), between monitors and blunters. The blunting measure did not differentiate weight change, \( t(56) = -0.24, p = .82 \), or the monitoring of all foods eaten, \( t(56) = -0.04, p = .97 \), between high and low blunters. The monitoring measure also failed to differentiate weight change, \( t(56) = -1.30, p = .20 \), or monitoring of all foods eaten, \( t(56) = -0.33, p = .74 \), between high and low monitors.

**Discussion**

Self-monitoring consistently emerged as a vital component of effective weight control in this study. First, the prediction that subjects would demonstrate considerable variability in levels of self-monitoring, with a substantial number monitoring at relatively high levels, was confirmed. Second, as expected, the monitoring of certain variables was related to weight change. Specifically, the monitoring of: (1) any food eaten, (2) all foods eaten, (3) time food was eaten, (4) quantity of food eaten, and (5) grams of fat consumed was positively correlated with weight change, while (6) not monitoring at all was negatively associated with weight change. In contrast, monitoring of variables such as water intake, situations in which food was eaten, and with whom the food was consumed was unrelated to weight change. Third, the prediction that subjects' dispositional monitoring style as assessed by the Miller Behavioral Style Scale would be related to self-monitoring and weight change was not confirmed. However, regardless of dispositional style, subjects lost more weight during those weeks that they self-monitored at their highest levels of consistency and completeness.

The present study substantiates the role of self-monitoring as a crucial component in the treatment of obesity (Brownell & Foreyt, 1985; Kirschenbaum, 1987; Perri et al., 1992; Wadden, 1993). At a descriptive level, between 62% and 72% of the subjects monitored all foods eaten most of the time. These levels of monitoring are generally higher than levels reported in other studies (Guare et al., 1989; Streit, Stevens, Stevens, & Rossner, 1991). Schlundt (1988) reported similar findings with subjects using the Self-Monitoring Analysis System (SMAS). During a period of between 8 and 12 weeks, 15% of subjects did not self-monitor, 10% provided records all of the time, and the remaining 75% provided data between 65% and 85% of the time. The People At Risk (PAR) Program's consistent emphasis on self-monitoring (see Kirschenbaum,
1988, 1992) and Schlundt's (1988) similar emphasis may partially explain why subjects in these studies monitored at higher than usual levels. Despite this programmatic attention to the vital role of self-monitoring, more than 25% of the clients did not monitor on most days, and 14% to 18% of them averaged monitoring only 2 days or less per week. Given the effectiveness of the PAR program (see Beliard et al., 1992; Conviser et al., in press; Kirschenbaum, 1988) and the emphasis placed on self-monitoring, these data suggest that a surprisingly substantial percentage of obese individuals in treatment can be expected to monitor at relatively low levels.

Differences between those who consistently monitor at relatively high levels and those who are poor and/or inconsistent monitors require further investigation. In the PAR program, obese individuals who were older (Rosendahl & Kirschenbaum, 1988), more financially secure (Beliard et al., 1992), and less psychologically distressed (Beliard et al., 1992) have tended to lose weight and maintain weight losses more effectively (see also Keefe, Wyshogrod, Weinberger, & Agras, 1984; Marcus, Wing, & Hopkins, 1988). Perhaps such "stabilizing" factors enable individuals to tolerate the inevitable imperfections of their efforts and thereby to sustain self-monitoring more consistently. Heatherton and Baumeister (1991) suggested that the desire to "escape from self awareness" (e.g., by discontinuing self-monitoring) may occur because people sometimes adopt unreasonably high standards and expectations. Perhaps many obese individuals disengage from self-monitoring in an attempt to escape perceptions of failure or personal inadequacy (Carver & Scheier, 1981; Kanfer & Schefft, 1988; Kirschenbaum, 1987).

The monitoring of specific variables was clearly related to weight loss. Monitoring of the 5 variables positively correlated with weight change and not monitoring accounted for 28% of the variance in weight change. However, significant amounts of variance were not contributed by the other variables beyond the variance accounted for by the monitoring of any food. The frequency of monitoring certain variables, such as exercise or mood, may have increased if participants had been specifically instructed to monitor them or if the monitoring booklets had been structured differently. However, participants did monitor some variables consistently (e.g., grams of fat consumed) without being specifically instructed or prompted to so do. The high degree of intercorrelation among the variables indicates that people may tend to monitor a certain set of variables when a fairly unstructured format is used. For instance, when subjects monitored any food, they almost always monitored several other key variables for the whole day (e.g., any food/all foods eaten, $r (56) = .98$). This clearly suggests that monitoring often occurs in an "all or none" fashion; that is, participants seemed to initiate and then maintain self-monitoring all day or they did not self-monitor at all that day. Thus, in accord with self-regulatory theory (e.g., Carver & Scheier, 1981; Kirschenbaum, 1987), attention may be more crucial than the actual information obtained via self-monitoring (cf. Perri et al., 1984). Clinically, it may be important to work on initiating and maintaining monitoring by helping clients maintain positive self-attributions and expectations (Carver & Scheier, 1981, 1990; Heatherton & Baumeister, 1991; Kanfer & Gaelick-Buys, 1991).
Subjects who monitor at the highest levels lost the most weight. In fact, as monitoring quality improved, so did the likelihood that subjects lost weight, particularly those monitoring at the highest levels (Figure 2). Other studies have demonstrated that self-monitoring was related to weight loss (e.g., Guare et al., 1989; Sandifer & Buchanan, 1983; Stalonas & Kirschenbaum, 1985) and that clients who completed the greatest number of weekly food records lost the most weight during a 12-month period (Streit et al., 1992). It is noteworthy that in the present study, at both 12 and 18 weeks, subjects at the lowest quartile of monitoring quality actually gained weight (Figure 3). Although studies with more power are needed to examine differences between quartile groups (Wing & Jeffery, 1984), the most consistent monitors (divided by the median or the quartiles) lost more weight than their less consistent peers. Moreover, the 6 subjects who monitored all of the foods they ate for 12 weeks lost twice as much weight as other subjects who lost weight but had more variability in their monitoring. These findings underscore the importance of consistent monitoring of key variables at relatively high levels to ensure successful weight control. The findings support the suggestion that an "obsessive-compulsive self-regulatory" style may be necessary for effective weight control (Kirschenbaum, 1987; Kirschenbaum & Tomarken, 1982).

Although consistent with both the extant self-regulatory and obesity literatures, these findings only begin to address the issue of causality. Perhaps those who monitored at higher levels were better at weight loss because of other factors not measured in this study, such as commitment to losing weight (e.g., greater self-efficacy), better coping skills, or some other dispositional characteristic. The Miller Behavioral Style Scale (Miller, 1987) did not predict monitoring behavior. This scale was designed to assess coping style under stressful conditions. Therefore, it may not have been relevant to the self-regulatory behaviors assessed in the present study. However, monitoring behavior across all weeks was predicted reliably from monitoring during the first week. Similarly, Hartman, Wapner, and Saxton (1990, cited in Wadden & Foster, 1992, p. 311) found that consistency of self-monitoring in the initial weeks of treatment predicted weight loss over a 6-month period. This degree of consistency across time suggests that participant monitoring behaviors may be influenced by dispositional or trait factors. Some empirical and clinical observations (Kirschenbaum et al., 1992) lead the authors to believe that certain characteristics such as obsessiveness, achievement orientation, and lack of psychopathology are associated with an enhanced ability to sustain self-awareness via self-monitoring. Perhaps individuals who sustain self-monitoring efforts have better frustration tolerance, are better able to make adaptive attributions regarding their monitoring, or are less likely to be disrupted by cognitive or affective factors (cf. Heatherton & Baumeister, 1991; Kanfer & Gaelick-Buys, 1991). In accord with this trait-oriented perspective, high monitors lost weight even during their worst weeks of monitoring (Figure 2). In contrast, the least consistent quartiles of monitors gained weight at both 12- and 18-week assessments.

Not only did those subjects who self-monitored at higher levels consistently
lose more weight, but subjects lost more weight during those weeks they self-monitored more completely as compared to weeks in which they monitored poorly (i.e., best vs. worst weeks of monitoring). This suggests that variability in subjects' overall consistency and completeness of monitoring may be influenced by "state factors." One such state factor may be monitoring weight loss. When weight controllers lose weight for whatever reason (e.g., because of stressful life events or illness), they may improve their self-monitoring, which in turn could improve other weight control behaviors (e.g., exercising; Holden et al., 1992). Other psychological or emotional states may more directly improve self-monitoring and thereby improve weight control. These probably include calm and positive moods, positive accomplishments, and strong encouragement from therapists and other significant people in their lives (Heatherton & Baumeister, 1991; Kanfer & Schefft, 1988; Kirschenbaum, 1987).

It is clear that consistent self-monitoring, regardless of dispositional style or overall level of monitoring, is beneficial. Therefore, it would certainly be worthwhile for clinicians to help poor monitors achieve higher levels of monitoring. Educating weight control participants about the rationale and efficacy of self-monitoring early in the treatment process may be very useful in this regard (e.g., by showing them Figures 2, 3, and 4). The positive treatment effect of role preparation has been demonstrated in a number of studies (Orlinsky & Howard, 1986). Evaluation of various strategies to initiate very strong commitments to self-monitoring early in treatment would be worthwhile because quality of monitoring early in treatment predicts monitoring across many weeks (Wadden & Foster, 1992).

It is unknown to what degree subjects' records of their self-monitoring were accurate. However, assuming this group is representative of obese persons in treatment, accuracy may not be as important as previously suggested (Lansky & Brownell, 1982; Rapp, Dubbert, Burkett, & Buttross, 1986; Todd, Hudes, & Calloway, 1983). Participants' weight losses were clearly related to their reports of monitoring independent of the objective veracity of their records. From a self-regulatory perspective, self-monitoring influences weight loss via enhancement of attentional focusing (e.g., Carver & Scheier, 1981; Kanfer & Karoly, 1972), and accuracy may be beneficial only to the extent that it improves self-focused attention.

The current findings may prove useful in guiding the focus of therapeutic interventions during the treatment of obesity. It is important to view self-monitoring not only as a process that mediates weight control but as an important outcome as well. The relationship between weight change and behavior change is an imperfect one at best. Interventions focused exclusively on weight loss rather than on the behaviors that produce weight loss are misguided. Reinforcement of weight loss rather than self-monitoring may also promote faulty attributions, inappropriate expectations, and ineffective weight control behaviors. If we can develop creative and effective means of sustaining self-monitoring (and "obsessive-compulsive self-regulation"), we may help more people persist at changing refractory behaviors more effectively.
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