



# Clinical Studies Overview



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## A Foundation for Better Health

Obesity, now considered one of our nation's leading health issues, has become a highly publicized concern as almost 69% of adults in the United States are overweight or obese and 35% are obese [1]. Being overweight or obese increases the risk of developing many related, often serious conditions, such as heart disease, diabetes, sleep apnea, and even some forms of cancer [2, 3]. For those concerned about the impact of excess body weight on overall health, studies show that weight loss can help to reduce the risk of developing these associated health conditions [2, 4-7]. While there are many options available for managing weight, not all of these are healthy or safe, and their effectiveness may be limited.

The long-standing scientific foundation and clinical heritage of Medifast is what makes us so unique. Originally developed by a physician, Medifast has evolved over the years to now offer a comprehensive approach to weight management that is supported by multiple clinical studies. The Medifast Program features a combination of Medifast meal replacements, conventional food choices, convenient and easy-to-understand meal plans, and customizable levels of support for weight loss and weight maintenance—all backed by our team of registered dietitians, behavioral experts, and food scientists.

Medifast's inclusive approach to weight management aligns well with recent guidelines issued by the American Heart Association, the American College of Cardiology and The Obesity Society. These guidelines recommend participation in a comprehensive lifestyle program, which includes a reduced calorie diet along with exercise and behavioral counseling, as the cornerstone of all treatment options for



overweight and obese individuals, with the goal of achieving clinically meaningful weight loss of at least 5-10% within a 6-month period [2]. These guidelines also support the use of commercial weight loss programs that provide a comprehensive lifestyle intervention as an option for weight loss when they are backed by evidence of their safety and efficacy.

Research also supports the use of meal replacements as a safe and effective tool for limiting calorie intake and promoting weight loss and weight maintenance among individuals who are overweight or obese [8, 9]. Similarly, the Medifast meal replacements serve as a convenient, individually-portioned, calorie-controlled source of nutrition. An excellent source of 24 vitamins and minerals, each Medifast Meal\* is specially-formulated to provide a balance of high-quality protein and good carbohydrates, including fiber, to help keep energy up and hunger at bay between meals. These tasty offerings are at the heart of Medifast's clinically proven program, helping individuals manage their weight quickly, safely, and simply.

We hope you choose Medifast, the brand recommended by over 20,000 doctors since 1980, as a key component of your health-related goals, both for successful weight management and as a part of an overall healthy lifestyle.

We invite you to read this Medifast Clinical Studies Overview, a compilation of abstracts from peer-reviewed research of randomized, controlled trials, prospective studies and retrospective reviews that support the use of Medifast products and programs in a wide variety of populations.

\*Medifast Meals for use during the weight loss phase; does not include other products or items.

## The Medifast® Scientific Advisory Board

Composed of leaders in their respective fields, the function of the Medifast Scientific Advisory Board is to provide the guiding vision for Medifast to create scientifically-valid, consumer-centric, high-quality innovations for lasting health. This team of international experts consists of physicians, dietitians, scientists, and behavioral and nutrition policy experts who help guide Medifast in making informed, evidence-based decisions regarding medical, nutritional, and scientific matters involving the company's products and programs.

The work of this cross-disciplinary group builds on Medifast's medical heritage of sound approaches to weight management and the incorporation of leading-edge clinical research into the company's products and programs.

Medifast first formed their Scientific Advisory Board in 2008. As of August 2015, the Medifast Scientific Advisory Board is comprised of the following experts:



**Lawrence Cheskin, MD**  
**Medifast Scientific Advisory Board Chairman**  
 Associate Professor of Health, Behavior and Society, Johns Hopkins Bloomberg School of Public Health, and Director, Johns Hopkins Weight Management Center

**Simon Barquera, MD, PhD**  
 President of the Nutrition Board of Professors at the Mexican School of Public Health and Director of Research on Nutrition Policies and Programs, National Institute of Public Health

**Susan Barr, PhD, RD**  
 Professor, Food Nutrition and Health, University of British Columbia

**George Bray, MD (not pictured)**  
 Boyd Professor Emeritus and Professor of Medicine Emeritus at the Pennington Biomedical Research Center, Louisiana State University

**John Foreyt, PhD**  
 Professor, Department of Psychiatry and Behavioral Sciences, Department of Medicine, Baylor College of Medicine

**Steven Heymsfield, MD**  
 Professor and Chair, Pennington Biomedical Research Center, Louisiana State University

**Mark Messina, PhD (not pictured)**  
 President, Nutrition Matters and Adjunct Associate Professor, Department of Nutrition, School of Public Health, Loma Linda University

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

## The Medifast 5 & 1 Plan®

*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 a Medifast Weight Control Center (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: 10.4236/fns.2012.310187.

# The Medifast 5 & 1 Plan®

*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:

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.S., 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.



# The Medifast 5 & 1 Plan®

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: 10.1038/ijo.2013.43.



# The Medifast 4 & 2 & 1 Plan™

## 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 study

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 & 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.

## The Medifast 5 & 2 & 2 Plan™

*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>

<sup>1</sup>Department of Scientific & Clinical Affairs, Medifast, Inc., 11445 Cronhill Drive, Owings Mills, MD, USA and <sup>2</sup>Independent Consultant, Clifton Park, NY, USA.

#### 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: 10.4172/2165-7904.S5-007.

# Diabetes

(Cheskin, 2008)

## Efficacy of meal replacements versus a standard food-based diet for weight loss in type 2 diabetes: a controlled clinical trial

LJ Cheskin, AM Mitchell, AD Jhaveri, AH Mitola, LM Davis, RA Lewis, MA Yep, TW Lycan

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., 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.



# Polycystic Ovarian Syndrome

(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 ( $-79.1 \pm 76.6$   $\mu$ U/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

### (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>, DK 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, North Carolina, 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:

Two-arm, single-blind, randomized, controlled trial at Wake Forest School of Medicine, Winston-Salem NC, USA. 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. 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. 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.

## 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) to 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. *The Journal of the Federation of American Societies for Experimental Biology*, 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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#### Purpose / Objective:

We examined the effect of the Trp64Arg [gene] variant on total and visceral adipose tissue loss, insulin sensitivity, and cardiovascular disease risk factors in response to weight reduction among 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:

Older obese women carrying the Trp64Arg  $\beta$ 3-adrenoceptor gene variant have an impaired capacity to lose visceral adipose tissue in response to prolonged calorie 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 beta3-adrenoceptor gene variant. *Diabetes*, 49(10), 1709-1713.

# Medifast® and Obesity Pharmacotherapy

*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., 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.

# Medifast® and Obesity Pharmacotherapy

*Peters (2013)*

Effects of Medifast® 5 & 1 meal replacement plan with Take Shape for Life® lifestyle intervention alone or in combination with Phentermine on food craving and weight loss—a randomized cross-over study

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**Purpose / Objective:**

Food craving is associated with obesity. Appetite and perceived hunger are complex multi-factorial variables impacted by internal and external signaling factors. Meal-replacements, lifestyle modification and phentermine are used as therapeutic modalities. This study was designed to clarify the separate and combined effects of these interventions on food craving and weight loss.

**Methods / Design:**

Subjects were randomized into a cross-over trial comparing Medifast® 5 & 1 Meal Replacement Plan (MR) with Take Shape For Life® (TSFL), a lifestyle intervention program, alone and in combination with phentermine 37.5mg/day. Seventy-eight subjects ages 35-60 with a BMI of 35-50 were randomized to Group Aa (MR/TSFL+phentermine) or Group Bp (MR/TSFL+placebo). At week 14, subjects crossed-over to the alternate intervention following a one-week washout. Subjects received weekly telephone calls from a health coach. Subjects read Dr. Wayne Andersen’s book, “Habits of Health” and filled out a weekly lifestyle change workbook. Weight was measured at baseline, 12- and 25-weeks. The Food Craving Index (FCI) was assessed at baseline, 6-, 12-, 19- and 25-weeks. Sixty subjects completed the study.



## Medifast® and Obesity Pharmacotherapy

*Peters (2013) continued*



### Results:

*Phase 1 (0-12 weeks):* Both groups had a significant reduction in FCI from baseline ( $p < 0.05$ ). FCI reduction was significantly greater in Group Aa (MR/TSFL+phentermine) ( $M=45.0$ ,  $SD=16.3$ ) compared to Group Bp (MR/TSFL+placebo) ( $M=54.9$ ,  $SD=16.6$ );  $p < 0.05$ ). Percent weight loss was significant in Group Aa ( $M=11.97$ ,  $SD=4.57$ ) and Group Bp ( $M=9.2$ ,  $SD=5.2$ ) but was significantly greater in Group Aa compared to Group Bp ( $p < 0.05$ ). *Phase 2 (13-25 weeks):* FCI significantly declined in Group Ba (MR/TSFL+phentermine) ( $M=46.2$ ,  $SD=13.1$ ) and increased in Group Ap (MR/TSFL+placebo) ( $M=47.1$ ,  $SD=14.2$ ) with no significant difference between groups. Percent weight loss was greater in Group Ba ( $M=7.1$ ,  $SD=5.8$ ) than Group Ap ( $M=3.2$ ,  $SD=5.9$ ) at endpoint ( $p < 0.05$ ). The overall percent weight loss was not significantly greater for Group A ( $M=15.0$ ,  $SD=8.1$ ) or Group B ( $M=16.7$ ,  $SD=8.2$ ) at endpoint compared to baseline.

### Conclusions:

MR and TSFL produced significant FCI reduction in phase-1 and percent weight loss in phase-1 and phase-2. Phentermine added a significant benefit in FCI reduction and increased percent weight loss in phase-1 and phase-2. These therapeutic modalities used continuously or intermittently can help provide long-term therapeutic accommodation to obese individuals with physiologic conditions. The introduction of phentermine after significant weight loss may further stimulate weight loss. Further investigation of these findings will be performed to determine optimal efficacy of treatment.

### Reference:

*This abstract was accepted and presented as a poster at the American Society of Bariatric Surgeons' conference in 2013.*

Peters, W., Herme, A., Eller, M., Schneider, L., Berk, L., Davis, W. Effects of Medifast 5 & 1 meal replacement plan with Take Shape for Life lifestyle intervention alone or in combination with Phentermine on food craving and weight loss—a randomized cross-over study. American Society of Bariatric Surgeons, 2013.

# Medifast® and (Non-Pharmaceutical) Appetite Suppression Supplements

## *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

*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).



## References

1. Fryar, C.D., M.D. Carroll, and C.L. Ogden, Prevalence of overweight, obesity, and extreme obesity among adults: United States, 1960–1962 through 2011–2012, N.C.f.H.S. (U.S.), Editor. 2014: Washington, D.C.
2. Jensen, M.D., et al., 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults: a report of the American College of Cardiology/ American Heart Association Task Force on practice guidelines and the Obesity Society. *Circulation*, 2013. **128**: p. 1-69.
3. National Heart, L., and Blood Institute,. What are the health risks of overweight and obesity? 2012 [cited 2015 May 28th]; Available from: <http://www.nhlbi.nih.gov/health/health-topics/topics/obe/risks>.
4. National Heart Lung and Blood Institute and National Institute of Diabetes and Digestive and Kidney Diseases (U.S.), Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report. NIH publication.1998, Bethesda, MD: National Institutes of Health, National Heart, Lung, and Blood Institute. xxx, 228 p.
5. Wing, R.R., et al., Benefits of modest weight loss in improving cardiovascular risk factors in overweight and obese individuals with type 2 diabetes. *Diabetes Care*, 2011. **34**(7): p. 1481-6.
6. Lau, D.C. and H. Teoh, Benefits of modest weight loss on the management of type 2 diabetes mellitus. *Can J Diabetes*, 2013. **37**(2): p. 128-34.
7. Anandam, A., et al., Effects of dietary weight loss on obstructive sleep apnea: a meta-analysis. *Sleep Breath*, 2013. **17**(1): p. 227-34.
8. Heymsfield, S.B., et al., Weight management using a meal replacement strategy: meta and pooling analysis from six studies. *Int J Obes Relat Metab Disord*, 2003. **27**(5): p. 537-49.
9. American Dietetic Association, Position of the American Dietetic Association: weight management. *Journal of the American Dietetic Association*, 2009. **109**(2): p. 330-346.



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