



MEDIFAST®



OPTAVIA®

# Clinical Studies Overview

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## The Science Behind Medifast: A Foundation for Better Health

Obesity is considered one of the most pressing health issues of our time.<sup>1</sup> Over 70% of adults in the United States (US) are overweight, including more than 42% classified as having obesity.<sup>2,3</sup> Being overweight or obese increases the risk of developing many related, often serious conditions (e.g. heart disease, stroke, diabetes and even some forms of cancer) and has a substantial economic impact.<sup>1,4,5</sup> Though estimates vary, a recent analysis found the aggregate medical cost of obesity for US adults exceeded \$260 billion.<sup>6</sup> Furthermore, the average annual medical costs for those with obesity are \$2,500 higher than people in a normal weight range.<sup>6-8</sup> Other countries are also experiencing growing rates of obesity.<sup>9</sup> Worldwide, obesity has nearly tripled since 1975.<sup>9</sup> Weight loss can help to reduce both the medical and economic impact of obesity by decreasing the risk of developing associated conditions.<sup>10-18</sup> Unfortunately, while there are many options available for managing weight, not all are healthy, safe or effective.

The long-standing scientific heritage of Medifast, the company behind **OPTAVIA**, combined with the support of an independent **OPTAVIA** Coach and like-minded **OPTAVIA** Community, clinically proven plans, and scientifically designed products is what makes us a comprehensive approach to Lifelong Transformation, One Healthy Habit at a Time<sup>®</sup>. All of our programs feature a combination of **OPTAVIA** Fuelings (meal replacements), conventional food choices, easy-to-understand meal plans and customizable levels of support for weight loss and weight maintenance—all backed by our team of registered dietitian nutritionists, behavioral experts and food scientists.

Our inclusive approach to weight management aligns well with the guidelines for the management of overweight and obesity issued by the American Heart Association, the American College of Cardiology and The Obesity Society. These guidelines recommend individuals who are currently at an unhealthy weight (overweight or obese) participate in a comprehensive lifestyle program which includes a reduced calorie diet, exercise and support that promotes positive behavioral changes, as the cornerstone of all treatment options, with the goal of achieving clinically meaningful weight loss of at least 5-10% within a 6-month period.<sup>4</sup> These guidelines also support the use of commercial weight loss programs as an option for weight loss, provided they are backed by evidence of their safety and efficacy and offer a comprehensive lifestyle intervention.<sup>4</sup>

Research also supports the use of meal replacements as a safe and effective tool for limiting calorie intake and promoting weight loss and maintenance among individuals who are overweight or obese.<sup>19-26</sup> Similarly, the **OPTAVIA** Fuelings serve as a convenient, individually-portioned, calorie-controlled source of nutrition. These tasty offerings are at the heart of Medifast's clinically proven plans, helping individuals manage their weight quickly, safely and simply.

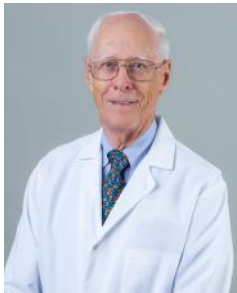
We invite you to read this Medifast Clinical Studies Overview, a compilation of abstracts from peer-reviewed clinical research of randomized, controlled trials, prospective and retrospective studies that support the use of our products and programs in a wide variety of populations. All studies were conducted in the US. Not all of the programs studied are available in all international markets.

## A Distinguished Scientific Advisory Board

The Medifast Scientific Advisory Board is comprised of internationally-recognized experts, all of whom have made significant contributions in their respective field. The function of the Scientific Advisory Board is to provide objective insight and external expertise to help guide Medifast in making informed, evidence-based decisions on medical, nutritional and scientific matters. The Scientific Advisory Board serves as a part of our foundation to create scientifically-valid, consumer-centric, high-quality innovations for lasting health.

This cross-disciplinary group consists of distinguished physicians, academic researchers, nutrition and health-related policy experts. The work of this prestigious board builds on Medifast's scientific and clinical heritage, which focuses on sound approaches to weight management while exploring forward-looking innovations, product and program offerings and clinical research opportunities.

Medifast first formed their Scientific Advisory Board in 2008. As of January 2022 the Medifast Scientific Advisory Board is comprised of the following experts:



**George Bray, MD**  
Boyd Professor Emeritus,  
Pennington Biomedical  
Research Center, Louisiana  
State University



**Carsten Smidt, PhD, FACN**  
Owner, Smidt Labs, Inc. and  
Fellow, American College  
of Nutrition



**Steven Heymsfield, MD**  
Professor and Director,  
Metabolism & Body  
Composition Laboratory,  
Pennington Biomedical  
Research Center, Louisiana  
State University



**Sylvia B. Rowe, MA**  
President, SR Strategy  
and Adjunct Professor at  
Tufts Friedman School  
of Nutrition Science and  
Policy and University of  
Massachusetts, Amherst



**Mark Messina, PhD**  
Co-owner, Nutrition Matters,  
Inc., Director, Nutrition  
Science and Research, Soy  
Nutrition Institute Global, and  
Adjunct Associate Professor,  
Loma Linda University



**Mark Matlock, MS**  
(Retired) Senior Vice  
President, Archer Daniel  
Midland (ADM); Fellow,  
American Oil Chemists Society



# The 5 & 1 Plan

## Arterburn (2019)

### Randomized Controlled Trial Assessing Two Commercial Weight Loss Programs in Adults with Overweight or Obesity

LM Arterburn<sup>1</sup>, CD Coleman<sup>1</sup>, J Kiel<sup>1</sup>, K Kelley<sup>2</sup>, L Mantilla<sup>2</sup>, N Frye<sup>1</sup>, K Sanoshy<sup>2</sup>, CM Cook<sup>2</sup>

<sup>1</sup>Department of Scientific and Clinical Affairs, Medifast, Inc., Baltimore, Maryland, USA

<sup>2</sup>Biofortis, Mérieux NutriSciences, Addison, IL, USA

#### PURPOSE/OBJECTIVE:

Lifestyle interventions remain the cornerstone for obesity treatment. Commercial programs offer one weight loss approach, yet the efficacy of few such programs have been rigorously investigated. The purpose of this study was to evaluate the efficacy of two commercial weight-loss programs, both utilizing pre-portioned meal replacements (MRs) and different levels of behavioral support, compared to a self-directed control diet in adults with overweight and obesity.

#### METHODS/DESIGN:

In this 16-week study, participants were randomized to the low-calorie **OPTAVIA** 5 & 1 Plan with telephone coaching (OPT), the reduced-calorie Medifast 4 & 2 & 1 self-guided plan (MED), or a self-directed, reduced-calorie control diet. Differences in weight, body composition (DXA) and body circumferences, all measured monthly, were assessed by analysis of covariance with sex and baseline measures as covariates.

#### RESULTS:

Of 198 participants randomized (80.8% female, BMI 34.2 kg/m<sup>2</sup>, 45.7 years), 92.3% completed the study.

The OPT and MED groups had significantly greater reductions in body weight (-5.7% and -5.0%, respectively,  $p < 0.0001$ ), fat and abdominal fat mass ( $p < 0.0001$ ) and waist and hip circumferences ( $p \leq 0.003$ ) than control at 16 weeks. Weight change was correlated with MR usage and completion of coaching support calls.

#### CONCLUSIONS:

Both structured commercial programs were more efficacious than a self-directed, reduced-calorie diet for weight loss and other anthropometric measures. Evidence-based commercial programs can be an important tool to help adults with overweight and obesity lose clinically relevant amounts of weight.

#### REFERENCE:

Arterburn L.M., Coleman C.D., Kiel J., Kelley K., Mantilla L., Frye N., Sanoshy K., Cook C.M. (2019). Randomized Controlled Trial Assessing Two Commercial Weight Loss Programs in Adults with Overweight or Obesity. *Obes Sci Pract*, 5(1):3-14. doi: [doi.org/10.1002/osp4.312](https://doi.org/10.1002/osp4.312).

## Shikany (2013)

### Randomized Controlled Trial of the Medifast 5 & 1 Plan for Weight loss

JM Shikany<sup>1,2</sup>, AS Thomas<sup>1</sup>, TM Beasley<sup>3</sup>, CE Lewis<sup>1,2</sup>, DB Allison<sup>2,4</sup>

<sup>1</sup>Division of Preventive Medicine, School of Medicine, University of Alabama at Birmingham, Birmingham, AL, USA; <sup>2</sup>Nutrition Obesity Research Center, University of Alabama at Birmingham, Birmingham, AL, USA; <sup>3</sup>Department of Biostatistics, School of Public Health, University of Alabama at Birmingham, Birmingham, AL, USA; <sup>4</sup>Dean's Office, School of Public Health, University of Alabama at Birmingham, Birmingham, AL, USA.

#### **PURPOSE/OBJECTIVE:**

The Medifast 5 & 1 Plan (MD) is a portion-controlled, nutritionally-balanced, low-fat weight-loss plan. We studied the effects of MD compared with a reduced-energy, food-based diet (FB) on body weight, waist circumference, fat mass and other measures in adults.

#### **METHODS/DESIGN:**

We conducted a two-parallel-arm, randomized, controlled trial comparing MD to FB over 52 weeks. A total of 120 men and women aged 19–65 years with BMI  $\geq 35$  and  $\leq 50$  kg/m<sup>2</sup> were randomized to MD (n=60) or FB (n=60). Follow-up included a 26-week weight-loss phase and 26-week weight-maintenance phase. Anthropometric, body composition, biochemical and appetite/satiety measures were performed at baseline and at 26 and 52 weeks. An intention-to-treat, linear mixed models analysis was the primary analysis.

#### **RESULTS:**

Fifty MD subjects (83.3%) and 45 FB subjects (75.0%) completed the study on assigned treatment. At 26 weeks, race-adjusted mean weight loss was 7.5 kg in MD subjects vs 3.8 kg in FB subjects (p=0.0002 for difference); reduction in waist circumference was 5.7 cm in MD vs 3.7 cm in FB (p=0.0064); and fat mass loss was 6.4 kg in MD vs 3.7 kg in FB (p=0.0011). At 52 weeks, the corresponding reductions were 4.7 vs 1.9 kg (p=0.0004); 5.0 vs 3.6 cm (p=0.0082); and 4.1 vs 1.9 kg (p=0.0019) in MD and FB subjects, respectively.

#### **CONCLUSIONS:**

In obese adults, MD resulted in significantly greater reductions in body weight and fat compared with a FB diet for 1 year after randomization.

#### **REFERENCE:**

Shikany J.M., Thomas A.S., Beasley T.M., Lewis C.E., Allison D.B. (2013). Randomized Controlled Trial of the Medifast 5 & 1 Plan for Weight Loss. *Int J Obes (Lond)*, 37(12), 1571-1578. doi: [doi.org/10.1038/ijo.2013.43](https://doi.org/10.1038/ijo.2013.43).



## Coleman (2012)

### Use of the Medifast Meal Replacement Program for Weight Loss in Overweight and Obese Clients: A Retrospective Chart Review of Three Medifast Weight Control Centers (MWCC)

C Coleman<sup>1</sup>, J Kiel<sup>1</sup>, A Hanlon-Mitola<sup>2</sup>, C Sonzone<sup>1</sup>, N Fuller<sup>1</sup>, LM Davis<sup>1</sup>

<sup>1</sup>Medifast, Inc., Owings Mills, Maryland, USA; <sup>2</sup>Private Practice, Clifton Park, New York, USA.

#### PURPOSE/OBJECTIVE:

A chart review was performed to evaluate the effectiveness of the Medifast (MD) meal replacement (MR) plan in three Medifast Weight Control Centers (MWCC) on body weight, body composition, and other health measures at 4, 12, 24 weeks, and final weight loss visit.

#### METHODS/DESIGN:

Charts included adults aged 18-70 (n=446) with a BMI  $\geq 25$  kg/m<sup>2</sup> who attended one of three MWCCs and were following the MD MR program. Data were collected electronically and included weight, systolic and diastolic blood pressure, pulse, lean muscle mass (LMM), body fat mass, % body fat, and abdominal circumference. Compliance measures included attendance at weekly visits, intake of MRs and supplements, food journals, and ketone testing.

#### RESULTS:

Significant weight loss and % weight loss were achieved at all time points with clinically significant weight loss (>5%) occurring in just 4 weeks. Additionally, significant improvements in body composition were seen at all time points coupled with increases in % total body weight as LMM (% LMM improved by 3.5, 9.8, 16.0, and 13.9%, respectively). Blood pressure and pulse were significantly improved, demonstrating the clinical benefit for clients. Multivariate regression revealed a strong inverse relationship between weight change, % compliance with attendance, and the number of weeks that MRs were taken as recommended as well as a positive association with number of ketone tests.

#### CONCLUSIONS:

The MD MR plan, combined with the support and accountability available in the MWCC, is an efficacious program that promotes significant weight loss and improvements in body composition. These results reveal significant associations between components of compliance and weight loss, but particularly highlight the importance of attendance, a focus of the MWCC model compared to non-clinic models.

#### REFERENCE:

Coleman C., Kiel J., Hanlon-Mitola A., Sonzone C., Fuller N., Davis L.M. (2012). Use of the Medifast Meal Replacement Program for Weight Loss in Overweight and Obese Clients: A Retrospective Chart Review of Three Medifast Weight Control Centers (MWCC). *Food and Nutrition Sciences*, 03(10), 1433-1444. doi: <http://dx.doi.org/10.4236/fns.2012.310187>.

## Davis (2010)

### Efficacy of a Meal Replacement Diet Plan Compared to a Food-based Diet Plan After a Period of Weight Loss and Weight Maintenance: A Randomized Controlled Trial

LM Davis<sup>1</sup>, C Coleman<sup>1</sup>, J Kiel<sup>1</sup>, J Rampolla<sup>1</sup>, T Hutchisen<sup>1</sup>, L Ford<sup>1</sup>, WS Andersen<sup>1</sup>, A Hanlon-Mitola<sup>2</sup>

<sup>1</sup>Research & Development, Medifast, Inc., Owings Mills, Maryland, USA; <sup>2</sup>Private Practice, Clifton Park, New York, USA.

#### PURPOSE/OBJECTIVE:

Obesity has reached epidemic proportions in the United States. It is implicated in the development of a variety of chronic disease states and is associated with increased levels of inflammation and oxidative stress.

The objective of this study is to examine the effect of Medifast's meal replacement program (MD) on body weight, body composition, and biomarkers of inflammation and oxidative stress among obese individuals following a period of weight loss and weight maintenance compared to an isocaloric, food-based diet (FB).

#### METHODS/DESIGN:

This 40-week randomized, controlled clinical trial included 90 obese adults with a body mass index (BMI) between 30 and 50 kg/m<sup>2</sup>, randomly assigned to one of two weight loss programs for 16 weeks and then followed for a 24-week period of weight maintenance. The dietary interventions consisted of Medifast's meal replacement program for weight loss and weight maintenance, or a self-selected isocaloric, food-based meal plan.

#### RESULTS:

Weight loss at 16 weeks was significantly better in the Medifast group (MD) versus the food-based group (FB) (12.3% vs. 6.7%), and while significantly more weight was regained during weight maintenance on MD versus FB, overall greater weight loss was achieved on MD versus FB. Significantly more of the MD participants lost ≥5% of their initial weight at week 16 (93% vs. 55%) and week 40 (62% vs. 30%). There was no difference in satiety observed between the two groups during the weight loss phase. Significant improvements in body composition were also observed in MD participants compared to FB at week 16 and week 40. At week 40, both groups experienced improvements in biochemical outcomes and other clinical indicators.

#### CONCLUSIONS:

Our data suggest that the meal replacement diet plan evaluated was an effective strategy for producing robust initial weight loss and for achieving improvements in a number of health-related parameters during weight maintenance, including inflammation and oxidative stress, two key factors more recently shown to underlie our most common chronic diseases.

#### REFERENCE:

Davis L.M., Coleman C., Kiel J., Rampolla J., Hutchisen T., Ford L., Andersen W., Hanlon-Mitola A. (2010). Efficacy of a Meal Replacement Diet Plan Compared to a Food-based Diet Plan After a Period of Weight Loss and Weight Maintenance: A Randomized Controlled Trial. *Nutr J*, 9, 11. doi: [10.1186/1475-2891-9-11](https://doi.org/10.1186/1475-2891-9-11).

# The 4 & 2 & 1 Plan



## Beavers (2018)

### Effect of an Energy-Restricted, Nutritionally Complete, Higher Protein Meal Plan on Body Composition and Mobility in Older Adults with Obesity: A Randomized Controlled Trial

KM Beavers<sup>1</sup>, BA Nesbit<sup>1</sup>, JR Kiel<sup>2</sup>, JL Sheedy<sup>1</sup>, LM Arterburn<sup>2</sup>, AE Collins<sup>1</sup>, SA Ford<sup>1</sup>, RM Henderson<sup>3</sup>, CD Coleman<sup>2</sup>, DP Beavers<sup>4</sup>

<sup>1</sup>Department of Health and Exercise Science, Wake Forest University, Winston-Salem, North Carolina; <sup>2</sup>Department of Scientific and Clinical Affairs, Medifast, Inc., Baltimore, Maryland; <sup>3</sup>Department of Internal Medicine, Section on Gerontology and Geriatric Medicine, Winston-Salem, North Carolina; <sup>4</sup>Department of Biostatistical Sciences, Wake Forest School of Medicine, Winston-Salem, North Carolina.

#### PURPOSE/OBJECTIVE:

Increasing protein content of the diet might be an effective strategy to preserve muscle mass in older adults undergoing caloric restriction, thereby preserving muscle function.

#### METHODS/DESIGN:

Ninety-six older adults (70 ± 3.7 years, 74% women, 27% African American) with obesity (35.4 ± 3.3 kg/m<sup>2</sup>; 47% total body fat) were randomized to a 6-month higher protein (providing 1.2-1.5 g/kg/d) weight loss (WL) program, utilizing the Medifast 4 & 2 & 1 Plan, or to weight stability (WS). Dual-energy x-ray absorptiometry-acquired total body mass and composition, and fast gait speed over 400-m was assessed at baseline, 3, and 6 months.

#### RESULTS:

At baseline, dual-energy x-ray absorptiometry-acquired total body, fat, and lean masses were 95.9 ± 14.6, 44.6 ± 7.6, and 48.7 ± 9.5 kg, respectively, and 400-m gait speed was 1.17 ± 0.20 m/s. Total body mass was significantly reduced in the WL group (-8.17 [-9.56, -6.77] kg) compared to the WS group (-1.16 [-2.59, 0.27] kg), with 87% of total mass lost as fat (WL: -7.1 [-8.1, -6.1] kg; -15.9% change from baseline). A differential treatment effect was not observed for change in lean mass (WL: -0.81 [-1.40, -0.23] kg vs WS: -0.24 [-0.85, 0.36] kg). Four-hundred-meter gait speed was also unchanged from baseline although trends suggest slightly increased gait speed in the WL group [0.01 (-0.02, 0.04) m/s] compared with the WS group [-0.02 (-0.05, 0.01) m/s].

#### CONCLUSIONS:

Intentional weight loss using a high-protein diet is effective in producing significant total body mass and fat mass loss, while helping preserve lean body mass and mobility, in relatively high-functioning older adults with obesity.

#### REFERENCE:

Beavers K.M., Nesbit B.A., Kiel J.R., Sheedy J.L., Arterburn L.M., Collins A.E., Ford S.A., Henderson R.M., Coleman C.D., Beavers D.P. (2018) Effect of an Energy-Restricted, Nutritionally Complete, Higher Protein Meal Plan on Body Composition and Mobility in Older Adults with Obesity: A Randomized Controlled Trial. *J Gerontol A Biol Sci Med Sci.* 74(6):929-935. doi: [10.1093/gerona/gly146](https://doi.org/10.1093/gerona/gly146).

## Normandin (2018)

# Feasibility of Weighted Vest use During a Dietary Weight Loss Intervention and Effects on Body Composition and Physical Function in Older Adults

E Normandin<sup>1</sup>, D Yow<sup>1</sup>, C Crotts<sup>1</sup>, J Kiel<sup>2</sup>, KM Beavers<sup>3</sup>, BJ Nicklas<sup>1,3</sup>

<sup>1</sup>Section on Gerontology and Geriatric Medicine, Wake Forest School of Medicine, Winston-Salem, NC 27157, USA; <sup>2</sup>Department of Scientific and Clinical Affairs, Medifast, Inc., Baltimore, MD 21202, USA; <sup>3</sup>Department of Health and Exercise Science, Wake Forest University, Winston-Salem, NC 27109, USA.

### PURPOSE/OBJECTIVE:

**Background:** While intentional weight loss in older adults with obesity yields clinically important health benefits there is a need to minimize the negative effects of weight loss on concomitant loss of muscle mass and strength. Data show wearing weighted vests during exercise improves lean mass and lower extremity strength, however the efficacy of wearing a weighted vest during a period of weight loss to mitigate muscle and strength loss is not known.

**Objectives:** This study examined the feasibility of daily weighted vest use during a dietary weight loss intervention, and examined effects of vest use on body composition and physical function in well-functioning older adults with obesity.

### METHODS/DESIGN:

**Design:** Randomized, controlled pilot study.

**Setting:** Wake Forest Baptist Medical Center in Winston-Salem, NC.

**Participants:** 37 older (age=65-79 years), obese (BMI=30-40 kg/m<sup>2</sup>) sedentary men and women.

**Interventions:** 22-week behavioral diet intervention (targeting 10% weight loss, 1100-1300 kcals/day) with (Diet+Vest; n=20) or without (Diet; n=17) weighted vest use (goal of 10 hours/day with weight added weekly according to individual loss of body mass).

**Measurements:** Body composition by dual-energy x-ray absorptiometry and measures of physical function, mobility, and muscle strength/power.

### RESULTS:

Average weighted vest use was 6.7 ± 2.2 hours/day and the vest-wear goal of 10 hrs/day was achieved for 67 ± 22% of total intervention days. Five participants reported adverse events from wearing the vest (all back pain or soreness). Both groups lost a similar amount of weight (Diet= -11.2 ± 4.4 kg; Diet+Vest= -11.0 ± 6.3 kg; p<0.001), with no differences between groups (p=0.25). Fat mass, lean mass, and % body fat decreased significantly (p<0.0001), with no differences between groups. Compared to Diet+Vest, the Diet intervention resulted in greater decreases in leg power (p<0.02), with no other between group differences in physical function.

### CONCLUSIONS:

This pilot study showed that vest use during dietary weight loss is feasible and safe in well-functioning older adults with obesity. Larger studies are needed to definitively determine whether external replacement of lost weight during caloric restriction may preserve lower extremity muscle strength and power.

### REFERENCE:

Normandin E., Yow D., Crotts C., Kiel J., Beavers K.M., Nicklas B.J.(2018) Feasibility of Weighted Vest Use During a Dietary Weight Loss Intervention and Effects on Body Composition and Physical Function in Older Adults. *J of Frailty & Aging*; 2018;7(3):198-203. doi: [10.14283/jfa.2018.17](https://doi.org/10.14283/jfa.2018.17).

## Coleman (2015)

### Effectiveness of a Medifast Meal Replacement Plan on Weight, Body Composition, and Cardiometabolic Risk Factors in Overweight and Obese Adults: A Multicenter Systematic Retrospective Chart Review

CD Coleman<sup>1</sup>, JR Kiel<sup>1</sup>, AH Mitola<sup>2</sup>, JS Langford<sup>1</sup>, KN Davis<sup>1</sup>, LM Arterburn<sup>1</sup>

<sup>1</sup>Department of Scientific and Clinical Affairs, Medifast, Inc., 11445 Cronhill Drive, Owings Mills, MD, United States and

<sup>2</sup>Independent Consultant, Clifton Park, NY, United States.

#### PURPOSE/OBJECTIVE:

Recent medical guidelines emphasize the importance of actively treating overweight and obesity with diet and lifestyle intervention to achieve  $\geq 5\%$  weight loss in a 6-month period. Commercial programs offer one approach provided there is evidence of their efficacy and safety. This study was conducted to evaluate the effectiveness of the Medifast 4 & 2 & 1 Plan™ on weight loss, body composition and cardiometabolic risk factors in overweight and obese adults.

#### METHODS/DESIGN:

A systematic retrospective chart review of 310 overweight and obese clients following the Medifast 4 & 2 & 1 Plan at one of 21 Medifast Weight Control Centers was conducted. Data were recorded electronically and key data points were independently verified. The primary endpoint was change from baseline body weight at 12 weeks. Within group paired t-tests were used to examine changes from baseline in a completers population. Differences between gender and age subgroups were examined using bivariate t-tests and mixed model regression analyses.

#### RESULTS:

For the primary endpoint at 12 weeks, body weight among completers (n=185) was reduced by a mean of  $10.9 \pm 5.6$  kg (10.1%,  $p < 0.0001$ ), and at 24 weeks (n=81) mean weight was reduced by  $16.0 \pm 7.9$  kg (14.3%). At 12 and 24 weeks, 85% and 96% of those remaining on the plan, respectively, had lost  $\geq 5\%$  of their baseline body weight. Lean mass was preserved to within 5% of baseline throughout the 24 weeks, and fat mass represented  $\geq 80\%$  of the body weight lost from 12 weeks onward. Men, women, seniors ( $\geq 65$  yrs), and non-seniors ( $< 65$  yrs) all had significant weight reductions with preservation of lean mass. Significant improvements in blood pressure, pulse and waist-to-hip ratio were observed. Mean weight regain among the subset who entered a formal maintenance phase was  $< 2\%$  during an average follow-up of 34 weeks. The meal plan was well tolerated, and program adherence was  $> 85\%$ .

#### CONCLUSIONS:

The 4 & 2 & 1 Plan used at Medifast Weight Control Centers was effective for weight loss, preservation of lean mass and improvement in cardiometabolic risk factors. The plan was generally well tolerated in a broad population of overweight and obese adults. #NCT02150837.

#### REFERENCE:

Coleman C.D., Kiel J.R., Mitola A.H., Langford J.S., Davis K.N., Arterburn L.M., (2015) Effectiveness of a Medifast Meal Replacement Program on Weight, Body Composition and Cardiometabolic Risk Factors in Overweight and Obese Adults: A Multicenter Systematic Retrospective Chart Review Study. *Nutr J*, 14, 77. doi: [10.1186/s12937-015-0062-8](https://doi.org/10.1186/s12937-015-0062-8).

# The 5 & 2 & 2 Plan



## Dimachkie (2021)

### Exploration of Biomarkers from a Pilot Weight Management Study for Men Undergoing Radical Prostatectomy

MD Dimachkie<sup>1</sup>, MD Bechtel<sup>1</sup>, HL Robertson<sup>1</sup>, C Michel<sup>1</sup>, EK Lee<sup>1</sup>, DK Sullivan<sup>2</sup>, P Chalise<sup>3</sup>, JB Thrasher<sup>1</sup>, WP Parker<sup>1</sup>, AK Godwin<sup>4</sup>, HB Pathak<sup>4</sup>, J DiGiovanni<sup>5</sup>, N Shivappa<sup>6,7,8</sup>, JR Hébert<sup>6,7,8</sup>, JM Hamilton-Reeves<sup>1,2</sup>

<sup>1</sup>Department of Urology, University of Kansas Medical Center, Kansas City, KS; <sup>2</sup>Department of Dietetics & Nutrition, University of Kansas Medical Center, Kansas City, KS; <sup>3</sup>Department of Biostatistics, University of Kansas Medical Center, Kansas City, KS; <sup>4</sup>Department of Pathology & Laboratory Medicine, University of Kansas Medical Center, Kansas City, KS; <sup>5</sup>Division of Pharmacology and Toxicology, College of Pharmacy, The University of Texas at Austin, Austin, TX; <sup>6</sup>Cancer Prevention and Control Program, University of South Carolina, Columbia, SC 29208; <sup>7</sup>Department of Epidemiology and Biostatistics, Arnold School of Public Health, University of South Carolina, Columbia, SC; <sup>8</sup>Connecting Health Innovations LLC, Columbia, SC

#### PURPOSE/OBJECTIVE:

Several biologic mechanisms, including inflammation and immune changes, have been proposed to explain the role of obesity in prostate cancer (CaP) progression. Compared to men of a healthy weight, overweight and obese men are more likely to have CaP recurrence post-prostatectomy. Obesity is related to inflammation and immune dysregulation; thus, weight loss may be an avenue to reduce inflammation and reverse these immune processes.

This study explores the reversibility of the biological mechanisms through intentional weight loss using a comprehensive weight management program in men undergoing prostatectomy. Outcomes include blood and tissue biomarkers, microtumor environment gene expression, inflammation markers and Dietary Inflammatory Index (DII) scores.

#### METHODS/DESIGN:

Twenty overweight men undergoing prostatectomy participated in this study. Fifteen men chose the intervention and 5 men chose the nonintervention group. The intervention consisted of a comprehensive weight loss program prior to prostatectomy and a weight maintenance program following surgery. Prostate tissue samples were obtained from diagnostic biopsies before the intervention and prostatectomy samples after weight loss. Blood samples and diet records were collected at baseline, pre-surgery after weight loss and at study end after weight maintenance. Immunohistochemistry and NanoString analysis were used to analyze the tissue samples. Flow cytometry was used to assess circulating immune markers. Inflammation markers were measured using Luminex panels.

#### RESULTS:

The intervention group lost >5% body weight prior to surgery. DII scores improved during the weight loss intervention from baseline to pre-surgery (p=0.002); and between group differences were significant (p=0.02). DII scores were not associated with IL-6 nor hsCRP. In the intervention, CXCL12, CXCR7, and CXCR4 (C-X-C motif chemokine ligand/receptor) and Ki67 expression decreased in the prostate tissue from biopsy to surgery (p=0.06), yet plasma CXCL12 increased during the same timeframe (p=0.009). The downregulation of several genes (FDR<0.001) was observed in the intervention compared to the non-intervention. Changes in immune cells were not significant in either group.

#### CONCLUSIONS:

This feasibility study demonstrates that in overweight men with localized CaP, weight loss alters blood, and tissue biomarkers, as well as tumor gene expression. More research is needed to determine the biological and clinical significance of these findings.

#### REFERENCE:

Dimachkie M. D., Bechtel M. D., Robertson H. L., Michel C., Lee E. K., Sullivan D. K., Chalise P., Thrasher J. B., Parker W. P., Godwin A. K., Pathak H. B., DiGiovanni J., Shivappa N., Hébert J. R., Hamilton-Reeves J. M. (2021). Exploration of Biomarkers from a Pilot Weight Management Study for Men Undergoing Radical Prostatectomy. *Urologic Oncology: Seminars and Original Investigations*. doi:10.1016/j.urolonc.2021.01.010.



## Hamilton-Reeves (2020)

### Feasibility of a Weight Management Program Tailored for Overweight Men with Localized Prostate Cancer - A Pilot Study

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#### PURPOSE/OBJECTIVE:

Overweight men with prostate cancer are more likely to suffer from recurrence and death following prostatectomy compared with healthy weight men. This study tested the feasibility of delivering a comprehensive program to foster weight loss before and weight maintenance after surgery in overweight men with localized prostate cancer.

#### METHODS/DESIGN:

Twenty overweight men scheduled for prostatectomy elected either the intervention (n=15) or the nonintervention (n=5). Anthropometrics, biomarkers, diet quality, nutrition literacy, quality of life, and long-term follow-up were assessed in both groups.

#### RESULTS:

The intervention led to 5.55 kg of weight loss including 3.88 kg of fat loss from baseline to surgery (mean=8.3 weeks). The intervention significantly increased fiber, protein, fruit, nut, and vegetable intake; and decreased trans fats intake during weight loss. The intervention significantly reduced insulin, C-peptide, systolic blood pressure, leptin:adiponectin ratio, and visceral adiposity compared to the nonintervention. Post-surgically, weight loss was maintained. Changes in lipid profiles, nutrition literacy, and follow-up were not statistically significant in either group.

#### CONCLUSIONS:

Significant weight loss ( $\geq 5\%$ ) is feasible with a coaching intervention in overweight men preparing for prostatectomy and is associated with favorable cardiometabolic effects. This study is registered under NCT02252484 ([www.clinicaltrials.gov](http://www.clinicaltrials.gov)).

#### REFERENCE:

Hamilton-Reeves J. M., Johnson C. N., Hand L. K., Bechtel M. D., Robertson H. L., Michel C., Metcalf M., Chalise P., Mahan N. J., Mirza M., Lee E. K., Sullivan D. K., Klemp J. R., Befort C. A., Parker W. P., Gibbs H. D., Demark-Wahnefried W., Thrasher, J. B. (2020). Feasibility of a Weight Management Program Tailored for Overweight Men with Localized Prostate Cancer - A Pilot Study. *Nutr Cancer*, 73:11-12, 2671-2686. <https://doi.org/10.1080/01635581.2020.1856890>.

## Kiel (2015)

# The Effectiveness of a Partial Meal Replacement Program in Extremely Obese Individuals: A Systematic Retrospective Chart Review of Medifast Weight Control Centers

JR Kiel<sup>1</sup>, CD Coleman<sup>1</sup>, AH Mitola<sup>2</sup>, JS Langford<sup>1</sup>, KN Davis<sup>1</sup>, LM Arterburn<sup>1</sup>

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### PURPOSE/OBJECTIVE:

Extreme obesity is associated with elevated risks of morbidities and mortality, and the prevalence of this condition has been rising. Lifestyle interventions are the cornerstone of all treatment options, yet relatively few studies have assessed the effectiveness of commercial programs for attaining clinically meaningful weight loss ( $\geq 5\%$ ) in this population. The purpose of this study was to evaluate the effectiveness of the Medifast 5 & 2 & 2 Plan™ administered along with counseling in obese adults, a majority of whom were extremely obese.

### METHODS/DESIGN:

We conducted a systematic retrospective chart review of 62 obese clients from 17 Medifast Weight Control Centers (MWCCs). Weight, body composition and cardiometabolic risk factor data were abstracted through 24 weeks. Data were recorded electronically, and key data points were independently verified. The primary endpoint was change from baseline body weight at 12 weeks, assessed using Wilcoxon signed rank tests.

### RESULTS:

The population consisted of 57% men, and 82% had a body mass index of  $\geq 40$  kg/m<sup>2</sup>. Mean body weight among completers was reduced by  $12.9 \pm 7.1$  kg ( $-8.6\%$ ,  $n=37$ ) at the 12-week primary endpoint and by  $19.3 \pm 11.4$  kg ( $-12.5\%$ ,  $n=17$ ) at 24 weeks ( $p<0.0001$ ). At 12 and 24 weeks, 76% and 88% of those remaining on the plan, respectively, had lost  $\geq 5\%$  of their baseline body weight. Fat mass accounted for a majority (68-80%) of the weight lost, resulting in improvements in body composition. Significant improvements in blood pressure and central adiposity were also observed. Program adherence was  $>80\%$ , and the meal plan was well-tolerated.

### CONCLUSIONS:

The 5 & 2 & 2 Plan used at MWCCs was effective for achieving clinically meaningful weight loss and improving cardiometabolic risk factors in a population of extremely obese individuals. This lifestyle program represents a viable first line approach for meeting treatment goals in extremely obese adults. #NCT02150837.

### REFERENCE:

Kiel J.R., Coleman C.D., Mitola A.H., Langford J.S., Davis K.N., Arterburn L.M. (2015) The Effectiveness of a Partial Meal Replacement Program in Extremely Obese Individuals: A Systematic Retrospective Chart Review of Medifast Weight Control Centers. *J Obes Weight Loss Ther*, S5:007. doi: <https://dx.doi.org/10.4172/2165-7904.S5-007>.

# Diabetes



## Coleman (2017)

# Comparative Effectiveness of a Portion-Controlled Meal Replacement Program for Weight Loss in Adults With and Without Diabetes/High Blood Sugar

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### PURPOSE/OBJECTIVE:

Individuals with type 2 diabetes (DM2) may be less successful at achieving therapeutic weight loss than their counterparts without diabetes. This study compares weight loss in a cohort of adults with DM2 or high blood sugar (D/HBS) to a cohort of adults without D/HBS. All were overweight/obese and following a reduced or low-calorie commercial weight-loss program incorporating meal replacements (MRs) and one-on-one behavioral support.

### METHODS/DESIGN:

Demographic, weight, body composition, anthropometric, pulse and blood pressure data were collected as part of systematic retrospective chart review studies. Differences between cohorts by D/HBS status were analyzed using Mann-Whitney *U*-tests and mixed model regression.

### RESULTS:

A total of 816 charts were included (125 with self-reported D/HBS). The cohort with D/HBS had more males (40.8 vs 25.6%), higher BMI (39.0 vs 36.3 kg/m<sup>2</sup>) and was older (56 vs 48 years). Among clients continuing on program, the cohorts with and without D/HBS lost, on average, 5.6 vs 5.8 kg (NS) (5.0 vs 5.6%; *p*=0.005) of baseline weight at 4 weeks, 11.0 vs 11.6 kg (NS) (9.9 vs 11.1%; *p*=0.027) at 12 weeks and 16.3 vs 17.1 kg (13.9 vs 15.7%; NS) at 24 weeks, respectively. In a mixed model regression controlling for baseline weight, gender and meal plan, and an intention-to-treat analysis, there was no significant difference in weight loss between the cohorts at any time point. Over 70% in both cohorts lost ≥5% of their baseline weight by the final visit on their originally assigned meal plan. Both cohorts had significant reductions from baseline in body fat, blood pressure, pulse and abdominal circumference.

### CONCLUSIONS:

Adults who were overweight/obese and with D/HBS following a commercial weight-loss program incorporating MRs and one-on-one behavioral support achieved therapeutic weight loss. The program was equally effective for weight loss and reductions in cardiometabolic risk factors among adults with and without D/HBS.

### REFERENCE:

Coleman C.D., Kiel J.R., Mitola A.H., Arterburn L.M. (2017) Comparative Effectiveness of a Portion-Controlled Meal Replacement Program for Weight Loss in Adults With and Without Diabetes/High Blood Sugar. *Nutr Diabetes*; 7(7):e284. doi: [10.1038/nutd.2017.32](https://doi.org/10.1038/nutd.2017.32).

## Cheskin (2008)

### Efficacy of Meal Replacements Versus a Standard Food-Based Diet for Weight Loss in Type 2 Diabetes: A Controlled Clinical Trial

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*From the Johns Hopkins Bloomberg School of Public Health, Department of International Health, Center for Human Nutrition, Baltimore, Maryland.*

#### PURPOSE/OBJECTIVE:

The purpose of this study is to compare the efficacy of a portion-controlled meal-replacement diet (PCD) to a standard diet (SD) based on recommendations by the American Diabetes Association in achieving and maintaining weight loss among obese participants with type 2 diabetes.

#### METHODS/DESIGN:

This study is a university-based, controlled clinical trial. Participants were 119 men and women with diabetes with a body mass index between 25 and 40 kg/m<sup>2</sup>, assigned randomly to one of two 34-week, 75% of predicted energy need diets (portion controlled or standard, self-selected, food based) and then followed by 1-year of maintenance.

#### RESULTS:

Using intention-to-treat (ITT) analyses, weight loss at 34 weeks and weight maintenance at 86 weeks was significantly better on PCD versus SD. Approximately 40% of the PCD participants lost ≥5% of their initial weight compared with 12% of those on the SD. Significant improvements in biochemical and metabolic measures were observed at 34 weeks in both groups. The retention rate and self-reported ease of adherence in the PCD group were significantly higher throughout the study.

#### CONCLUSIONS:

A diet using portion-controlled meal replacements yielded significantly greater initial weight loss and less regain after 1 year of maintenance than a standard, self-selected, food-based diet. As PCDs may help obese patients with type 2 diabetes adhere to a weight control program, diabetes educators may consider recommending them as part of a comprehensive approach to weight control.

#### REFERENCE:

Cheskin L.J., Mitchell A.M., Jhaveri A.D., Mitola A.H., Davis L.M., Lewis R.A., Yep, M.A., Lycan T.W. (2008) Efficacy of Meal Replacements Versus a Standard Food-Based Diet for Weight Loss in Type 2 Diabetes: A Controlled Clinical Trial. *Diabetes Educ*, 34(1), 118-127. doi: [10.1177/0145721707312463](https://doi.org/10.1177/0145721707312463).

# Polycystic Ovarian Syndrome (PCOS)



## Yuh (2011)

# Efficacy of a Hypocaloric Weight Management Program in Obese Women with Polycystic Ovarian Syndrome (PCOS)

J Yuh<sup>1</sup>, D Debrakeleer<sup>1</sup>, W McIntyre<sup>1</sup>, C Coleman<sup>2</sup>, L Fox<sup>2</sup>, L Barmat<sup>3</sup>

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<sup>2</sup>Department of Scientific and Clinical Affairs, Medifast, Inc., 11445 Cronhill Drive, Owings Mills, MD, United States, 21117 and ; <sup>3</sup>Department of Obstetrics and Gynecology, Grand View Hospital, 700 Lawn Avenue, Sellersville, PA, United States, 18960.

### PURPOSE/OBJECTIVE:

To evaluate the efficacy of a hypocaloric diet program utilizing a health coach on body weight and changes in biochemical and metabolic profiles in obese PCOS patients.

### METHODS/DESIGN:

A prospective study conducted in a teaching community hospital. Subjects were obese (BMI  $33.1 \pm 3.0$ ), adult, nonpregnant women age 20-39 ( $27.7 \pm 6.1$ ) with PCOS defined by Rotterdam criteria. Subjects were eligible if they were free of hormonal medications for  $\geq 3$  months, were nonsmokers, and did not have diabetes or hypertension. For 3 months patients followed a 1000 calorie diet plan with the guidance of a health coach consisting of 5 Medifast meals and one self-prepared meal. Meetings with the health coach, weight measurement, and lab draws occurred on a monthly basis. The primary outcome was change in body weight; secondary outcomes were biochemical and metabolic changes. Paired t-tests were used to examine the longitudinal changes from baseline. Significance was defined as  $p < 0.05$ .

### RESULTS:

Eleven subjects completed the study. The hypocaloric diet resulted in significant decline in body weight ( $-18.2 \pm 6.85$  lbs;  $p < 0.0001$ ), 2-hour oral glucose ( $-23.0 \pm 22.4$  mg/dl;  $p = 0.010$ ), 2-hour insulin ( $-79.1 \pm 76.6$   $\mu$ IU/ml;  $p = 0.022$ ), and calculated free androgen index ( $-3.7 \pm 2.54$ ;  $p = 0.017$ ). There was a marginally significant increase in SHGB ( $+9.2 \pm 14.1$  nmol/L;  $p = 0.069$ ). For subjects with elevated levels at baseline, significant improvements were found in total cholesterol ( $-37.0 \pm 13.90$  mg/dl;  $p = 0.013$ ), LDL cholesterol ( $-28.0 \pm 10.80$  mg/dl;  $p = 0.014$ ), and triglycerides ( $-90.0 \pm 1.41$  mg/dl;  $p = 0.007$ ). Overall, 1/3 of previously anovulatory women began ovulating and 7 out of 11 began regular menstruation.

### CONCLUSIONS:

Significant improvements in body weight and biochemical and metabolic markers were achieved in obese PCOS subjects after 3 months following a hypocaloric portion controlled diet plan under the guidance of a health coach making conditions more favorable for ovulation.

### REFERENCE:

*This abstract was accepted and presented as a poster at the American Society for Reproductive Medicine's 67th Annual Meeting in 2011.*

Yuh J, Debrakeleer D, McIntyre W, Coleman C, Fox L, Barmat, L. Efficacy of a Hypocaloric Weight Management Program in Obese Women with Polycystic Ovarian Syndrome (PCOS)[abstract]. 9th Annual Meeting of Androgen Excess & PCOS Society; 2011 Oct 13 - 15; Abstract nr 21.

# Seniors





## Miller (2021)

### Incorporating Nutrition, Vests, Education and Strength Training (INVEST) in Bone Health: Trial Design and Methods

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#### PURPOSE/OBJECTIVE:

Achievement of 5-10% weight loss (WL) among older adults living with obesity considerably improves prognosis of health-related outcomes; however, concomitant declines in bone mineral density (BMD) limit overall benefit by increasing fracture risk. Declines in mechanical loading contribute to WL-associated BMD loss, with pilot data signaling the addition of external weight replacement (via weighted vest use) during intentional WL mitigates bone loss at weight bearing sites to a similar degree as resistance exercise training (RT). Definitive data in support of weighted vest use as a potential strategy to mitigate WL-associated bone loss in this population are needed.

#### METHODS/DESIGN:

In the Incorporating Nutrition, Vests, Education, and Strength Training (INVEST) in Bone Health trial ([NCT04076618](https://clinicaltrials.gov/ct2/show/study/NCT04076618)), 192 older adults (60-85 years) who are overweight (BMI $\geq$ 27 kg/m<sup>2</sup>) with at least one obesity-related risk factor or obese (BMI=30-40 kg/m<sup>2</sup>) will be randomly assigned to participate in one of three 12-month intervention groups: WL alone, WL + weighted vest use (WL + VEST), or WL + RT. The primary aim is to determine the effects of WL + VEST compared to WL alone and WL + RT on indicators of bone health and subsequent fracture risk.

#### DISCUSSION:

Determining effective, translatable strategies that minimize bone loss during intentional WL among older adults holds public health potential. The INVEST in Bone Health trial offers an innovative approach for increasing mechanical stress during intentional WL in the absence of RT. If successful, findings from this study will provide evidence in support of a scalable solution to minimize bone loss during intentional WL among older adults with obesity.

#### REFERENCE:

Miller R. M., Beavers D. P., Cawthon P. M., Crotts C., Fanning J., Gerosa J., Greene K. A., Hsieh K. L., Kiel J., Lawrence E., Lenchik L., Lynch S. D., Nesbit B. A., Nicklas B. J., Weaver A. A., Beavers K. M. (2021). Incorporating Nutrition, Vests, Education, and Strength Training (INVEST) in Bone Health: Trial Design and Methods. *Contemporary Clinical Trials*, 104, 106326. <https://doi.org/10.1016/j.cct.2021.106326>.

## Quillen (2020)

### Use of Metabolomic Profiling to Understand Variability in Adiposity Changes Following an Intentional Weight Loss Intervention in Older Adults

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#### PURPOSE/OBJECTIVE:

Inter-individual response to dietary interventions remains a major challenge to successful weight loss among older adults. This study applied metabolomics technology to identify small molecule signatures associated with a loss of fat mass and overall weight in a cohort of older adults on a nutritionally complete, high-protein diet.

#### METHODS/DESIGN:

A total of 102 unique metabolites were measured using liquid chromatography-mass spectrometry (LC-MS) for 38 adults aged 65–80 years randomized to dietary intervention and 36 controls. Metabolite values were analyzed in both baseline plasma samples and samples collected following the six-month dietary intervention to consider both metabolites that could predict the response to diet and those that changed in response to diet or weight loss.

#### RESULTS:

Eight metabolites changed over the intervention at a nominally significant level: D-pantothenic acid, L-methionine, nicotinate, aniline, melatonin, deoxycarnitine, 6-deoxy-L-galactose, and 10-hydroxydecanoate. Within the intervention group, there was broad variation in the achieved weight-loss and dual-energy x-ray absorptiometry (DXA)-defined changes in total fat and visceral adipose tissue (VAT) mass. Change in the VAT mass was significantly associated with the baseline abundance of  $\alpha$ -amino adipate ( $p=0.0007$ ) and an additional mass spectrometry peak that may represent D-fructose, myo-inositol, mannose,  $\alpha$ -D-glucose, allose, D-galactose, D-tagatose, or L-sorbose ( $p=0.0001$ ).

#### CONCLUSIONS:

This hypothesis-generating study reflects the potential of metabolomics biomarkers for the development of personalized dietary interventions.

#### REFERENCE:

Quillen E. E., Beavers D. P., Cox A. O. B., Furdui C. M., Lee J., Miller R. M., Wu H., Beavers K. M. (2020). Use of Metabolomic Profiling to Understand Variability in Adiposity Changes Following an Intentional Weight Loss Intervention in Older Adults [Article]. *Nutrients*, 12(10), 3188. <https://doi.org/10.3390/nu12103188>.

## Serra (2019)

# Effects of a Hypocaloric, Nutritionally Complete, Higher Protein Meal Plan on Regional Body Fat and Cardiometabolic Biomarkers in Older Adults with Obesity

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### PURPOSE/OBJECTIVE:

Whether improvements in cardiometabolic health following weight loss (WL) are associated with changes in regional body fat distribution (gluteal vs. android) is not well documented.

### METHODS/DESIGN:

Older (age: 70 ± 4 years; mean ± SD) adults with obesity were randomized to a 6-month WL program (WL; n=47), accomplished using a hypocaloric, nutritionally complete, higher protein (targeting ≥1.0 g/kg/day) meal plan, or a weight stability (WS; n=49) program. Android, gynoid, visceral, and subcutaneous abdominal fat masses (via dual energy x-ray absorptiometry) and fasting glucose and lipid profiles were assessed at baseline and 6 months.

### RESULTS:

The WL group lost more body weight (WL: -8.6% vs. WS: -1.7%, p<0.01), resulting in a reduction in fat mass at each region only following WL (all p<0.05). The decline in the ratio of android/gynoid fat mass also was significant only following WL, resulting in greater declines than WS (mean [95% CI]; WL: -0.026 [-0.040 to -0.011] vs. WS: 0.003 [-0.012 to 0.019] g, p<0.01). The change in the ratio of visceral/subcutaneous abdominal fat mass was not significant in either group and did not differ between groups (WL: 0.65 [-0.38 to 1.68] vs. WS: 0.05 [-1.00 to 1.10] g, p=0.42). In general, the improvements in glucose and lipid profiles were associated with declines in fat mass at the gynoid and android regions (r's= 0.20-0.42, all p<0.05), particularly the visceral depot but not the ratios.

### CONCLUSIONS:

WL achieved via a hypocaloric, nutritionally complete, higher protein meal plan is effective in reducing body fat in the android, gynoid, and visceral depots, which relate to cardiometabolic improvements.

### REFERENCE:

Serra M.C., Beavers D.P., Henderson R.M., Kelleher J.L., Kiel J.R., Beavers K.M. (2019) Effects of a Hypocaloric, Nutritionally Complete, Higher Protein Meal Plan on Regional Body Fat and Cardiometabolic Biomarkers in Older Adults with Obesity. *Ann Nutr Metab.*, 74(2):149-155. doi: [10.1159/000497066](https://doi.org/10.1159/000497066).

## Weaver (2019)

### Effect of a Hypocaloric, Nutritionally Complete, Higher Protein Meal Plan on Bone Density and Quality in Older Adults with Obesity: A Randomized Trial

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<sup>1</sup>Department of Biomedical Engineering, Wake Forest School of Medicine, Winston-Salem, NC; <sup>2</sup>Department of Internal Medicine, Section on Gerontology and Geriatric Medicine; <sup>3</sup>Department of Nutritional Sciences; <sup>4</sup>Department of Biostatistical Sciences, Rutgers University, New Brunswick, NJ; <sup>5</sup>Department of Health and Exercise Science, Wake Forest University, Winston-Salem, NC

#### PURPOSE/OBJECTIVE:

Dietary protein and micronutrients are important to the maintenance of bone health and may be an effective countermeasure to weight-loss-associated bone loss.

We aimed to determine the effect of a 6-mo hypocaloric, nutritionally complete higher-protein meal plan on change in bone density and quality as compared with weight stability in older adults using a randomized post-test design. We hypothesized that participants randomly assigned to this meal plan would maintain similar bone density and quality to weight-stable controls, despite significant reductions in body mass.

#### METHODS/DESIGN:

Ninety-six older adults (70 ± 3.7 y, 74% women, 27% African American) with obesity [body mass index (kg/m<sup>2</sup>): 35.4 ± 3.3] were randomly assigned to a 6-mo hypocaloric, nutritionally complete, higher-protein meal plan targeting ≥1.0 g protein · kg body weight<sup>-1</sup> · d<sup>-1</sup> [weight loss (WL) group; n=47] or to a weight-stability (WS) group targeting 0.8 g protein · kg body weight<sup>-1</sup> · d<sup>-1</sup>, the current Recommended Dietary Allowance (n=49). The primary outcome was total hip bone mineral density (BMD), with femoral neck BMD, lumbar spine BMD, and lumbar spine trabecular bone score (TBS) as secondary outcomes, all assessed at baseline and 3 and 6 mo with dual-energy x-ray absorptiometry.

#### RESULTS:

Baseline total hip, femoral neck, and lumbar spine BMDs were 1.016 ± 0.160, 0.941 ± 0.142, and 1.287 ± 0.246 g/cm<sup>2</sup>, respectively; lumbar TBS was 1.398 ± 0.109. Despite significant weight loss achieved in the WL group (6.6 ± 0.4 kg; 8.6% ± 0.4% of baseline weight), 6-mo regional BMD estimates were similar to the WS group (all p>0.05). Lumbar spine TBS significantly increased at 6 mo in the WL group (mean: 1.421; 95% CI: 1.401, 1.441) compared with the WS group (1.390; 95% CI: 1.370, 1.409; p=0.02).

#### CONCLUSIONS:

Older adults on a hypocaloric, nutritionally complete higher-protein meal plan maintained similar bone density and quality to weight-stable controls. Our data suggest adherence to this diet does not produce loss of hip and spine bone density in older adults, and may improve bone quality. This trial was registered at clinicaltrials.gov as NCT02730988.

#### REFERENCE:

Weaver A.A., Houston D.K., Shapses S.A., Lyles M.F., Henderson R.M., Beavers D.P., Baker A.C., Beavers K.M. (2019) Effect of a Hypocaloric, Nutritionally Complete, Higher Protein Meal Plan on Bone Density and Quality in Older Adults with Obesity: A Randomized Trial. *Am J Clin Nutr.*, 109(2):478-486. doi: <https://doi.org/10.1093/ajcn/nqy237>.

## Beavers (2018)

### Effect of an Energy-Restricted, Nutritionally Complete, Higher Protein Meal Plan on Body Composition and Mobility in Older Adults with Obesity: A Randomized Controlled Trial

KM Beavers<sup>1</sup>, BA Nesbit<sup>1</sup>, JR Kiel<sup>2</sup>, JL Sheedy<sup>1</sup>, LM Arterburn<sup>2</sup>, AE Collins<sup>1</sup>, SA Ford<sup>1</sup>, RM Henderson<sup>3</sup>, CD Coleman<sup>2</sup>, DP Beavers<sup>4</sup>

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#### PURPOSE/OBJECTIVE:

Increasing protein content of the diet might be an effective strategy to preserve muscle mass in older adults undergoing caloric restriction, thereby preserving muscle function.

#### METHODS/DESIGN:

Ninety-six older adults (70 ± 3.7 years, 74% women, 27% African American) with obesity (35.4 ± 3.3 kg/m<sup>2</sup>; 47% total body fat) were randomized to a 6-month higher protein (providing 1.2-1.5 g/kg/d) weight loss (WL) program, utilizing the Medifast 4 & 2 & 1 Plan, or to weight stability (WS). Dual-energy x-ray absorptiometry-acquired total body mass and composition, and fast gait speed over 400-m was assessed at baseline, 3, and 6 months.

#### RESULTS:

At baseline, dual-energy x-ray absorptiometry-acquired total body, fat, and lean masses were 95.9 ± 14.6, 44.6 ± 7.6, and 48.7 ± 9.5 kg, respectively, and 400-m gait speed was 1.17 ± 0.20 m/s. Total body mass was significantly reduced in the WL group (-8.17 [-9.56, -6.77] kg) compared to the WS group (-1.16 [-2.59, 0.27] kg), with 87% of total mass lost as fat (WL: -7.1 [-8.1, -6.1] kg; -15.9% change from baseline). A differential treatment effect was not observed for change in lean mass (WL: -0.81 [-1.40, -0.23] kg vs WS: -0.24 [-0.85, 0.36] kg). Four-hundred-meter gait speed was also unchanged from baseline although trends suggest slightly increased gait speed in the WL group [0.01 (-0.02, 0.04) m/s] compared with the WS group [-0.02 (-0.05, 0.01) m/s].

#### CONCLUSIONS:

Intentional weight loss using a high-protein diet is effective in producing significant total body mass and fat mass loss, while helping preserve lean body mass and mobility, in relatively high-functioning older adults with obesity.

#### REFERENCE:

Beavers K.M., Nesbit B.A., Kiel J.R., Sheedy J.L., Arterburn L.M., Collins A.E., Ford S.A., Henderson R.M., Coleman C.D., Beavers D.P. (2018) Effect of an Energy Restricted, Nutritionally Complete, Higher Protein Meal Plan on Body Composition and Mobility in Older Adults with Obesity: A Randomized Controlled Trial. *J Gerontol A Biol Sci Med Sci.* 74(6):929-935 doi: [10.1093/gerona/gly146](https://doi.org/10.1093/gerona/gly146).

## Shaver (2018)

### Effect of Intentional Weight Loss on Mortality Biomarkers in Older Adults With Obesity

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<sup>1</sup>Department of Health and Exercise Science, Wake Forest University, Winston-Salem, North Carolina. <sup>2</sup>Department of Biostatistical Sciences, Wake Forest School of Medicine, Winston-Salem, North Carolina. <sup>3</sup>Department of Scientific and Clinical Affairs, Medifast, Inc., Baltimore, Maryland. <sup>4</sup>Sticht Center for Healthy Aging and Alzheimer's Prevention, Wake Forest School of Medicine, Winston-Salem, North Carolina.

#### PURPOSE/OBJECTIVE:

Observational research has identified several mortality biomarkers; however, their responsiveness to change is unknown. We tested whether the Healthy Aging Index (HAI) and other mortality biomarkers were responsive to intentional weight loss (WL), which is associated with lower mortality risk in recent meta analyses.

#### METHODS/DESIGN:

Older adults (70.3 ± 3.7 years) with obesity were randomized into a 6-month WL (n=47) or weight stability (WS: ±5% baseline weight; n=48) program. Baseline and 6-month HAI score (0-10) was calculated from component sum (each 0-2: systolic blood pressure, forced vital capacity [FVC], creatinine, fasting blood glucose [FBG], Montreal Cognitive Assessment), and gait speed, grip strength, Digit Symbol Substitution Test, FEV1, Interleukin-6, C-Reactive Protein, and Cystatin-C were assessed at baseline and 6 months.

#### RESULTS:

Mean baseline HAI was 3.2 ± 1.6. By 6 months, WL participants lost 8.87 (95% CI: -10.40, -7.34) kg, whereas WS participants remained weight stable. WL group reduced HAI score (WL: -0.75 [95% CI: -1.11, -0.39] vs WS: -0.22 [95% CI: -0.60, 0.15]; p=0.04), and components changing the most were FBG (WL: -3.89 [95% CI: -7.78, 0.00] mg/dL vs WS: 1.45 [95% CI: -2.61, 5.50] mg/dL; p=0.047) and FVC (WL: 0.11 [95% CI: -0.01, 0.23] L vs WS: -0.05 [95% CI: -0.17, 0.08] L; p=0.06). Among other biomarkers, only Cystatin-C significantly changed (WL: -2.53 [95% CI: -4.38, -0.68] ng/mL vs WS: 0.07 [95% CI: -1.85, 1.98] ng/mL; p=0.04). Combining treatment groups, 1 kg WL was associated with a 0.07 (95% CI: 0.03, 0.12) HAI reduction (p<0.01).

#### CONCLUSIONS:

Intentional WL via caloric restriction reduced HAI score by 0.53 points, largely attributable to metabolic and pulmonary improvements.

#### REFERENCE:

Shaver L.N., Beavers D.P., Kiel J., Kritchevsky S.B., Beavers K.M. (2018). Effect of Intentional Weight Loss on Mortality Biomarkers in Older Adults with Obesity. *J Gerontol A Biol Sci Med Sci.* 74(8):1303-1309. doi:10.1093/gerona/gly192.

## Normandin (2018)

# Feasibility of Weighted Vest use During a Dietary Weight Loss Intervention and Effects on Body Composition and Physical Function in Older Adults

E Normandin<sup>1</sup>, D Yow<sup>1</sup>, C Crotts<sup>1</sup>, J Kiel<sup>2</sup>, KM Beavers<sup>3</sup>, BJ Nicklas<sup>1,3</sup>

<sup>1</sup>Section on Gerontology and Geriatric Medicine, Wake Forest School of Medicine, Winston-Salem, NC 27157, USA; <sup>2</sup>Department of Scientific and Clinical Affairs, Medifast, Inc., Baltimore, MD 21202, USA; <sup>3</sup>Department of Health and Exercise Science, Wake Forest University, Winston-Salem, NC 27109, USA.

### PURPOSE/OBJECTIVE:

While intentional weight loss in older adults with obesity yields clinically important health benefits there is a need to minimize the negative effects of weight loss on concomitant loss of muscle mass and strength. Data show wearing weighted vests during exercise improves lean mass and lower extremity strength, however the efficacy of wearing a weighted vest during a period of weight loss to mitigate muscle and strength loss is not known.

This study examined the feasibility of daily weighted vest use during a dietary weight loss intervention, and examined effects of vest use on body composition and physical function in well-functioning older adults with obesity.

### METHODS/DESIGN:

**Design:** Randomized, controlled pilot study.

**Setting:** Wake Forest Baptist Medical Center in Winston-Salem, NC.

**Participants:** 37 older (age=65-79 years), obese (BMI=30-40 kg/m<sup>2</sup>) sedentary men and women.

**Interventions:** 22-week behavioral diet intervention (targeting 10% weight loss, 1100-1300 kcals/day) with (Diet+Vest; n=20) or without (Diet; n=17) weighted vest use (goal of 10 hours/day with weight added weekly according to individual loss of body mass).

**Measurements:** Body composition by dual-energy x-ray absorptiometry and measures of physical function, mobility, and muscle strength/power.

### RESULTS:

Average weighted vest use was 6.7 ± 2.2 hours/day and the vest-wear goal of 10 hrs/day was achieved for 67 ± 22% of total intervention days. Five participants reported adverse events from wearing the vest (all back pain or soreness). Both groups lost a similar amount of weight (Diet= -11.2 ± 4.4 kg; Diet+Vest= -11.0 ± 6.3 kg; p<0.001), with no differences between groups (p=0.25). Fat mass, lean mass, and % body fat decreased significantly (p<0.0001), with no differences between groups. Compared to Diet+Vest, the Diet intervention resulted in greater decreases in leg power (p<0.02), with no other between group differences in physical function.

### CONCLUSIONS:

This pilot study showed that vest use during dietary weight loss is feasible and safe in well-functioning older adults with obesity. Larger studies are needed to definitively determine whether external replacement of lost weight during caloric restriction may preserve lower extremity muscle strength and power.

### REFERENCE:

Normandin E., Yow D., Crotts C., Kiel J., Beavers K.M., Nicklas B.J.(2018) Feasibility of Weighted Vest Use During A Dietary Weight Loss Intervention and Effects on Body Composition and Physical Function in Older Adults. *J Frailty & Aging*; 7(3):198-203. doi: [10.14283/jfa.2018.17](https://doi.org/10.14283/jfa.2018.17); [PMC6489119](https://pubmed.ncbi.nlm.nih.gov/36489119/).

## Kelleher (2017)

### Weighted Vest Use During Dietary Weight Loss on Bone Health in Older Adults with Obesity

JL Kelleher<sup>1</sup>, DP Beavers<sup>2</sup>, RM Henderson<sup>3</sup>, D Yow<sup>3</sup>, C Crotts<sup>3</sup>, J Kiel<sup>4</sup>, BJ Nicklas<sup>1,3</sup>, KM Beavers<sup>1</sup>

<sup>1</sup>Department of Health and Exercise Science, Wake Forest University, Winston-Salem, NC 27109, USA; <sup>2</sup>Department of Biostatistics, Wake Forest University, Winston-Salem, NC 27157, USA; <sup>3</sup>Section on Gerontology and Geriatric Medicine, Wake Forest School of Medicine, Winston-Salem, NC 27157, USA; <sup>4</sup>Department of Scientific and Clinical Affairs, Medifast, Inc., Owings Mills, MD 21117, USA.

#### PURPOSE/OBJECTIVE:

To examine the effects of daily weighted vest use during a dietary weight loss intervention, on (a) hip and spine bone mineral density (aBMD), and (b) biomarkers of bone turnover, in older adults with obesity.

#### METHODS/DESIGN:

37 older ( $70.1 \pm 3.0$  years) adults with obesity ( $BMI=35.3 \pm 2.9$ ) underwent a 22 week dietary weight loss intervention (1100-1300 kcal/day) with (Diet+Vest; n=20) or without (Diet; n=17) weighted vest use (goal: 10+ h/day; weight added incrementally based on amount of weight lost). Total body weight; DXA-acquired aBMD of the total hip, femoral neck and lumbar spine; and biomarkers of bone turnover (OC, BALP, PINP, CTX) were measured at baseline and follow up. General linear models, adjusted for baseline values of the outcome and gender, were used to examine intervention effects.

#### RESULTS:

Average weight loss was significant in both groups ( $-11.2 \pm 4.4$  kg and  $-11.0 \pm 6.3$  kg, Diet+Vest and Diet groups, respectively), with no difference between groups ( $p=0.91$ ). Average weighted vest use was  $6.7 \pm 2.2$  h/day. No significant changes in aBMD or biomarkers were observed, although trends were noted for total hip aBMD and BALP. Loss in total hip aBMD was greater in the Diet group compared with Diet+Vest ( $\Delta$ :  $-18.7$  [ $29.3, -8.1$ ] mg/cm<sup>2</sup> versus  $-6.1$  [ $-15.7, 3.5$ ] mg/cm<sup>2</sup>;  $p=0.08$ ). BALP increased in the Diet+Vest group by 3.8% ( $\Delta$ :  $0.59$  [ $-0.33, 1.50$ ]  $\mu$ g/L) and decreased by -4.6% in the Diet group ( $\Delta$ :  $-0.70$  [ $-1.70, 0.31$ ]  $\mu$ g/L,  $p=0.07$ ).

#### CONCLUSIONS:

Weighted vest use during weight loss may attenuate loss of hip aBMD and increase bone formation in older adults with obesity. Further study is warranted.

#### REFERENCE:

Kelleher J.L., Beavers D.P., Henderson R.M., Yow D., Crotts C., Kiel J., Nicklas B.J., Beavers K.M. (2017) Weighted Vest Use During Dietary Weight Loss on Bone Health in Older Adults with Obesity. *J Osteopor Phys Act*, 5(4); doi: [10.4172/2329-9509.1000210](https://doi.org/10.4172/2329-9509.1000210).



## Beavers (2015)

# Effect of Protein Source During Weight Loss on Body Composition, Cardiometabolic Risk and Physical Performance in Abdominally Obese, Older Adults: A Pilot Feeding Study

KM Beavers<sup>1</sup>, MM Gordon<sup>1</sup>, L Easter<sup>2</sup>, DP Beavers<sup>3</sup>, KG Hairston<sup>4</sup>, BJ Nicklas<sup>1</sup>, MZ Vitolins<sup>5</sup>

<sup>1</sup>Department of Internal Medicine, Section on Gerontology and Geriatric Medicine; <sup>2</sup>Translational Science Institute; <sup>3</sup>Department of Biostatistical Sciences; <sup>4</sup>Department of Endocrinology and Metabolism; <sup>5</sup>Department of Epidemiology and Prevention, Wake Forest School of Medicine, Winston-Salem, NC 27157 USA.

### PURPOSE/OBJECTIVE:

The purpose of this pilot study was to begin to examine the effect of dietary protein source (soy protein versus non-soy protein) during weight loss on body composition, and cardiometabolic and functional decline risk factors in older, abdominally obese adults.

### METHODS/DESIGN:

**Design:** Two-arm, single-blind, randomized, controlled trial.

**Setting:** Wake Forest School of Medicine, Winston-Salem NC 27157, USA.

**Participants:** 25 older (68.4 ± 5.5 years, 88% female), abdominally obese (BMI: 35.1 ± 4.3 kg/m<sup>2</sup>; WC: 101.4 ± 13.1 cm) men and women were randomized to participate in the study.

**Intervention:** A 12-week weight loss intervention, with participants randomized to consume soy protein-based meal replacements (S; n=12) or non-soy protein-based meal replacements (NS; n=12), in addition to prepared meals, and all participants targeted to receive an individualized calorie deficit of 500 kcal/day.

**Measurements:** Body weight and composition (assessed via DXA and CT), conventional biomarkers of cardiometabolic risk, and physical performance measures were assessed pre- and post-intervention. Additional endpoints of feasibility (accrual, participation, retention, compliance, and safety) are reported.

### RESULTS:

A total of 24 participants (87% female) completed the study (96% retention) and lost an average of 7.8 ± 3.0 kg over the 12-week period, with no difference seen between groups (p=0.83). Although nearly all measures of global and regional body composition were significantly reduced following the 12-week intervention, differences were not observed between groups. Among cardiometabolic risk factors and physical performance measures, only diastolic blood pressure was significantly lower in the NS group compared to the S group (66.7 ± 2.7 mmHg vs 73.5 ± 2.7 mmHg, respectively; p=0.04). Interestingly, in groups combined, despite significant reductions in body weight and lean mass, no significant changes in the 400-meter walk time (+5.3 ± 43.4 s), short physical performance battery score (+0.1 ± 1.0), grip strength (-0.3 ± 3.2 kg), or relative knee extensor strength (-0.0 ± 0.0 N/m/cm<sup>3</sup> thigh muscle volume) were observed.

### CONCLUSIONS:

Data presented here suggest that a 12-week weight loss intervention, which incorporates S and NS meal replacement products, is associated with clinically significant weight loss and improvements in several parameters of cardiometabolic risk and unchanged physical function and strength. Results do not differ by protein source and suggest that soy protein is at least as good as other protein sources for weight loss during low-calorie dietary interventions in older adults.

### REFERENCE:

Beavers K.M., Gordon M.M., Easter L., Beavers D.P., Hairston K.G., Nicklas B.J., Vitolins M.Z. (2015) Effect of Protein Source during Weight Loss on Body Composition, Cardiometabolic Risk and Physical Performance in Abdominally Obese, Older Adults: A Pilot Feeding Study. *J Nutr Health Aging*, 19(1), 87-95. doi: [10.1007/s12603-015-0438-7](https://doi.org/10.1007/s12603-015-0438-7); [PMC4818969](https://pubmed.ncbi.nlm.nih.gov/26481896/)



# Teenagers

## Cheskin (2007)

### A RCT Comparing Balanced Energy Deficit Diets With or Without Meal Replacements for Weight Loss and Maintenance Among Children Dieting Alone or With a Parent

LJ Cheskin, AH Mitola, A Mitchell, A Jhaveri, V Mitchell

*International Health/Nutrition. Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland.*

#### PURPOSE/OBJECTIVE:

We compared the safety and efficacy of supplemental Medifast portion-controlled meal replacements (MRs) with a USDA Food Guide Pyramid-based diet.

#### METHODS/DESIGN:

Both weight loss diets were 20% energy restricted (~500 kcal deficit). Eighty 8-15 year old children, BMI >95th%ile, were screened and 40 randomized to either a MR diet (3 MRs/day during active weight loss and 2 MRs/day during maintenance) or to the food-based diet. Subjects were further randomized to dieting alone or with a parent.

#### RESULTS:

By ITT analysis, dieting with a parent, or food vs MR, made no difference in weight outcome. However, following initial weight loss (6 months) and 1 year maintenance (18 months), significant ( $p < 0.05$ ) decreases were seen in the MR group in BMI%ile (0 months =  $98.8 \pm 1.0$ , 6 months =  $96.6 \pm 3.2$ , 18 months =  $96.4 \pm 3.4$ ); body fat (5.9% at 6 months, 5.3% at 18 months); total cholesterol (6.7% [at 6 months], 5.6% [at 18 months]); LDL (19.8% [at 6 months], 7.9% [at 18 months]); and triglycerides (23.6% [at 6 months], 22.3% [at 18 months]). No significant between-group differences, differences in growth rates, or adverse events were observed.

#### CONCLUSIONS:

Among overweight 8-15 year old children, dieting with or without a parent, meal replacements were as safe and effective as a food-based diet for weight loss and maintenance.

#### REFERENCE:

*This abstract was accepted and presented as a poster at the Experimental Biology Conference in 2007.*

Cheskin L.J., Hanlon-Mitola A., Mitchell A., Jhaveri A., Yep M., Mitchell, V. (2007). A RCT Comparing Balanced Energy Deficit Diets with or Without Meal Replacements for Weight Loss and Maintenance Among Children Dieting Alone or with a Parent. *FASEB J*, 21, 1b214.



**Trp64Arg Gene Variant**

## Tchernof (2000)

### Impaired Capacity to Lose Visceral Adipose Tissue During Weight Reduction in Obese Postmenopausal Women with the Trp64Arg $\beta_3$ -Adrenoceptor Gene Variant

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<sup>1</sup>Department of Medicine, College of Medicine, University of Vermont, Burlington, Vermont; <sup>2</sup>Department of Medicine, the Division of Endocrinology, Diabetes and Nutrition, University of Maryland; <sup>3</sup>Geriatric Research Education and Clinical Center, Baltimore Veterans Administration Medical Center; <sup>4</sup>Division of Geriatric Medicine and Gerontology, Johns Hopkins University, Baltimore, Maryland.

#### PURPOSE/OBJECTIVE:

Controversy exists regarding the association between the Trp64Arg variant of the  $\beta_3$ -adrenoceptor gene and visceral obesity. The cross-sectional nature of most studies, the modest effect of the variant, and the sex or ethnic differences between groups have contributed to discrepancies among investigations. To overcome these confounding factors, we examined the effect of the Trp64Arg variant on total and visceral adipose tissue loss, insulin sensitivity, and cardiovascular disease risk factors in response to weight reduction in obese older women.

#### METHODS/DESIGN:

A total of 24 women (age  $57 \pm 4$  years), including 1 Trp64Arg homozygote, 10 Trp64Arg heterozygotes, and 13 normal homozygotes, were admitted to a weight reduction program of  $13 \pm 3$  months, with weight and nutritional intake stabilization established before testing. Total and regional adiposity were measured with dual-energy x-ray absorptiometry and computed tomography, insulin sensitivity was measured by the hyperinsulinemic-euglycemic clamp technique, and a blood lipid profile was obtained.

#### RESULTS:

No baseline differences were noted in adiposity measurements, glucose disposal, and lipid profiles among carriers and noncarriers of the variant allele. In response to weight loss, carriers and noncarriers of the Trp64Arg allele had similar reductions in body weight ( $-16.4 \pm 5.0$  vs.  $-14.1 \pm 6.2$  kg, NS) and body fat ( $-10.0 \pm 5.2$  vs.  $-11.5 \pm 3.9$  kg, NS). However, loss of visceral adipose tissue was 43% lower in carriers of the Trp64Arg allele compared with noncarriers ( $-46 \pm 27$  vs.  $-81 \pm 51$  cm<sup>2</sup>,  $p=0.05$ ). Furthermore, there was less improvement in the total cholesterol-to-HDL cholesterol ratio ( $-0.18 \pm 0.54$  vs.  $-0.72 \pm 0.56$ ,  $p=0.04$ ) in carriers compared with noncarriers of the allele. Although glucose disposal improved in both groups, there was no difference in the magnitude of improvement between carriers and noncarriers of the variant allele.

#### CONCLUSIONS:

In conclusion, older obese women carrying the Trp64Arg  $\beta_3$ -adrenoceptor gene variant have an impaired capacity to lose visceral adipose tissue in response to prolonged caloric restriction. Despite these genetic differences in loss of intra-abdominal adipose tissue, improvement in glucose disposal was similar between groups.

#### REFERENCE:

Tchernof A., Starling R.D., Turner A., Shuldiner A.R., Walston J.D., Silver K., Poehlman E.T. (2000). Impaired Capacity to Lose Visceral Adipose Tissue During Weight Reduction in Obese Postmenopausal Women with the Trp64Arg  $\beta_3$ -Adrenoceptor Gene Variant. *Diabetes*, 49(10), 1709-1713. doi:10.2337/diabetes.49.10.1709

# Obesity Pharmacotherapy



## Moldovan (2016)

### Effects of a Meal Replacement System Alone or in Combination with Phentermine on Weight Loss and Food Cravings

CP Moldovan<sup>1\*</sup>, AJ Weldon<sup>2\*</sup>, NS Daher<sup>3</sup>, LE Schneider<sup>4</sup>, DL Bellinger<sup>5</sup>, LS Berk<sup>3,6</sup>, AC Herme<sup>1</sup>, AL Archeiga<sup>1</sup>, WL Davis<sup>2</sup>, WR Peters<sup>7</sup>

<sup>1</sup>Department of Psychology, School of Behavioral Health, <sup>2</sup>Department of Pharmaceutical and Administrative Sciences, School of Pharmacy,

<sup>3</sup>Department of Allied Health Studies, School of Allied Health Professions, <sup>4</sup>Department of Nutrition and Dietetics, School of Allied Health Professions, <sup>5</sup>Department of Pathology and Human Anatomy, <sup>6</sup>Department of Physical Therapy, School of Allied Health Professions,

<sup>7</sup>Department of Preventative Medicine, School of Medicine, Loma Linda University, Loma Linda, CA, USA \*CPM and AJW contributed equally to this article.

#### PURPOSE/OBJECTIVE:

To examine the effects of phentermine combined with a meal replacement program on weight loss and food cravings and to investigate the relationship between food cravings and weight loss.

#### METHODS/DESIGN:

In a 12-week randomized, double-blind, placebo-controlled clinical trial, 77 adults with obesity received either phentermine or placebo. All participants were provided with Medifast meal replacements, were instructed to follow the Take Shape for Life Optimal Weight 5 & 1 Plan for weight loss, and received lifestyle coaching in the *Habits of Health* program. The Food Craving Inventory and the General Food Cravings State and Trait Questionnaires were used to measure food cravings.

#### RESULTS:

The phentermine group lost 12.1% of baseline body weight compared to 8.8% in the placebo group. Cravings for all food groups decreased in both groups; however, there was a greater reduction in cravings for fats and sweets in the phentermine group compared with the placebo group. Percent weight loss correlated significantly with reduced total food cravings ( $r=0.332$ ,  $p=0.009$ ), cravings for sweets ( $r=0.412$ ,  $p<0.000$ ), and state food cravings ( $r=0.320$ ,  $p=0.007$ ).

#### CONCLUSIONS:

Both phentermine combined with a meal replacement program and meal replacements alone significantly reduced body weight and food cravings; however, the addition of phentermine enhanced these effects.

#### REFERENCE:

Moldovan C.P., Weldon A.J., Daher N.S., Schneider L.E., Bellinger D.L., Berk L.S., Herme A.C., Archeiga A.L., Davis W.L., Peters W.R. (2016). Effects of a Meal Replacement System Alone or in Combination with Phentermine on Weight Loss and Food Cravings. *Obesity*. 2016;24(11):2344-2350. doi: 10.1002/oby.21649.

## Haddock (2008)

### Effectiveness of Medifast Supplements Combined with Obesity Pharmacotherapy: A Clinical Program Evaluation

CK Haddock<sup>1</sup>, WSC Poston<sup>1</sup>, JP Foreyt<sup>2</sup>, JJ DiBartolomeo<sup>3</sup>, PO Warner<sup>4</sup>

<sup>1</sup>University of Missouri, Kansas City School of Medicine; <sup>2</sup>Baylor College of Medicine; <sup>3</sup>Medifast, Inc.; <sup>4</sup>New Dimensions Medical Group.

#### PURPOSE/OBJECTIVE:

To evaluate the long-term impact of Medifast meal-replacement supplements (MMRS) combined with appetite suppressant medication (ASM) among participants who received 52 weeks of treatment.

#### METHODS/DESIGN:

We conducted a systematic program evaluation of weight loss data from a medically-supervised weight control program combining the use of MMRS and ASM. Data were obtained and analyzed from 1,351 patient (BMI $\geq$ 25) medical charts who had participated for at least 12 weeks of treatment. Outcomes included weight loss (kg) and percent weight loss from baseline at 12, 24, and 52 weeks. Both completers and intention-to-treat (ITT) analyses were conducted. Completers' (i.e., those with complete data for 52 weeks) outcomes were evaluated after stratification for reported adherence to the MMRS and ASM.

#### RESULTS:

Participants who completed 52 weeks of treatment experienced substantial weight losses at 12 (-9.4  $\pm$  5.7 kg), 24 (-12.0  $\pm$  8.1 kg), and 52 weeks (-12.4  $\pm$  9.2 kg), and all measures were significantly different from baseline weight ( $p$ <0.001 for all contrasts) for both true completers ( $n$ =324) and for ITT analysis ( $n$ =1,351). Fifty percent of patients remained in the program at 24 weeks and nearly 25% were still participating at one year.

#### CONCLUSIONS:

This weight loss program using a combination of MMRS and ASM produced significant and sustained weight losses at 52 weeks. Results were better than those typically reported for obesity pharmacotherapy in both short- and long-term studies and also better than those reported for partial meal replacement programs. Program retention at one year was similar to that reported in many controlled drug trials and better than most commercial programs reported in the literature.

#### REFERENCE:

Haddock C.K., Poston W.S.C., Foreyt J.P., DiBartolomeo J.J., Warner P.O. (2008) Effectiveness of Medifast Supplements Combined with Obesity Pharmacotherapy: A Clinical Program Evaluation. *Eat Weight Disord*, 13(2), 95-101. doi:10.1007/BF03327609





# Non-Pharmaceutical Appetite Suppressants

## Matalon (2000)

### An Evaluation of Weight Loss Following a Carbohydrate and Fat Restricted Diet with Appetite Suppressant and Dietary Supplementation

V Matalon<sup>1</sup>

<sup>1</sup>TLC Healthcare, Inc., Marlton, N.J. USA.

#### PURPOSE/OBJECTIVE:

This was an open label trial designed to assess the safety and effectiveness of a weight loss regimen consisting of a carbohydrate and fat restricted diet, supplemented with an appetite suppressant, a dietary supplement, and a liquid protein drink.

#### METHODS/DESIGN:

Forty-seven adult patients were prescribed a carbohydrate and fat restricted diet supplemented with a natural appetite suppressant, a dietary supplement and a liquid protein drink [Medifast]. In addition, patients at risk for gallbladder disease were given ursodiol (Actigall®) 300 mg BID. At baseline, evaluations included a history and physical, and measurements of total body weight (lbs), body fat (%), BMI, lean body mass, water weight and blood pressure. Patients were then seen weekly for 6 months. At each weekly visit, total weight, % body fat, BMI, lean body mass, water weight and BP were noted.

#### RESULTS:

At the end of the study, statistically significant differences from baseline to final value were noted for body weight ( $p < 0.001$ ), percent body fat ( $p < 0.001$ ), BMI ( $p < 0.001$ ), lean body mass ( $p = 0.001$ ), water weight ( $p = 0.01$ ), and both systolic ( $p = 0.003$ ) and diastolic ( $p < 0.001$ ) blood pressure.

#### CONCLUSIONS:

This dietary regimen showed that a carbohydrate and fat restricted program supplemented by a natural appetite suppressant can lead to progressive weight loss of comparable value to currently prescribed pharmacological agents [at the time of the study]. Patients in this study experienced statistically significant decreases in overall body weight, percent body fat, BMI, lean body mass, total body water and both systolic and diastolic blood pressure.

#### REFERENCE:

Matalon, V. (2000). An Evaluation of Weight Loss Following a Carbohydrate and Fat Restricted Diet with Appetite Suppressant and Dietary Supplementation. *The Bariatrician*, 10-13.

# Medifast Products



## Miller (2021)

### Current Practices and Desired Features Associated with Recipes on a Commercial Weight Management Program

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#### PURPOSE/OBJECTIVE:

An online survey of real-world **OPTAVIA** Coaches and Clients was conducted to understand the use and desired features of **OPTAVIA** recipes as part of the **OPTAVIA** program, a holistic commercial weight management program that includes support from a Coach. The survey targeted recipe use, improvements, and optimization for Client acquisition and retention.

#### METHODS/DESIGN:

A randomized sample of 15,000 Clients and 7,000 Coaches with purchase activity in the past 6 months, plus 7 Coach Leaders, were sent an electronic survey invitation. 1296 respondents (631 Coaches; 665 Clients) were included in the analysis. All data was self-reported. Categorical variables were quantified using frequencies and percentages.

#### RESULTS:

86% of respondents reported using recipes. 66% prepared their meals the day of compared to preparing some (31%) or all (3%) in advance. Most desired recipe features include: <30 minutes of preparation (75%), simple (60%) easy-to-find ingredients (60%) and use a slow cooker/crockpot (46%). Vegan (12%) and vegetarian options/modifications (15%) and sweeter (17%) recipes ranked lowest. Greatest desired improvements include: clear portion sizes (52%), less preparation (43%), grocery list provision (42%) and reducing cook time (38%). Least desired include: detailed nutritionals (16%) and recipe ratings (17%). 83% of Coaches use recipes for Client engagement; 75% for acquisition. The greatest recipe-use barriers: too much preparation (20%) and family's dislikes (20%).

#### CONCLUSIONS:

Developing simple to prepare recipes with clear portion sizes and easy-to-find ingredients that can be used for later meals may optimize recipe use and enhance Coaches' ability to leverage recipe-sharing for both Client engagement and acquisition.

#### REFERENCE:

*This abstract was accepted and presented as a poster at the Academy of Nutrition and Dietetics' Food and Nutrition Conference and Exposition (Virtual) Conference in 2021.*

Miller A., Christman J., LaCalamita C. (2021). Current Practices and Desired Features Associated with Recipes on a Commercial Weight Management Program. *J Acad Nutr Diet*, 121(10) PA138. DOI: <https://doi.org/10.1016/j.jand.2021.08.054>

## Davis (2008)

### The Effect of Metabolism-Boosting Beverages on 24-hr Energy Expenditure

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#### PURPOSE/OBJECTIVE:

The effect of thermogenic meal replacement beverages (TMRB) containing 90 mg [epigallocatechin gallate] EGCG and 100 mg of caffeine on resting energy expenditure (REE) was tested.

#### METHODS/DESIGN:

Thirty adults (19 women, 11 men) were stratified into 3 groups: lean (n=10, BMI 21.5 ± 2.1 [kg/m<sup>2</sup>]); overweight/obese (OW) (n=10, BMI 29.8 ± 2.7); or weight maintainers (WM) (n=10, BMI 28.8 ± 4.0). Following an overnight fast, baseline measurements, including REE via indirect calorimetry, were performed. REE was repeated at 30, 60, 90, and 120 minutes after consuming a TMRB. Appetite was assessed via visual analogue scale at baseline, 30 minutes, and 120 minutes after the TMRB.

#### RESULTS:

Mean 24-hour REE was increased 5.9 ± 2.5% overall (p=0.000), 5.7 ± 3.1% among lean subjects (p=0.0002), 5.3 ± 1.4% among OW subjects (p=0.000), and 6.8 ± 2.7% among WM subjects (p=0.0007). Appetite was significantly reduced 30 minutes after the TMRB (p=0.0002).

#### CONCLUSIONS:

TMRB appear to be a promising weight control tool.

#### REFERENCE:

Davis L.M., Coleman C., Andersen W.S., Cheskin L.J. (2008) The Effect of Metabolism-Boosting Beverages on 24-hr Energy Expenditure. *The Open Nutrition Journal*, 2(37-41). [doi:10.2174/1874288200802010037](https://doi.org/10.2174/1874288200802010037)

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