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Obesity in Coronary Heart Disease: An Unaddressed Behavioral Risk Factor

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Abstract

Obesity is an independent risk factor for the development and progression of coronary heart disease (CHD). Over 80% of patients with CHD are overweight or obese. While obesity is often considered a relatively "minor" CHD risk factor, weight loss is a broadly effective risk-factor intervention. Weight loss can profoundly influence a number of "major" risk factors including: hypertension, dyslipidemia and insulin resistance/type 2 diabetes mellitus. Despite its prominence as a risk factor most cardiac rehabilitation (CR) programs do not have a specific, targeted intervention to assist patients with weight loss. Consequently, the weight loss that occurs during CR is quite small and unlikely to appreciably alter risk factors. Relying on CR associated exercise as a sole intervention is an ineffective strategy to promote weight loss. There is evidence, however, that behavioral weight loss (BWL) interventions can be effectively employed in the CR setting. In contrast to programs that do not offer a targeted intervention, studies show that participants in CR-related BWL programs lose significantly more weight. The additional weight loss from the BWL intervention is associated with greater improvements in insulin sensitivity and other components of the metabolic syndrome such as hypertension and lipid abnormalities. As a means of maximizing CHD risk factor reduction CR programs need to incorporate BWL programs as a standard programming for overweight/obese patients.

Obesity is an independent risk factor for the development of coronary heart disease (CHD) [1]. Furthermore, after the diagnosis of CHD obesity is associated with accelerated progression of CHD. Overweight and obesity also predispose to insulin resistance and type 2 diabetes mellitus (T2DM) [2] which, in turn, accelerates the progression of CHD and worsening prognosis. Moreover, insulin resistance and T2DM are independently associated with renal, ocular, neurologic and cerebrovascular complications [3]. While obesity is often considered a relatively "minor" independent CHD risk factor weight loss is a broadly effective intervention. Weight loss can profoundly influence a number of "major" risk factors including: hypertension, dyslipidemia and insulin resistance/T2DM [4]. Unlike other risk factor reduction strategies employed for CHD such as exercise and more broadly, cardiac rehabilitation (CR) [5], specifics regarding the treatment of obesity in CR are remarkably limited. The Physical Activity Guidelines for Americans recommends a minimum of 150 minutes per week of moderate exercise for preventing many chronic diseases. This amount of exercise, however, has generally not been sufficient to bring about weight loss in

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overweight/obese individuals and weight loss efforts are strengthened when physical activity is combined with dietary caloric restriction[6–8]. In CR over 80% of patients are overweight and nearly 50% are obese [9]. Yet, the treatment of obesity in patients in CR has been notably ineffective. The occurrence of a seemingly life-changing event such as a myocardial infarction or coronary revascularization is not spontaneously associated with behaviors that lead to significant weight loss [10]. Furthermore, cardiologists, not trained to counsel patients for behavioral weight loss (BWL), tend to treat the consequences of obesity (hyperlipidemia, hypertension and T2DM) with medications without treating the root cause. Observational studies demonstrate that weight loss associated with traditional CR programming is generally quite modest (Table 1). The reason for minimal weight loss is likely multifaceted. First, the exercise prescription most typically employed in CR burns remarkably few calories [11]. Consequently, CR related exercise, as a sole intervention, will not result in appreciable weight loss. Secondly, most CR programs do not include a behavioral strategy to specifically target weight loss. In particular, when BWL is not specifically addressed in CR, little weight loss occurs (Table 1). Components of BWL counseling include teaching concepts of self-monitoring (keeping dietary records), stimulus control, problem solving, assertiveness training, goal setting, relapse prevention, positive reinforcement along with an increase in physical activity[12,13].

Weight loss recommendations are made for essentially all obese patients with CHD despite some evidence of an inverse relationship between overweight/obesity and mortality often termed “the obesity paradox”. This paradoxical relationship between obesity and health outcomes has been observed in studies utilizing retrospective analysis of diverse populations including patients with CHD, heart failure, hypertension and peripheral artery disease [14]. Physiologic explanations remain elusive although associations between low body weight and a number of chronic diseases have been demonstrated and these study cohorts may have included individuals with subclinical chronic disease. Additionally, the use of body mass index (BMI) as the measure of obesity is problematic. When other measures of body composition are used, such as waist circumference, the paradoxical relationship between BMI and total mortality is eliminated [15]. In view of the risk factor benefits of weight loss and exercise training, few would recommend against weight loss in obese patients with CHD.

At least two studies have shown a favorable effect of weight loss on the development of CHD in high risk individuals and on prognosis within the CHD population [16,17]. The first is an observational study of intentional weight loss among patients recruited to receive nutritional counseling from a dietitian to support the medical recommendation to lose weight [16]. Among 1,669 patients, intentional weight loss predicted a lower incidence of CHD over 4 years. In another analysis of 377 CR participants, the effect of weight loss on a composite outcome of total mortality, acute myocardial infarction, stroke or hospital admission for congestive heart failure was studied [17]. Patients who lost 1 kg or more in CR had a 24% rate of the composite outcome compared with a 37% rate for individuals that did not lose weight ($P<0.05$). Results were adjusted for potential confounders but the possibility of residual bias remains such that data from a more definitive randomized controlled trial is needed. In studies of individuals with T2DM, a group at particularly high risk for developing CHD, a lifestyle intervention of exercise and dietary counseling has proven to be an effective

treatment strategy. Additionally, studies suggest that T2DM can be prevented or put into partial remission [18] and the need for cardio-preventive medication can be minimized [19].

When BWL is offered in CR significant weight loss occurs and it is associated with important risk factor benefits as well. For multiple reasons, CR is an optimal setting to deliver a BWL intervention. Cardiac rehabilitation is somewhat unique in that participants have already committed to the requisite exercise component of a BWL program. Also, CR professionals are exceptionally well trained in providing behavior change counseling. While it is often assumed that the BWL intervention need be delivered by a Registered Dietician, there is evidence that other CR staff members can develop the necessary expertise[20,21].

In a study that combined BWL with a type of exercise termed “high caloric expenditure exercise” that consisted primarily of daily longer distance walking of up to 45 minutes per day, a mean weight loss of 8.2 kg over 6 months was accomplished[4] compared to 3.7 kg of weight loss when standard (lower caloric expenditure) exercise program was prescribed. The additional weight loss that was the result of higher volume of exercise and the BWL intervention was associated with greater improvements in insulin sensitivity and other components of the metabolic syndrome. Other studies utilizing a standard CR exercise training protocol provide further evidence that when BWL is delivered in the CR setting 5 to 6 kg of weight loss is accomplished[4, 22–25] (Table 1). In contrast, less than 2 kg of weight loss is observed when a BWL intervention is not employed [26–30]. While demonstrating promise, additional study of the optimal dose of exercise and best methods to deliver BWL programming in the CR setting is still needed. In the clinical setting we have observed that 4–9 weekly 1-hour BWL sessions over 4 months combined with CR exercise yields a weight loss range of 4–8 kg over a 4 month period (unpublished).

In summary, obesity and related insulin resistance are associated with a constellation of coronary risk factors that predispose to the progression of CHD. Weight loss accomplished in the CR setting with BWL and exercise results in a host of favorable effects on CHD risk factors and is associated with an improved prognosis. Moreover, T2DM is prevented or put into partial remission and the need for cardio-preventive medication is minimized. Therefore, programs need to develop alternatives to the traditional CR model to specifically address the needs of overweight patients. Given that weight management is a defined “core component” of CR[8] and that BWL programs can be set up in CR programs by using existing staff, a passive approach to this issue is unacceptable.

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References

1. Wilson PW, D’Agostino RB, Sullivan L, et al. Overweight and obesity as determinants of cardiovascular risk: the Framingham experience. Arch Intern Med. 2002; 162:1867–72. [PubMed: 12196085]
2. Grundy SM, Cleeman JI, Daniels SR, et al. American Heart Association; National Heart, Lung, and Blood Institute. Diagnosis and management of the metabolic syndrome: an American Heart

Association/National Heart, Lung, and Blood Institute Scientific Statement. Circulation. 2005; 112:2735–52. [PubMed: 16157765]

3. American Diabetes Association. http://www.diabetes.org/living-with-diabetes/complications/. Accessed January 5, 2017
4. Ades PA, Savage PD, Toth MJ, et al. High-calorie-expenditure exercise: a new approach to cardiac rehabilitation for overweight coronary patients. Circulation. 2009; 119:2671–8. [PubMed: 19433757]
5. Ades PA. Cardiac rehabilitation and secondary prevention of coronary heart disease. N Engl J Med. 2001; 345:892–902. [PubMed: 11565523]
6. https://www.cdc.gov/physicalactivity/basics/adults/index.htm Accessed 3/28/17
7. Ades PA, Savage PD, Harvey-Berino J. The treatment of obesity in cardiac rehabilitation. J Cardiopulm Rehabil Prev. 2010; 30:289–98. [PubMed: 20436355]
8. Balady GJ, Williams MA, Ades PA, Bittner V, Comoss P, Foody JM, Franklin B, Sanderson B, Southard D. Core components of cardiac rehabilitation/secondary prevention programs: 2007 update: a scientific statement from the American Heart Association Exercise, Cardiac Rehabilitation, and Prevention Committee, the Council on Clinical Cardiology; the Councils on Cardiovascular Nursing, Epidemiology and Prevention, and Nutrition, Physical Activity, and Metabolism; and the American Association of Cardiovascular and Pulmonary Rehabilitation. Circulation. 2007 May 22; 115(20):2675–82. [PubMed: 17513578]
9. Audelin MC, Savage PD, Ades PA. Changing clinical profile of patients entering cardiac rehabilitation/secondary prevention programs: 1996 to 2006. J Cardiopulm Rehabil Prev. 2008:299–306. [PubMed: 18784538]
10. Levantesi G, Macchia A, Marfisi R, Franzosi MG, Maggioni AP, Nicolosi GL, Schweiger C, Tavazzi L, Tognoni G, Valagussa F, Marchioli R, GISSI-Prevenzione Investigators. Metabolic syndrome and risk of cardiovascular events after myocardial infarction. J Am Coll Cardiol. 2005; 46:277–83. [PubMed: 16022955]
11. Savage PD, Brochu M, Scott P, Ades PA. Low caloric expenditure in cardiac rehabilitation. Am Heart J. 2000; 140:527–33. [PubMed: 10966557]
12. Brownell, K. The LEARN Program for Weight Management. 10th. Dallas, TX: American Health Publishing Company; 2004.
13. Harvey-Berino J. Weight loss in the clinical setting: applications for cardiac rehabilitation. Coron Artery Dis. 1998; 9:795–798. [PubMed: 9894923]
14. Ades PA, Savage PD. The obesity paradox: perception vs knowledge. Mayo Clin Proc. 2010; 85:112–4. [PubMed: 20118385]
15. Coutinho T, Goel K, Corrêa de Sá D, Carter RE, Hodge DO, Kragelund C, Kanaya AM, Zeller M, Park JS, Kober L, Torp-Pedersen C, Cottin Y, Lorgis L, Lee SH, Kim YJ, Thomas R, Roger VL, Somers VK, Lopez-Jimenez F. Combining body mass index with measures of central obesity in the assessment of mortality in subjects with coronary disease: role of “normal weight central obesity”. J Am Coll Cardiol. 2013 Feb 5;61(5):553–60. Erratum in: J Am Coll Cardiol. 2013; 62:261.
16. Eilat-Adar S, Eldar M, Goldbourt U. Association of intentional changes in body weight with coronary heart disease event rates in overweight subjects who have an additional coronary risk factor. Am J Epidemiol. 2005; 161:352–8. [PubMed: 15692079]
17. Sierra-Johnson J, Wright SR, Lopez-Jimenez F, Allison TG. Relation of body mass index to fatal and nonfatal cardiovascular events after cardiac rehabilitation. Am J Cardiol. 2005; 96:211–4. [PubMed: 16018844]
18. Ades PA, Savage PD, Marney AM, Harvey J, Evans KA. Remission of recently diagnosed type 2 diabetes mellitus with weight loss and exercise. J Cardiopulm Rehabil Prev. 2015; 35:193–7. [PubMed: 25636149]
19. Diabetes Prevention Program Research Group. Long-term safety, tolerability, and weight loss associated with metformin in the Diabetes Prevention Program Outcomes Study. Diabetes Care. 2012; 35:731–737. [PubMed: 22442396]
20. Savage PD, Lee M, Harvey-Berino J, Brochu M, Ades PA. Weight reduction in the cardiac rehabilitation setting. J Cardiopulm Rehabil. 2002; 22:154–60. [PubMed: 12042682]

21. Ades PA, Savage PD. Potential benefits of weight loss in coronary heart disease. Prog Cardiovasc Dis. 2014; 56:448–56. [PubMed: 24438737]
22. Aggarwal S, Arena R, Cuda L, Hauer T, Martin BJ, Austford L, Stone JA. The independent effect of traditional cardiac rehabilitation and the LEARN program on weight loss: a comparative analysis. J Cardiopulm Rehabil Prev. 2012; 32:48–52. [PubMed: 22207088]
23. Savage PD, Lakoski SG, Ades PA. Course of body weight from hospitalization to exit from cardiac rehabilitation. J Cardiopulm Rehabil Prev. 2013; 33:274–80. [PubMed: 23823906]
24. Minneboo M1, Peters RJ, Miller-Kovach K, Lemmens J, Bucx JJ. Referral to a Commercial Weight Management Program in Patients With Coronary Heart Disease: A Pilot Study in the Netherlands. J Cardiopulm Rehabil Prev. 2015; 35:268–71. [PubMed: 26034935]
25. Khadanga S, Savage PD, Ades PA. Insulin Resistance and Diabetes Mellitus in Contemporary Cardiac Rehabilitation. J Cardiopulm Rehabil Prev. 2016; 36:331–8. [PubMed: 27182762]
26. Brochu M, Poehlman ET, Savage P, Ross S, Ades PA. Coronary risk profiles in men with coronary artery disease: effects of body composition, fat distribution, age and fitness. Coron Artery Dis. 2000; 11:137–44. [PubMed: 10758815]
27. Bader DS, Maguire TE, Spahn CM, O'Malley CJ, Balady GJ. Clinical profile and outcomes of obese patients in cardiac rehabilitation stratified according to National Heart, Lung, and Blood Institute criteria. J Cardiopulm Rehabil. 2001; 21:210–7. [PubMed: 11508180]
28. Milani RV, Lavie CJ. Prevalence and profile of metabolic syndrome in patients following acute coronary events and effects of therapeutic lifestyle change with cardiac rehabilitation. Am J Cardiol. 2003; 92:50–4. [PubMed: 12842245]
29. Pack QR, Rodriguez-Escudero JP, Thomas RJ, Squires RW, Johnson L, Somers VK, Lopez-Jimenez F. Diagnostic performance of weight loss to predict body fatness improvement in cardiac rehabilitation patients. J Cardiopulm Rehabil Prev. 2013:68–76. [PubMed: 23426557]
30. Roca-Rodríguez MM, García-Almeida JM, Ruiz-Nava J, Alcaide-Torres J, Saracho-Domínguez H, Rioja-Vázquez R, García-Fernández C, Gómez-González A, Montiel-Trujillo A, Tinahones-Madueño FJ. Impact of an outpatient cardiac rehabilitation program on clinical and analytical variables in cardiovascular disease. J Cardiopulm Rehabil Prev. 2014; 34:43–8. [PubMed: 24280905]

Table 1

Weight Loss in Cardiac Rehabilitation

Study	N	Patient Population	Weight change (%)	BWL − or +	Comments
Ades et al [4]	74	BMI 27–40	¯6.2kg (¯7%)	+	BWL(combined cohort with half randomized to high caloric exercise training half standard CR exercise)
Brochu et al [26]	303	BMI>25	¯0.5 kg (¯1%)	−	Nutritional advice provided
Bader et al [27]	449	BMI 25–40	¯1.8 kg (¯2%)	−	Individual Consult with Registered Dietician
Milani et al [28]	136	Patients with Metabolic Syndrome Mean BMI = 29	¯1.0kg (¯1%)	−	Individual Consult with Registered Dietician
Aggarwal et al [22]	44	BMI > 25	¯5.5 kg (¯6%)	+	BWL Immediately after phase 2 cardiac rehabilitation
Pack et al [29]	142	Consecutive patients, no BMI limits	¯1.3 kg (¯1%)	−	Nutritional advice provided
Savage et al [23]	49	BMI > 25	1.2 Kg (1.5%) 5.6 Kg (6%)	− +	Participants chose to attend 4 weekly 1-hour sessions BWL
Roca-Rodriguez et al [30]	59	Consecutive patients, no BMI limits	¯1.8 kg (¯2%)	−	Reduced caloric Mediterranean diet recommended
Minneboo et al [24]	35	BMI>30	¯5.8kg (¯5.6%)	+	BWL intervention provided by commercial entity (Weight Watchers)
Khadanga et al [25]	392	BMI >25	¯1.0 Kg (1%) ¯5.6 kg (5.2%)	− +	Participants chose to attend 4 weekly 1-hour sessions BWL

BWL= Behavioral Weight Loss using the precepts of the LEARN [12] program

− = No BWL program for patients

+ = BWL program for patients

Studies that included a BWL intervention accomplished >5kg weigh loss (4,22–25)