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Behavioral approaches to weight control: a review of current research

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Weight management is a salient issue for women. Studies of behavioral, pharmacological and surgical interventions indicate that women comprise the majority of patients presenting for weight-loss treatment. In this review we discuss the health impact of obesity for women, review behavioral treatments for adult overweight and obesity, and address topics of particular relevance for women, including concerns that weight-loss treatment may precipitate the development of eating pathology, as well as time periods of high risk for weight gain such as pregnancy and menopause.

Health impact of obesity & modest weight loss

Approximately 62% of adult women in the USA are overweight or obese (body mass index [BMI] ≥ 25 kg/m²), with over half of these classified as obese (BMI ≥ 30 kg/m²) [1]. This poses a significant public health burden, since obesity is associated with increased risk of Type 2 diabetes, cardiovascular disease and death (Table 1) [2–8]. In addition, obesity increases the risk of developing cancer [9–11] and for women this includes gynecologic [12] and postmenopausal breast cancer [13]. Women who are overweight or obese are more likely to experience reproductive disorders [14], obstetric complications [15,16], urinary incontinence [17] and depression [18,19]. While obesity significantly impacts length and quality of life for all persons, epidemiological data suggest that obese women experience a disproportionate burden of obesity-related disease as evidenced by differences in health-related quality of life and late-life mortality compared with men [20]. For example, obese women report greater impairment in areas of physical and social function, vitality, self-esteem and lower overall health-related quality of life compared with obese men [20–22], morbidity studies suggest that the association between obesity and certain medical conditions (e.g., Type 2 diabetes and depression) appears stronger for women than for men [18,23,24], and data from a nationally representative sample of US adults reveal that after the age of 45 years, obesity has a greater impact on mortality for women than men [20].

Weight loss is recommended for individuals who are obese or those who are overweight with two or more risk factors, including (but not limited to) hypertension, high cholesterol, Type 2

diabetes, physical inactivity and smoking [25]. Modest weight loss of 7–10% of body weight among overweight and obese individuals has significant health benefits, including reductions in blood pressure, total cholesterol and triglycerides, increased cardiorespiratory fitness and improvements in health-related quality of life [26–28]. The strongest evidence to date of the benefits of modest weight loss for prevention of disease comes from the Diabetes Prevention Program [29]. In this study, 3234 overweight or obese individuals (68% female) with impaired glucose tolerance were randomly assigned to one of three groups: an intensive lifestyle intervention focused on changing eating and exercise behaviors, metformin (a diabetes medication), or placebo. Participants in the lifestyle program achieved a 7% weight loss at 6 months and maintained a 5% weight loss at 3 years [30]. This modest weight loss reduced the incidence of diabetes by 58% compared with placebo and was significantly more effective than metformin. The benefit of weight loss in the prevention of Type 2 diabetes was also demonstrated by Tuomilehto and colleagues [31]. Furthermore, intentional weight loss has been associated with a reduced risk of certain cancers among postmenopausal women [32], as well as improvements in reproductive functioning [33], urinary incontinence [34] and depression [35].

Behavioral weight-loss treatment Overview of treatment components & structure of treatment

Behavioral weight-loss treatments (also called lifestyle interventions or standard behavioral treatment [SBT]) focus on changing diet and physical activity (PA) to promote weight loss and weight-loss maintenance [36]. These programs

Keywords: behavioral treatment, diet, exercise, obesity, weight loss, women

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Table 1. Health consequences of obesity.

Health condition/illness	Author	Ref.
Type 2 diabetes	Hu <i>et al.</i>	[2]
Cardiovascular disease	Kurth <i>et al.</i> , Field <i>et al.</i>	[3,4]
Colon cancer	Ford <i>et al.</i> , Lin <i>et al.</i>	[9,11]
Pancreatic cancer	Larsson <i>et al.</i>	[10]
Urinary incontinence	Hannestad <i>et al.</i>	[17]
Postmenopausal breast cancer	Morimoto <i>et al.</i>	[13]
Female reproductive disorders	Rich-Edwards <i>et al.</i>	[14]
Gynecologic cancers	Modesitt <i>et al.</i>	[12]
Obstetric complications	Jensen <i>et al.</i> , O'Brien <i>et al.</i>	[15,16]
Depression (in women)	Carpenter <i>et al.</i> , Stunkard <i>et al.</i>	[18,19]
Impaired quality of life	Katz <i>et al.</i> , Kolotkin <i>et al.</i>	[21,22]
Death	Fontaine <i>et al.</i> , Adams <i>et al.</i> , Muennig <i>et al.</i>	[6,8,20]

have become relatively standardized and are generally administered using manuals that describe treatment goals and procedures (e.g., the Diabetes Prevention Program manual [37] or the Lifestyle, Exercise, Attitudes, Relationships and Nutrition (LEARN) Program for Weight Management 2000 [38]). Treatment is typically conducted in closed groups of 10–20 patients with 60–90 min sessions held weekly for 20–24 weeks. Many programs continue biweekly sessions for another 20–52 weeks to facilitate improved weight-loss maintenance [39]. Sessions are typically led by a multidisciplinary team including behavioral psychologists, dietitians and exercise physiologists and include structured lessons on nutrition education, PA and behavioral skills. Group treatment has been shown to produce greater weight losses than individual treatment and to be as effective in improving psychological functioning [40].

The goal of standard behavioral programs is a 10% reduction from starting weight, with a weekly weight loss goal of 0.5–1.0 kg/week [36]. Patients typically achieve this goal within the first 6 months, and then focus on maintenance. In order to achieve a 10% weight loss, patients are prescribed specific goals for dietary intake and PA (Box 1). Most behavioral programs emphasize a moderately restricted calorie diet (1200–1500 kcal/day) with no more than 20–30% calories from fat. Nutrition lessons help patients achieve this goal by teaching a variety of skills including how to make healthy food choices, read food labels and prepare healthy, low-calorie foods. PA is generally

focused on moderate-intensity aerobic exercise such as brisk walking. Patients are encouraged to gradually increase their exercise to at least 150–200 min/week and to increase their overall lifestyle activity (e.g., taking stairs instead of the elevator, parking further from one's destination). Lessons on PA teach patients about the benefits of being active, exercise safety, types of exercise and the distinction between lifestyle activity and programmed activity, in which time is set aside for the purpose of exercise.

To change eating and exercise, patients are taught behavioral skills including self-monitoring, stimulus control, goal setting, problem solving and relapse prevention. Self-monitoring is an essential part of behavioral weight-loss programs. Throughout treatment, individuals are instructed to keep daily records of calorie and fat content of food and beverages consumed, duration of PA and body weight. Such detailed monitoring increases patients' awareness of the types and amount of food they consume and highlights problematic eating patterns. Regular self-weighing gives patients important information regarding their weight and allows them to observe how their weight is influenced by their eating and exercise. Greater consistency in self-monitoring has been associated with improved weight loss and maintenance [41,42].

Box 1. Components of standard behavioral weight-loss treatments.

Dietary goals

- Low-calorie, low-fat diet
- 1200–1500 kcal/day
- 20–30% calories from fat

Physical activity goals

- Moderate-intensity aerobic activity (e.g., brisk walking)
- Gradually build up to at least 150–200 min/week
- Exercise at least 5 days/week
- Increase overall lifestyle activity

Behavioral skills

- Self-monitoring (eating, activity, body weight)
- Stimulus control
- Goal setting
- Problem solving
- Cognitive restructuring
- Relapse prevention

Behavioral approaches are based on the premise that cues in the environment (including physical, social and cognitive cues) are important determinants of behavior. Therefore, patients are taught to modify aspects of their environment to favor healthy eating and PA. For example, through the use of stimulus-control techniques, individuals are encouraged to decrease cues for unhealthy eating (e.g., remove high-fat, high-calorie foods from their home) and to increase positive cues for healthy eating and PA (e.g., keep low-calorie foods available, place reminders for exercise in plain sight). Similarly, cognitive restructuring focuses on teaching patients to recognize irrational thoughts that can lead to overeating (e.g., labeling foods as all good or all bad, creating rationalizations for behaviors, exaggerating consequences based on a single event) and to modify these thoughts to promote positive behavioral change.

Goal setting, problem solving and relapse prevention are also typical components of behavioral treatment. In addition to calorie, exercise and weight-loss goals, patients are encouraged to set weekly behavioral goals that reflect the lesson topic. Problem-solving skills teach patients to identify situations that may be problematic for healthy eating and PA and to develop and evaluate strategies to manage them. Relapse prevention is based on the work of Marlatt and Gordon and emphasizes that lapses or slips are a natural part of behavior change [43]. Behavioral programs teach patients to plan for situations that may precipitate a lapse so they will be better prepared to cope effectively and prevent a relapse of unhealthy eating and/or inactivity. For a more extensive review of behavioral strategies for weight control see Wing [36].

Outcome of behavioral weight loss treatments

The weight losses achieved in behavioral programs have improved over time (Table 2). In 1974, the average weight loss was approximately 4 kg whereas between 1996 and 2002, the average weight loss was nearly 11 kg (approximately 10% of initial weight) [44]. A key factor in this increase has been the gradual lengthening of treatment programs, from a mean of 8 weeks in 1974 to a mean of 31 weeks in more recent trials.

Despite progress in obesity treatment, two problems are still apparent in the outcomes of behavioral programs. First, there is marked variability in outcome, with some patients who are very successful and others who are not. In fact,

many studies report standard deviations that are equal to or greater than mean weight losses [45–47]. Efforts to identify baseline predictors of who will succeed in behavioral treatment have resulted in mixed findings [48–50].

The second problem is with respect to long-term weight-loss maintenance. Patients typically achieve maximum weight loss within the first 6 months of behavioral treatment but weight regain is observed when treatment terminates [51,52].

Extending initial treatment with weight-maintenance sessions improves weight-loss outcomes [39]. Most programs show good maintenance of initial losses or even continued weight loss during the first 6 months of maintenance therapy; however, weight regain typically occurs during the second 6 months and continues when maintenance therapy ends [44,46,53]. Long-term follow-up studies reveal significant regain over time and suggest that more than 50% of patients are back to their baseline weight by 5 years post-treatment [54,55]. The following section reviews recent research efforts to improve weight-loss outcomes by strengthening the dietary and PA components of standard behavioral weight-loss programs.

Dietary component

One strategy for improving outcomes is to increase initial weight losses through stronger dietary interventions. Increasing the structure of the diet through meal replacements and food provision has been effective [27,56–58]. Another approach, the use of very low-calorie diets (VLCDs: 400–800 kcal/day), consistently produces larger initial weight losses but long-term outcomes have been disappointing [45,59]. Both of these approaches are discussed below.

Meal replacements

Meal replacements typically include commercially available food products, such as shakes and meal/snack bars, that are designed to replace one or two meals or snacks per day as part of a nutritionally balanced, low-calorie diet. While most meal replacements are fortified with vitamins and minerals, other products such as prepackaged, shelf-stable frozen entrees have also been used in behavioral weight loss programs to control portions and facilitate weight loss [60]. A calorie-restricted diet that includes meal-replacement products should improve adherence by ensuring accurate portion-size estimation and reducing environmental cues associated with overeating. A recent meta-analysis of six randomized trials

Table 2. Summary of behavior therapy for obesity.

	Years			
	1974	1985–1987	1991–1995	1996–2002
Number of studies	15	13	5	9
Sample size	53.1	71.6	30.2	28.0
Initial weight (kg)	73.4	87.2	94.9	92.2
Length of treatment (weeks)	8.4	15.6	22.2	31.4
Weight loss (kg)	3.8	8.4	8.5	10.7
Loss per week (kg)	0.5	0.5	0.4	0.4
Attrition (%)	11.4	13.8	18.5	21.2
Length of follow-up (weeks)	15.1	48.3	47.7	41.8
Loss at follow-up (kg)	4.0	5.3	5.9	7.2

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($n = 487$, 75% female) testing the efficacy and safety of partial meal-replacement plans compared with conventional reduced-calorie diets demonstrated that while both diets achieved significant weight loss, participants using the partial meal-replacement plan lost a significantly greater percentage of their baseline weight than those using a conventional diet at 3 months (7 vs 4%) and 1 year (7–8 vs 3–7%) [56]. No program or product-related adverse events were reported.

One trial included in this meta-analysis extended follow-up to 4 years to examine the effect of meal replacements on long-term weight-loss maintenance [61,62]. This study consisted of 100 obese participants (79% women) randomized to either a moderately restricted calorie diet (1200–1500 kcal/day), in which meals and snacks were selected from conventional foods (Group A), or to an isocaloric diet, in which vitamin/mineral-fortified meal replacements replaced two main meals and two snacks each day (Group B) for the first 3 months [61,62]. During the next 4 years, patients in both groups followed the same caloric prescription and were instructed to replace one meal and one snack each day with a meal-replacement product. All patients had monthly visits with a dietician and food records were reviewed. At 3 months, both groups lost weight but participants who used meal replacements (Group B) lost a significantly greater percentage of initial body weight than those who followed a calorie-restricted diet without meal replacements (7.8 vs 1.5%). At 4-year follow-up, both groups were significantly below baseline weight, but Group B maintained a greater percentage weight reduction than Group A (8.4 vs 3.2%).

Food provision

Another strategy used to increase dietary structure in standard behavioral weight-loss programs is to provide meals and snacks directly to patients in appropriate portion sizes. In one such trial, patients who were instructed to consume a low-calorie, low-fat diet (1000–1500 kcal/day) and were provided with prepackaged meals for five breakfasts and five dinners each week achieved significantly greater weight losses at 6, 12 and 18 months than those prescribed the same dietary guidelines without food provision [57]. After the 18-month program, the investigators stopped all treatment and food provision and reexamined 177 participants 1 year later. All treated groups had gained weight during this period; average losses did not differ among the groups and were only slightly better than a no-treatment control condition [63]. These findings indicate that while adding food provision was more effective than standard treatment alone during the program, the benefits were not maintained after food provision stopped.

In a subsequent study, Wing and colleagues randomly assigned 163 overweight women to receive SBT, SBT plus structured meal plans and grocery lists, SBT plus structured meal plans and food provision with participants sharing food costs, or SBT plus structured meal plans and food provision at no cost [58]. Mean weight losses in the latter three conditions did not differ from one another at 6 months or 1 year follow-up and were all significantly greater than weight loss in the SBT-only group at both assessment points. Furthermore, the groups with meal plans and grocery lists experienced similar improvements in

planning meals, structuring eating and increasing availability of healthy foods as those that were provided with food. Thus, use of meal plans and grocery lists were shown to be as effective as actual food provision in the short term and longer term, with the added benefit of being more practical and less costly. Taken together, these two studies suggest that helping patients increase the structure of their eating by using meal plans and grocery lists may be a simple and effective way to promote dietary adherence and improved weight loss.

Very low-calorie diets

VLCDs have been shown to be safe, when administered under careful medical supervision with appropriate patients, and effective in producing average weight losses of 16% in approximately 13 weeks [64]. VLCD regimens have been incorporated into behavioral programs with the hope that greater initial weight losses would be maintained in the context of behavior therapy, thereby facilitating improved long-term weight loss. However, results of a recent meta-analysis of six randomized trials comparing the long-term efficacy of VLCDs and conventional low-calorie diet regimens of 800–1800 kcal/day demonstrated that while VLCDs achieved superior short-term weight losses, they were also associated with significantly greater regain such that no differences in mean weight losses were observed at follow-ups of 1–5 years (mean: 1.9 years) compared with low-calorie diets [64]. Based on these findings, the authors determined that there appears to be no long-term benefit of VLCDs and that this approach should generally not be recommended over low-calorie diet regimens. The findings from this meta-analysis support the earlier conclusion of the National Heart Lung and Blood Institute expert panel [25].

Physical activity component

PA alone appears to have a modest impact on short-term weight losses; however, there is substantial evidence demonstrating that routine PA is essential for long-term weight-loss maintenance [25,65]. Given the long-term benefit, recent research has focused on identifying the optimal duration of PA and strategies for improving adherence.

Increasing duration of physical activity

Behavioral weight loss programs have typically prescribed gradual increases in PA to a goal of 1000 kcal/week of energy expenditure (approximately 30 min/day of brisk walking). However,

few data support this goal and recent studies suggest that higher levels of PA appear to be more beneficial for long-term weight loss. This benefit was recently demonstrated in a trial of 202 overweight adults enrolled in an 18-month behavioral weight-loss program [47]. Participants were randomly assigned to a standard-energy expenditure goal of 1000 kcal/week (SBT group) or a high-energy expenditure goal of 2500 kcal/week (approximately 75 min/day of brisk walking: high PA group). PA was increased gradually and both groups were given the same dietary goal (1000–1500 kcal/day). Results showed that high PA participants achieved significantly greater levels of PA than SBT throughout the 18-month intervention. Weight-loss outcomes showed no differences between high PA and SBT groups at 6 months (9.0 vs 8.1 kg), a trend for greater weight loss for high PA at 12 months (8.5 vs 6.1 kg), and significantly greater weight loss in high PA participants at 18 months compared with SBT (6.7 vs 4.1 kg). These findings indicate that high levels of PA are attainable by overweight individuals and promote better long-term weight loss when combined with moderate caloric restriction compared with traditional PA goals.

Other studies have also demonstrated greater weight losses associated with higher levels of PA. For example, Jakicic and colleagues showed that among obese women enrolled in a behavioral weight-loss program, those who reported exercising for 200 min or more/week maintained greater weight losses at 18 months (13.1 kg) compared with those who exercised for 150–200 min/week (8.5 kg) and less than 150 min/week (3.5 kg) [46]. A similar dose–response pattern was also observed in a later investigation [66].

Improving adherence to physical activity

One strategy for improving adherence to PA addresses the problem of lack of time, a common reason for not exercising. Jakicic and colleagues conducted a randomized trial of 56 obese females enrolled in a 20-week behavioral weight loss program in which one group was instructed to divide activity up into multiple short bouts and the other to exercise in one long bout [67]. Both groups received the same PA goal of 200 min/week. Participants in the long-bout group exercised in one session each day (beginning with 20 min and building up to 40), while those in the short-bout group split exercise up into several 10-min sessions throughout the day

(beginning with two sessions/day and building up to four). After 20 weeks, women who exercised in multiple short bouts had significantly better adherence and a trend toward greater weight loss compared with women exercising in one long bout (8.9 vs 6.4 kg).

In a subsequent trial, 148 overweight women participating in an 18-month behavioral weight loss program were randomly assigned to long-bout exercise, multiple short-bout exercise, or multiple short-bout exercise plus home treadmills. Results of this study demonstrated that exercising in one long bout or several short bouts can be equally effective for exercise adherence, improved cardiorespiratory fitness and long-term weight loss in the context of a behavioral weight-loss program [46]. The findings also suggest that increasing access to PA facilitates long-term adherence and may enhance long-term weight-loss outcomes. Taken together, these findings indicate that engaging in multiple short bouts of exercise throughout the day can be an effective way for women to incorporate PA into their lifestyle and appears to be as beneficial as one long bout of exercise for long-term weight loss.

Behavioral weight-loss treatment & binge eating

Concerns have been raised that the focus on dietary restriction and weight-loss characteristic of behavioral obesity programs may precipitate the development of eating disorders and/or exacerbate existing disorders [68,69]. In response to such concerns, a National Task Force on the Prevention and Treatment of Obesity was convened to review the empirical literature on the effect of weight-loss treatment and dietary restriction on the development of eating disorders in overweight and obese adults [70]. Based upon this review, the Task Force concluded that moderate calorie restriction in the context of behavioral weight-loss programs does not appear to cause clinically significant binge eating in adults who do not present with binge eating before treatment. A recent randomized trial designed to test whether dieting would elicit binge eating or mood disturbance among obese adult women enrolled in a behavioral weight-loss program supported the conclusions of the Task Force [71]. Results of this trial prospectively demonstrated (over a period of 65 weeks) that moderate caloric restriction in combination with behavioral treatment resulted in clinically significant weight loss and

improvement in mood symptoms and was not associated with increased rates of binge eating compared with a nondieting approach.

Dieting behavior and its relationship with eating pathology among children and adolescents was not addressed by the Task Force and is beyond the scope of this review. For more information on this topic see Butryn and Wadden [72] and Neumark-Sztainer and colleagues [73].

Another concern that has been raised regarding behavioral weight-loss treatment is whether obese patients with binge-eating behavior will be safely and effectively treated using this approach. Binge-eating disorder (BED) is characterized by recurrent episodes of binge eating (i.e., eating a large amount of food in a discrete period of time and experiencing a lack of control over eating) in the absence of compensatory behavior (i.e., vomiting, abusing laxatives, over-exercise). Research reveals increased psychiatric morbidity, particularly depression, in obese individuals with BED compared with obese persons who do not binge [74–76]. Because some women presenting for weight-loss treatment may binge eat, we consider how treatment might be distinct for this subgroup.

Treatment of BED in obese women can focus on reducing binge eating, weight loss or both. Specialized treatments for BED (e.g., cognitive behavioral therapy, interpersonal therapy, dialectical behavior therapy) place a primary emphasis on reducing binge episodes, whereas behavioral weight-loss approaches focus on weight loss through reducing energy intake and increasing energy expenditure. Studies directly comparing behavioral weight loss to specialized treatment for BED have shown comparable effects on binge eating at post-treatment [77,78]. Moreover, many specialized interventions have failed to produce weight loss in obese binge eaters [79] and studies suggest that behavioral weight-loss treatment is equally effective in producing weight loss for obese binge eaters as it is for nonbinge-eating participants [80]. In fact, some studies have found that participants with BED have lost more weight than obese nonbinge eaters, adjusting for higher initial weight [80]. Behavioral weight-loss treatment has also been shown to reduce psychiatric symptoms, particularly depression, in individuals with BED [80]. In summary, findings of successful weight loss and reductions in binge eating and depressive symptoms provide a strong argument for the use of behavioral weight-loss treatment with obese binge eaters.

Pregnancy

The period during pregnancy and the postpartum year pose a high risk for weight gain. Moreover, many women report pregnancy as a significant trigger for weight gain and problems with obesity. In 1990, the Institute of Medicine (IOM) published recommended weight-gain guidelines for pregnancy based on prepregnancy weight. Women with a BMI of less than 19.8 are encouraged to gain 28–40 lbs, women with BMI between 19.8 and 26.0 to gain 25–35 lbs, those with a BMI between 26.1 and 29.0 to gain 15–25 lbs, and women with BMI greater than 29.0 to gain at least 15 lbs [81]. However, research suggests that 46% of normal-weight women and over two-thirds of overweight women exceed recommendations [82]. Excessive weight gains during pregnancy can be problematic for the mother and infant. For example, greater than recommended weight gains have been associated with elevated rates of gestational diabetes, cesarean deliveries, postpartum infections and preeclampsia [83,84], as well as neonatal complications such as hypoglycemia, hyperbilirubinemia and large for gestational age infants [82,85]. Moreover, weight gained during pregnancy is one of the strongest predictors of weight retention during the postpartum year [86,87] and gestational weight gain and postpartum weight retention are related to elevated BMI at long-term follow-up [88].

Relatively few controlled treatment trials of pregnancy-related weight gain have been published. However, the two approaches that have been used to minimize postpartum weight retention include interventions during pregnancy to help women gain weight as recommended and interventions directed at the postpartum period to help mothers minimize weight retention.

Studies of interventions during pregnancy have used education and feedback regarding diet, PA and recommended weight gains. For example, Polley and colleagues randomized 120 lower-income pregnant adults to receive a stepped-care behavioral intervention delivered at regular clinic appointments or standard nutrition counseling provided as part of routine prenatal care [89]. The intervention focused on education and behavioral strategies to promote consumption of a low-fat diet, modest exercise and recommended weight gains. For normal-weight women, the intervention significantly reduced the percentage of participants who exceeded weight-gain recommendations compared with controls (33 vs 58%). However, for

overweight women there was a nonsignificant trend in the opposite direction (59% of intervention participants exceeded recommended weight gains compared with 32% of controls), which the authors suggest may have been related to the low rate of excessive weight gain among overweight women in the control group or may have reflected the limited effectiveness of the intervention in this group. Recently, Olson and colleagues tested an intervention that included a by-mail educational component for pregnant women focused on diet, PA and IOM weight-gain recommendations, as well as guidance for healthcare providers to facilitate monitoring of gestational weight gain [90]. Among low-income women, the intervention significantly reduced the proportion of patients who gained beyond recommended levels compared with controls (33 vs 52%). Furthermore, low-income overweight women who received the intervention were at significantly reduced risk for retaining 2.3 kg or more at 1-year postpartum. For high-income patients, the intervention did not impact gestational weight gains and had a marginally significant effect on postpartum weight retention in normal-weight women.

Other studies have targeted the postpartum year in efforts to reduce retention of pregnancy-related weight gain. For example, Leermakers and colleagues randomly assigned 90 nonlactating adult mothers who were 3–12 months postpartum and at least 6.8 kg above prepregnancy weight to a 6-month correspondence-based behavioral weight-control intervention that promoted a calorie-restricted diet (1000–1500 kcal/day, 20% kcal from fat) and regular aerobic exercise or to a control condition [91]. Retention at 6 months was 69%, with most attrition due to subsequent pregnancy. Completer and intent-to-treat analyses revealed greater mean weight losses in the intervention group. Furthermore, significantly more women who received the intervention returned to their prepregnancy weight relative to controls (33 vs 11.5%). A second investigation tested a group-based weight-loss program focused on diet and PA compared with a self-directed intervention for 40 overweight mothers who were 6–24 weeks postpartum [92]. Results are limited by low retention (58%); however, among study completers, intervention participants lost significantly more weight at 12 weeks and maintained greater weight losses at 1 year postpartum compared with women using a self-directed program. Relatively high

attrition rates of these studies may reflect specific challenges associated with intervening during the postpartum period. Future studies that identify potential barriers for new mothers and examine strategies that may facilitate adherence to behavioral interventions would be an important contribution.

The IOM states that weight losses of up to 2 kg/month in overweight breastfeeding mothers appear to be safe [93]. Clinical studies of diet and exercise interventions during the postpartum period support these recommendations and demonstrate that gradual weight losses of approximately 0.5–1 kg/week among overweight breast feeding mothers does not appear to have adverse effects on milk volume or infant growth [94,95].

Menopause

The years surrounding menopause are associated with weight gain for women [96–98]. This trend appears to have risen in recent years, with the prevalence of obesity increasing by 48% between 1991 and 1998 for women in the early menopausal years (i.e., 50–59 years) [99]. Postmenopausal overweight and obesity is associated with numerous cardiovascular risk factors, including increased rates of elevated cholesterol, hypertension, diabetes mellitus and coronary artery disease [97]. Moreover, postmenopausal women may experience an increase in central adiposity, which heightens cardiovascular disease risk [97]. Aging in women is also associated with an increasingly sedentary lifestyle, which reduces daily energy expenditure and creates a vulnerability to obesity [98,100].

General guidelines for the treatment of overweight or obese postmenopausal women closely parallel treatment recommendations for younger women. Lifestyle interventions, including caloric restriction and increased PA, have been demonstrated to produce changes in coronary heart disease risk factors, including glucose, lipids and blood pressure, even when weight losses are relatively small (i.e., 4–6 kg) [96]. Similar results were found in a weight-gain prevention study with premenopausal women between the ages of 44 and 50 years [97]. In this trial, participants were randomly assigned to either a behavioral dietary and PA program or an assessment-only control group. Participants in the treatment group were encouraged to attain modest weight-loss goals, follow a 1300 kcal/day diet and increase PA by 1000–1500 kcal/week. Findings after 4.5 years

revealed that twice as many women in the intervention group (55%) were at or below baseline weight compared with controls (26%), and significant reductions in waist circumference and body fat also were maintained [97]. These results suggest that adverse changes in body composition related to menopause can be prevented. Additional studies have confirmed the benefits of weight loss and lifestyle interventions for this population [96,101].

There has been some concern regarding bone loss secondary to weight-loss in this population, particularly given the increased risk for osteoporosis associated with aging. Studies have yielded mixed results as to the actual decrease in total bone mineral density or increased bone turnover within a weight loss program [102,103], and still other findings have actually highlighted the benefits of exercise in preserving bone mineral density and increasing muscle strength in postmenopausal women [104,105]. In fact, there is considerable evidence to warrant the inclusion of PA as a component of behavioral interventions for menopausal women [97,104–107]. Owing to the potential for bone loss to contribute to osteoporosis and an overall decline in functioning, such factors should be assessed throughout treatment [106], and both aerobic and strength-training exercise should be considered valuable components of a weight-loss program for this population.

Overall, the role of menopause in the development of obesity may be particularly important as women's life spans increase. Evidence suggests that behavioral therapies are effective for postmenopausal women [96,101]. In fact, weight-loss treatment and weight-gain prevention may be especially beneficial to improve the cardiovascular health of postmenopausal women [96,97].

Conclusion

Behavioral weight-loss treatments focus on changing eating, activity and thinking patterns that contribute to overweight and obesity. On average, these treatments produce a 10% reduction in initial weight, which is associated with clinically significant improvements in numerous health conditions. Concerns that behavioral obesity treatments may precipitate or exacerbate eating pathology in obese adults have not been supported by the literature. In fact, current evidence suggests that such treatments are effective in reducing binge eating and associated symptoms (e.g., depression). For

women, two periods of high risk for weight gain are pregnancy and the years surrounding menopause. Behavioral interventions focused on achieving healthy gestational weight gains and minimizing postpartum weight retention appear promising but additional research in this area is needed. For obese peri- and postmenopausal women, behavioral treatments that include dietary and exercise components have been effective in producing clinically significant weight loss.

Future perspective

At present, the biggest challenge in obesity treatment is long-term weight-loss maintenance. While outcomes have been improved by extending length of treatment, research trials show a reliable pattern of weight regain over time with concurrent declines in session attendance and adherence [108]. Recent research has focused on innovative strategies to improve long-term weight control and such research

efforts will continue over the next decade. For example, investigations that have used technology such as the internet and interactive television to increase the availability and convenience of extended treatment appear promising and warrant additional study [109,110]. Other research has examined the use of primary-care physicians to increase access to treatment and facilitate maintenance of behavioral changes needed for long-term weight control [111–114]. Finally, the success of a recent study that tested a novel stand-alone weight maintenance intervention focused on skills to prevent weight regain after successful weight loss suggests that developing distinct weight-maintenance programs may be an important strategy for improving long-term outcomes [42].

Acknowledgement

Preparation of this manuscript was supported in part by a grant from the NIH/Office of Research on Women's Health (K12 HD043447-04).

Executive summary

Health impact of obesity & modest weight loss

- Obesity is associated with increased risk of cardiovascular disease, Type 2 diabetes, cancer, urinary incontinence, reproductive disorders, obstetric complications, depression and mortality.
- Modest weight loss of 7–10% of body weight among overweight and obese individuals has significant physical and psychological health benefits.

Behavioral weight-loss treatment

- Behavioral treatments for obesity teach patients how to change their diet and exercise behaviors to lose weight.
- Patients are taught a variety of behavioral skills to initiate and maintain weight loss, including self-monitoring, stimulus control, goal setting, problem solving, cognitive restructuring and relapse prevention.
- On average, behavioral treatments achieve clinically significant weight losses of 10% in approximately 6 months.
- Increasing dietary structure through use of meal replacements or meal plans and increasing duration of physical activity are effective ways of improving weight-loss outcomes.

Behavioral weight-loss treatment & binge eating

- Concerns that behavioral obesity treatments may precipitate eating pathology or exacerbate existing disorders in overweight or obese adults have not been supported by the empirical literature.
- To the contrary, research suggests that for obese adults with binge-eating disorder, behavioral weight-loss treatment is associated with reductions in binge eating, improvements in depressive symptoms and weight loss.

Pregnancy

- Pregnancy and the postpartum year are periods of high risk for weight gain.
- Excessive gestational weight gains have been associated with complications for the mother and infant.
- Behavioral interventions focused on achieving recommended weight gains during pregnancy and minimizing postpartum weight retention appear promising but additional research in this area is needed.

Menopause

- The years surrounding menopause are associated with weight gain.
- Behavioral interventions focused on modifying eating and exercise behaviors have been associated with improved health in postmenopausal women.

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