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# EFFECTS OF A RESISTANCE TRAINING AND DIETARY INTERVENTION ON BODY COMPOSITION IN OVERWEIGHT AND OBESE COMMUNITY DWELLING OLDER ADULTS

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**EFFECTS OF A RESISTANCE TRAINING AND**

**DIETARY INTERVENTION ON BODY**

**COMPOSITION IN OVERWEIGHT AND OBESE**

**COMMUNITY DWELLING OLDER ADULTS**


**BY**

**LEAH DORFMAN**


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# ABSTRACT

**Background:** Community-based interventions that incorporate resistance training and dietary changes have not been extensively studied in overweight and obese older adults. The purpose of this investigation was to determine the effects of a combined community-based resistance training and dietary intervention on body composition in overweight and obese older adults.

**Methods:** Ninety-five overweight and obese (BMI = 33.4 ± 4.0 kg/$m^2$) older adults aged (69.2 ± 6.2) years completed an eight-week resistance training and dietary intervention at four Rhode Island senior centers. Participants performed resistance training twice per week using resistance tubing, dumbbells, and ankle weights. Participants also attended one weekly dietary counseling session on a modified Dietary Approaches to Stop Hypertension diet. Outcome measurements included anthropometrics and body composition.

**Results:** There were small but statistically significant changes in body mass (-1.0 ± 1.8 kg, $p<0.001$), waist circumference (-5.2 ± 3.8 cm, $p<0.001$), hip circumference (-5.3 ± 4.1 cm, $p<0.001$), fat mass (-0.8 ± 1.6 kg, $p<0.001$), and percent body fat (-0.5 ± 1.4 %, $p<0.001$). Additionally, no significant change was seen in fat-free mass.

**Conclusion:** Community-based resistance training and dietary interventions can improve body composition in overweight and obese older adults. Future investigations should determine if this intervention is effective for sustaining long-term changes in older adults.

## ACKNOWLEDGMENTS

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## PREFACE

This thesis was written to comply with the University of Rhode Island graduate school Manuscript Thesis Format. This thesis contains one manuscript: *Effects of a Resistance Training and Dietary Intervention on Body Composition in Overweight and Obese Community Dwelling Older Adults.* This manuscript has been written in a form suitable for publication in the *Journal of Physical Activity and Health.*

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## Effects of a Resistance Training and Dietary Intervention on Body Composition in Overweight and Obese Community Dwelling Older Adults

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**Conclusion:** Community-based resistance training and dietary interventions can improve body composition in overweight and obese older adults. Future investigations should determine if this intervention is effective for sustaining long-term changes in older adults.

# INTRODUCTION

From 1991 to 2000, the prevalence of obesity increased in the 60-69 and over 70 year old age groups by 56% and 36% respectively (1). This increase in fat mass (FM) is attributed to factors such as a decline in physical activity, reduced basal metabolic rate, and an increase in energy intake (2, 3). Weight loss is recommended for obese adults who are at risk of obesity-related illness and disability (4). Sarcopenia, the age-related reduction in skeletal muscle mass, is typically accompanied by declines in physical function and subsequent disability (5). Additional adverse consequences of sarcopenia include difficulty with ambulation, a reduction in muscular strength, and an associated increase in adiposity (6, 7). Moreover, the deleterious effects of sarcopenia are exacerbated with obesity (8). Previous investigations have reported a significant and independent association between fat mass and physical disability in postmenopausal women (9) and older men (10). While dietary modifications alone may elicit reductions in total body mass and fat mass, weight loss interventions for older adults are typically accompanied by involuntary decrements in muscle mass (11), which is likely detrimental to strength and function.

Resistance training (RT) has been suggested as a safe and efficacious strategy for attenuating loss of fat-free mass (FFM) during weight loss, which may be instrumental in the prevention of sarcopenia-related functional limitations (12). However, these studies have typically used resistance exercise machines and relatively high training intensities (i.e. > 70% of one-repetition maximum). Furthermore, there is a paucity of research investigating the additive effects of RT and dietary changes in overweight and obese older adults.  Recently, Fitzpatrick and colleagues (13) reported that a community-based physical activity program (i.e., chair-based exercises and walking promotion) that also promoted increased consumption of fruits and vegetables resulted in significant improvements in functional performance in older men and women.  While that study provided dietary education focused on the benefits of increasing fruit and vegetable intake, dietary restriction was not implemented. Additionally, a four-week exercise program utilizing hand weights and elastic bands resulted in significantly improved physical function in a cohort of older African-American women (14).  Although these interventions improved functional abilities, the above investigations did not incorporate dietary modifications for the purpose of eliciting weight loss and only one of the studies (13) involved overweight and obese older adults.  Thus, there is a need to establish the effectiveness of community-based interventions that integrate RT and dietary education on body composition in overweight older adults.

The purpose of this investigation was to assess the effects of light RT on body composition in overweight and obese, community-dwelling older adults who received a concomitant dietary intervention for intentional weight loss at four Rhode Island senior centers (two urban and two rural).  We hypothesized that an eight-week intervention integrating light RT and behavioral-based dietary education would facilitate significant improvements in body composition in overweight and obese older adults.  Additionally, locations were chosen based on research suggesting that education level is a predictor of socioeconomic status which is in turn an important predictor of physical activity behavior (15).  Therefore an exploratory analysis was conducted to compare the rural and urban senior centers.

## METHODS

*Study Design:* The study design was a quasi-experimental, community-based outreach intervention with baseline and post-intervention measurements. The intervention was eight weeks and comprised of two, one-hour sessions per week at two urban and two rural senior centers. Each participant provided written informed consent prior to participation and the study was approved by the Institutional Review Board (IRB) of the University of Rhode Island.

*Participants:* Overweight and obese, community-residing older adults aged 55-80 years (n=109) who, by self-report, were not engaged in a regular exercise program were recruited for this study. Participants were recruited via newspaper advertisements as well as flyers, brochures, and word-of-mouth at the participating senior centers. Prior to participating in this study, all participants underwent phone screening interviews, completed comprehensive medical history questionnaires. In addition, it was recommended that each participant's primary care physician also provide medical clearance. Eligibility criteria included a body mass index (BMI) between 25.0-39.9 kg/$m^2$, medication-stable (within the last three weeks; > 6 months for lipid-lowering medications), and weight-stable (within 5%) during the last three months. Exclusion criteria included significant cardiovascular, metabolic, musculoskeletal, or psychological disorders that may have adversely affected the individual's ability to engage in regular exercise. Fourteen participants did not complete the study for various reasons (six lost to follow-up, five due to unrelated personal or family health issues, two due to time commitment, and one due to study-related adverse event of a strained muscle), which yielded an analytic sample of 95 participants.  No significant differences in age or BMI existed between those participants who did not complete the study and the analytic sample.

*Anthropometrics:* Body mass was measured to the nearest 0.1 kg and height was measured to the nearest 0.5 cm using a standard balance beam scale (Detecto, model 439, Webb City, MO).  Body mass index was calculated via weight (kg) divided by height (m) squared.  Waist circumference (WC) was measured at the iliac crest using a standard 60" Gulick tape measure (Richardson, Frankfort, IL) with attached tensometer with measurements rounded to the nearest 0.25 cm and hip circumference was measured at the broadest circumference of the hips above the gluteal fold to the nearest 0.25 cm.

*Body Composition:* Percent body fat, FM, and FFM were measured using a battery-powered handheld bioelectrical impedance device (Omron, model HBF-306C, Bannockburn, IL) in the morning following a 12-hour fast.  This device was chosen because it is portable, safe, and is both a valid and reliable measure of body composition (16).  In order to minimize the risk of an adverse event, individuals with pacemakers were not tested because the device produces a small electrical current during the measurement which may have interfere with the proper functioning of the pacemaker.  Fat mass was calculated as percent body fat multiplied by total body weight (kg) divided by 100.  Fat free mass was calculated as total weight (kg) minus FM (kg).

*Questionnaires:* The Dietary Screening Tool (DST) was used to assess dietary intake. The DST is a validated, 24-item questionnaire developed to assess dietary intake and identify nutritional risk among older adults in a community setting.  The

DST measures overall dietary intake, assesses where a diet may be lacking or in excess of a specific macro- or micro-nutrient, and categorizes individuals into a degree of nutritional risk. Based on the DST score (range 0-100 points), subjects are categorized into one of three nutrition risk levels; <60, 60-75, and >75 place subjects in either at-risk, possible-risk, or not-at-risk, respectively. A majority of the DST questions relate to aspects of the DASH diet as questions inquire about the consumption of fruits, vegetables, dairy products, whole grains, meats and protein, fats, and sweets (23). Additionally, the Yale Physical Activity Survey (YPAS) was administered in order to estimate habitual physical activity energy expenditure.

*Dietary Intervention:* All participants attended one 30-minute behavioral-based dietary session during each week of the intervention. A modified Dietary Approaches to Stop Hypertension (DASH) diet was implemented immediately following baseline testing and participants were instructed to adhere to these recommendations for the duration of the intervention. The DASH diet encourages reduced consumption of saturated fat, increased consumption of fruits and vegetables, reduced consumption of dietary sodium, and the accumulation of ~ 180 minutes of moderate-intensity physical activity each week (17). The DASH diet was modified for this investigation by placing an increased emphasis on consumption of unsaturated fatty acids and limiting total fat intake to less than 35% of daily caloric consumption, rather than the less than 27% recommended by the original DASH guidelines because unsaturated fatty acids may possess advantageous cardio-protective properties (18). Dietary education topics included reading and understanding food labels, estimating portion sizes, and behavioral strategies for increasing consumption of fruits and vegetables and how to self-monitor. All dietary classes were conducted by a registered dietitian.

*Resistance Training Intervention:* All participants completed two 30 to 45 minute sessions of supervised RT on non-consecutive days of the week for eight weeks. Participants performed RT exercises using hand-held dumbbells, elastic tubing, and ankle weights. Three upper-body (chest press, shoulder press, and back row) and three lower-body (leg press, knee extension, and leg curl) exercises were completed during each training session and three sets of 8-12 repetitions were performed for each exercise. This specific repetition assignment was chosen because 8-12 repetitions performed to volitional fatigue is recommended for optimizing muscle strength and is in accordance with physical activity guidelines published by the American College of Sports Medicine (19). Each participant's individual progression was monitored by study staff and resistance was increased when the participant was able to complete > 12 repetitions for a particular exercise with proper form. Participants were instructed to perform a ~ 1 s concentric phase of each exercise, with a ~ 2-3 s eccentric phase. Comparable RT protocols have been successfully implemented in similar cohorts and have been shown to be effective at improving strength and function (13, 20). In order to monitor intensity, participants were introduced to the rating of perceived exertion scale and were instructed to subjectively monitor the difficulty of each exercise based on this scale. Exercise intensity was designed to be "somewhat hard," which has been shown to be effective at facilitating an increase in physical function (21). Past studies have indicated this intensity is tolerable in geriatric populations (22), resulting in greater adherence to exercise programs (23). Study staff was trained by the principal investigators and those proficient with the exercise protocol supervised all RT sessions.

*Statistical Analyses:* An outlier analysis was performed and values greater than three standard deviations from the mean were identified and considered outliers. While outliers (≤ 3) were identified for several outcome variables, they were included in all analyses as they did not meaningfully alter the interpretation of the results. The Shapiro-Wilk test was conducted to determine normality for all primary outcome variables. Paired samples t-tests were conducted for changes in normally distributed variables for the total group, while the non-parametric Wilcoxon signed-rank test was performed for the non-normally distributed variable (i.e. percent body fat). Additionally, an exploratory analysis of paired samples t-tests were conducted for changes within site area (i.e., urban or rural) changes. Analysis of covariance was conducted for between-group (urban vs. rural sites) differences in all change variables and analyses were adjusted for baseline values, age, and gender. A chi-square test was performed to determine the frequency of categorical variables between rural and urban senior centers. All analyses were conducted using SAS software (SAS Institute Inc., version 9.2, Cary, NC) and statistical significance was set at $p<0.05$. Data are presented as mean ± SD.

## RESULTS

Participant characteristics at baseline, post-intervention, and change from baseline to post-intervention for the analytic sample are presented in Table 1. Our analytic sample consisted of 95 overweight and obese (BMI = 33.4 ± 4.0 kg/$m^2$) adults (80 female, 15 male) with a mean age of 69.1 ± 6.2 years. Following the intervention, a significant reduction was evident in total body weight, BMI, WC, percent body fat and FM ($p<0.001$). No significant changes were observed in FFM. As described in a previous report from our laboratory, diet quality significantly improved (Table 1) from baseline to post-intervention (23). However, while participants were encouraged to increase leisure-time physical activity, no significant differences were observed in physical activity energy expenditure between baseline and post-intervention (8,726 ± 6,513 Kcal vs. 9,461 ± 8,135 Kcal, $p=0.194$). Additionally, it is important to note that of the 95 participants 64 lost weight, 26 gained weight, and 5 remained weight stable.

Table 2 presents a comparison of rural and urban sites at baseline, post-intervention, and change values. A chi-square test determined that the frequency of education level variables between rural and urban senior centers was significantly different ($p < 0.0167$). While no significant changes occurred in FFM the rural group demonstrated significant changes in weight, BMI, WC, hip circumference, and FM ($p<0.001$). Additionally, significant changes were observed in percent body fat ($p<0.01$). Within the urban group, no significant changes were found in either percent body fat or FFM. However, significant changes did occur in total body weight, WC, and hip circumference ($p<0.005$). Additionally, significant changes occurred in BMI and FM ($p<0.05$).

## DISCUSSION

To our knowledge this is the first study to investigate the effects of a community-based intervention that integrated RT and dietary changes to facilitate weight loss on body composition in overweight and obese, community-dwelling older adults in both urban and rural sites. The results of this investigation suggest that community-based RT and concomitant dietary modifications for intentional weight loss is an effective strategy for promoting healthy weight changes in body composition in overweight and obese older adults.

WC decreased by ~ 5.2 cm, which is similar to the reduction observed in a previous laboratory based intervention that incorporated RT and dietary modifications in obese older adults (25). The reduction in WC demonstrated by the analytic sample may be of particular importance as centrally-deposited adiposity is associated with the development of metabolic abnormalities in older adults (26). While this decrease was statistically significant, it may also be of clinical importance as well. WC is an independent risk factor for both cardiovascular disease and type 2 diabetes. The cut-off for high risk of cardiovascular disease is 102 cm and 88 cm in men and women respectively (27). It has additionally been found that WC is a very good predictor of insulin sensitivity; a WC of below 100 cm excludes insulin resistance in both sexes (27). This intervention decreased participants WC ~ 5.2 cm (100.6 ± 12.1 to 95.4 ± 11.2 cm), suggesting that the implementation of this intervention is effective at decreasing risk for insulin resistance and potentially cardiovascular disease.

Weight loss is recommended for obese adults who are at risk of obesity-related illness and disability, but in order to improve health and function, weight loss should be accomplished by decreasing FM while preserving FFM (28). The results of this study indicate that this intervention was effective at eliciting weight loss through a statistically significant decrease in FM ($p<0.001$), while successfully preserving FFM ($p=0.161$).

A comparison of the rural and urban senior centers was done because research suggests that socioeconomic status is an important predictor of physical activity behavior (15). While socioeconomic status was not directly measured, education level was assessed and has been considered a major determinant of socioeconomic status (29). Additionally, past research has indicated that variability in sedentary behavior may be predicated on living environment (i.e. urban versus rural) and educational attainment among women (30). Based on these previously reported differences, we believed it was worthwhile to compare the effectiveness of this intervention between rural and urban senior centers. However, although education level was significantly different between the rural and urban sites, our analyses suggest that the intervention was equally effective for the rural and urban senior centers (Table 2).

Although favorable alterations in body composition were observed, potential limitations should be acknowledged. A primary limitation is that there was not a control group for this study, as it was a community-outreach intervention, but participants served as their own control. Additionally, a previous investigation from our laboratory showed that those in a weight loss-only control group demonstrated improvements in global physical function measures, but not muscle strength (31). Another limitation is that handheld bioelectrical impedance is not capable of measuring percent body fat values > 50%, which excluded 13 participants from obtaining FFM, FM, and percent body fat data. However, handheld bioelectrical impedance is relatively inexpensive, portable, low-risk and a valid and reliable measurement of body composition (16) and was therefore appropriate for a community outreach intervention of this manner. No differences in baseline characteristics or anthropometrics existed between those who were assessed via bioelectrical impedance and those who were not. Another limitation of this study is true of all community-based interventions which involve RT, these studies are limited by both the type and quantity of exercise equipment available to participants. Participants of this study performed RT using free weights, resistance tubing, and ankle weights. However, such equipment is cost-effective and feasible for use in community-based settings and other investigations have reported improvements that utilized similar equipment (13, 14). Finally, changes in body composition may have been less robust because this intervention was shorter than other previous investigations involving older adults (32, 33, 34). It is likely that the modest weight loss in our study was limited by the length of the intervention and greater reductions in body mass may have been observed with a longer intervention. Although it is important to note that previous studies with comparable to duration to ours have achieved significant weight loss, similar to that reported here (25, 35).

The results of this investigation suggest that an eight-week RT and dietary intervention can be successfully implemented in a community-based setting and is associated with improvements in body composition in overweight and obese older adults. Studies of longer duration are needed in order to facilitate greater weight loss and to determine if this combination of intervention strategies results in long-term behavior changes and reduces the risk of future chronic disease.

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Table 1. Baseline, post-intervention, and change values for the analytic sample (n = 95*) for body composition, physical function, and muscle strength variables

| Variable | Baseline | Post | Change | P Value |
|---|---|---|---|---|
| Height (cm) | 160.3 ± 8.0 | - | - | - |
| Weight (kg) | 86.1 ± 13.9 | 85.1 ± 13.5 | -1.0 ± 1.8 | <0.001 |
| Body Mass Index (kg/m$^2$) | 33.4 ± 4.0 | 33.1 ± 4.1 | -0.4 ± 0.8 | <0.001 |
| Waist Circumference (cm) | 100.6 ± 12.1 | 95.4 ± 11.2 | -5.2 ± 3.8 | <0.001 |
| Hip Circumference (cm) | 115.1 ± 9.6 | 109.8 ± 8.8 | -5.3 ± 4.1 | <0.001 |
| Percent Fat (%) | 43.7 ± 4.8 | 43.2 ± 4.8 | -0.5 ± 1.4 | <0.001 |
| Fat Mass (kg) | 37.5 ± 7.3 | 36.7 ± 7.2 | -0.8 ± 1.6 | <0.001 |
| Fat-free Mass (kg) | 48.4 ± 9.3 | 48.2 ± 9.0 | -0.2 ± 1.2 | 0.161 |
| Dietary Screening Tool | 66.7 ± 12.1 | 73.4 ± 10.4 | 6.8 ± 10.0 | <0.0001 |

Data are presented as mean ± standard deviation. N=95.
*Some variables do not have 95 participants (BMI = 94, Percent Fat = 82, Fat Mass = 82, Fat Free Mass = 82)

Table 2. Comparison of rural and urban sites at baseline, post-intervention, and changes in anthropometric variables.

| | Rural (n = 54)§ | | | | Urban (n = 41)‡ | | | |
|---|---|---|---|---|---|---|---|---|
| **Variable** | **Baseline** | **Post** | **Change** | **Within-group P Value** | **Baseline** | **Post** | **Change** | **Within-group P Value** |
| Weight (kg) | 85.6 ± 14.3 | 84.6 ± 13.9 | -1.0 ± 1.8 | <0.001 | 86.7 ± 13.4 | 85.7 ± 13.2 | -1.0 ± 1.8 | 0.001 |
| Body Mass Index (kg/m$^2$) | 33.1 ± 3.7 | 32.7 ± 3.8 | -0.4 ± 0.8 | <0.001 | 33.9 ± 4.4 | 33.6 ± 4.4 | -0.3 ± 0.8 | 0.032 |
| Waist Circumference (cm) | 99.9 ± 12.0 | 95.0 ± 11.5 | -4.9 ± 3.8 | <0.001 | 101.4 ± 12.3 | 95.9 ± 11.0 | -5.5 ± 3.9 | <0.001 |
| Hip Circumference (cm) | 114.7 ± 8.9 | 109.1 ± 8.2 | -5.6 ± 3.2 | <0.001 | 115.7 ± 10.6 | 110.8 ± 9.5 | -4.9 ± 5.1 | <0.001 |
| Percent Fat (%) | 43.5 ± 4.7 | 42.9 ± 4.8 | -0.6 ± 1.2 | 0.003 | 43.9 ± 4.9 | 43.6 ± 4.8 | -0.3 ± 1.5 | 0.071 |
| Fat Mass (kg) | 36.8 ± 6.8 | 35.8 ± 6.6 | -1.0 ± 1.5 | <0.001 | 38.5 ± 7.9 | 37.8 ± 7.8 | -0.7 ± 1.8 | 0.014 |
| Fat-free Mass (kg) | 48.1 ± 9.9 | 47.9 ± 9.6 | -0.2 ± 1.2 | 0.307 | 48.9 ± 8.6 | 48.6 ± 8.3 | -0.3 ± 1.2 | 0.329 |
| DST | 66.8 ± 12.4 | 74.3 ± 10.6 | 7.5 ± 10.6 | <0.0001 | 66.5 ± 11.9 | 72.3 ± 10.1 | 5.8 ± 9.3 | 0.0002 |

All change variables were adjusted for baseline values, age, and gender. Data are presented as least squared means ±Standard deviation.

§Some variables do not have 54 participants (Percent Fat, Fat Mass, and Fat Free Mass = 46)

‡Some variables do not have 41 participants (BMI = 40, Percent Fat, Fat Mass, and Fat Free Mass =36)

## LIST OF APPENDICES

## Appendix A: Review of Literature

The purpose of this literature review is to demonstrate the public health problem of obesity as well as other deleterious changes in body composition that are associated with the aging process in adults. Additionally, this review will detail research which has been conducted thus far in an aging population on obesity, sarcopenic-obesity, dietary weight loss interventions, the Dietary Approaches to Stop Hypertension (DASH) diet, and resistance training (RT) during weight loss. Specific emphasis will be placed on the effect of community-based RT interventions during weight loss or dietary changes.

Age associated loss of skeletal muscle mass and strength, and increased fat mass (FM) along with decreased lean mass are well documented, and are known to be associated with multiple clinical outcomes such as mobility impairments, disability, falls, and fractures (Binder, Yarasheski et al. 2005). Obesity and sarcopenia are both major public health concerns that constitute a significant burden as the adult population ages in the United States (U.S.).

***Obesity***

Obesity is defined as an unhealthy excess of body fat that increases risk for morbidity and mortality (Villareal, Apovian et al. 2005). According to body mass index (BMI), which is calculated as body weight (kg) divided by height squared ($m^2$); one is considered to be obese with a BMI $\geq$ 30.0 kg/$m^2$. Obesity is associated with reduced functional status and an increased risk of subsequent institutionalization in older adults (Visser, Langlois et al. 1998). Between 1991 and 2000, obesity rates have increased in the 60-69 and over 70 year old age groups by 56% and 36% respectively

(Alley and Chang 2007).  This increase in FM is attributed to factors such as a decline in physical activity, reduced basal metabolic rate, and an increase in energy intake (Stenholm, Harris et al. 2008; Zamboni, Mazzali et al. 2008).

During the aging process alterations in skeletal muscle mass accompanied by an increase in total adiposity are often observed (Evans and Campbell 1993; Zamboni, Mazzali et al. 2005).  Longitudinal data indicate that adipose tissue increases with age and peaks between 60-75 years of age (Stenholm, Harris et al. 2008).  Recent reports suggest that obesity has reached epidemic proportions in the U.S. and the number of obese older adults is rising (Mokdad, Serdula et al. 1999).  Since 1980, the prevalence of obesity has increased (Mokdad, Serdula et al. 1999) and approximately 71% of adults aged 60 years and older are classified as overweight or obese (Ogden, Carroll et al. 2006).  Additionally, it has been estimated that 20% of the U.S. population will be aged 65 years and older by 2030 (National Center for Health Statistics, 1999). Therefore with an aging population the prevalence of obesity in older adults is likely to increase, thus obesity represents an urgent public health matter for the elderly population.  Weight loss is recommended for obese adults who are at risk of obesity-related illness and disability (Villareal, Apovian et al. 2005).

Excess body fat is associated with many negative health consequences in older adults including cardiovascular disease, metabolic syndrome, dyslipidemia, knee osteoarthritis, urinary incontinence, breast cancer, cataracts, and pulmonary function abnormalities (Riebe, Blissmer et al. 2009).  In addition to these negative health outcomes an association between overweight and obesity and an increased risk of functional limitations in older adults has also been reported (Ensrud, Nevitt et al.

1994). Many studies have identified the relationship between obesity and functional limitations (Ensrud, Nevitt et al. 1994; Visser, Langlois et al. 1998; Zizza, Herring et al. 2002; Villareal, Banks et al. 2004; Zoico, Di Francesco et al. 2004; Riebe, Blissmer et al. 2009; Kemmler, von Stengel et al. 2010). Now that this relationship has been identified it is of major public health concern to find effective strategies to intervene to prevent this negative symbiotic relationship. The following studies sought to identify the relationship between obesity and functional limitations.

Visser and colleagues analyzed data from the Cardiovascular Health Study to examine the relationship between body composition and self-reported mobility-related disability in a cohort of men and women aged 65-100 years of age. Body composition was assessed using bioelectrical impedance analysis and mobility-related disability was measured via the self-reported ability to walk 0.5 miles and climb 10 stairs. After adjustment for potential confounders, increased FM was associated with a two- to three-fold greater likelihood of mobility-related disability during a three-year follow-up period. These results suggest that excessive FM is an independent predictor of mobility-related disability among community-dwelling elderly men and women. While this study determined a relationship between FM and function, other studies have found a similar relationship between BMI and function (Visser, Langlois et al. 1998).

Zoico and colleagues also investigated the relationship between obesity and physical disability in community-dwelling women aged 67-78 years. Body composition was measured via dual energy x-ray absorptiometry (DXA) and physical disability was assessed. The prevalence of functional limitations was significantly greater in older women with a BMI ≥ 30.0 kg/m$^2$ and in the highest quintile of percent body fat (Zoico, Di Francesco et al. 2004). These findings confirm the relationship between BMI and functional status reported in a prior study that observed a greater prevalence of self-reported functional decline among community-dwelling older adults with a BMI ≥ 35.0 kg/m$^2$ (Jensen and Friedmann 2002).

Additionally, Villareal and colleagues also sought to explore the relationship between body composition, physical function, and health-related quality of life in obese, community-dwelling men and women > 65 years of age. Obesity was associated with significant impairments in lower-extremity muscle strength, gait velocity, balance, and health-related quality of life compared to those participants with a desirable body composition. Specifically, scores in the Medical Outcomes Short Form (SF-36) Health Survey physical function domains (e.g., role limitations due to physical problems, vitality, and physical function) were significantly reduced relative to healthy participants (Villareal, Banks et al. 2004).

More recently, Riebe and colleagues investigated the relationship between obesity and physical function in a cohort of 821 community-dwelling adults ≥ 60 years. Body mass index was used to categorize participants as normal weight, overweight, or obese and functional mobility was assessed via the timed up-and-go test. The obese group demonstrated significantly greater timed up-and-go scores compared to individuals who were normal weight and overweight. In addition, obese participants were 1.4 times more likely to have scores that were considered abnormal compared to individuals who were normal weight. These findings suggest that the presence of obesity negatively affects functional mobility (Riebe, Blissmer et al. 2009).

Along with negative effects on functional capacity and mobility, obesity increases the risk of institutionalization in obese older adults relative to those who are not obese (Zizza, Herring et al. 2002).  Furthermore, the increasing prevalence of overweight and obese individuals and the association with subsequent adverse clinical outcomes in older adults demonstrates the need and public health importance to develop efficacious strategies for both prevention and treatment.  Another health outcome which requires development of effective interventions for both treatment and prevention is sarcopenia, and even more so the combination of sarcopenia and obesity.

***Sarcopenic-Obesity***

Sarcopenia is defined as the age-related loss of muscle mass (Rosenberg 1997). This age related loss of muscle mass is accompanied by declines in physical function and increased FM, which is associated with an increased risk of certain types of chronic diseases such as type 2 diabetes (Goodpaster, Thaete et al. 2000).  This condition is associated with reductions in physical function, and subsequently leads to increases in disability (Ferrucci, Guralnik et al. 2004).  Additionally, sarcopenia is a major contributor to disability, as it has been shown to be linked to gait and balance problems, increased risk of falling, and the loss of functional independence (Katula, Rejeski et al. 2008).  Some causes of sarcopenia include changes in hormones, increased inflammation, and a decline in physical activity (Rolland, Lauwers-Cances et al. 2009).  In adults, decreases in fat-free mass (FFM) begins around the fourth decade of life and this loss accelerates with each passing decade (Zacker 2006). This demonstrates the need for effective interventions to reverse the effects of FFM.

With aging the simultaneous occurrence of FFM loss and increased FM makes older adults particularly susceptible to future disability. Obesity and sarcopenia are both independently associated with the development of functional limitations in older adults (Zoico, Di Francesco et al. 2004). However, it is hypothesized that sarcopenia and obesity have a synergistic effect on the process of disablement in older adults (Roubenoff 2004). The combination of these conditions results in sarcopenic-obesity, which is defined as excessive FM accompanied by the age-related decrease in skeletal muscle mass, and is more detrimental to physical function in the elderly than either condition alone (Baumgartner, Wayne et al. 2004). This combination of sarcopenia and obesity place these older adults at higher risk for coronary heart disease (CHD), insulin resistance, type 2 diabetes mellitus, and disability (Alley and Chang 2007). Weight loss is recommended for obese adults who are at risk of obesity-related illness and disability (Villareal, Apovian et al. 2005), but in order to improve health and function FM should be decreased while attenuating the loss of FFM. In order to successfully intervene in obesity-related chronic diseases it is necessary to integrate both nutrition and exercise. Therefore it is of extreme importance to test the combined effects of multiple modalities in order to identify the most effective combination of modalities (Ferrucci, Guralnik et al. 2004).

The increased prevalence of obesity may have negative implications on physical function in older adults. Research has shown the negative effects of sarcopenia are exacerbated when excessive FM is present (Evans, 2000). For example, Rolland and colleagues investigated the association of sarcopenia, obesity, and sarcopenic-obesity with the incidence of self-reported functional limitations in a cohort of community-dwelling women aged 75 years and older. Using similar criteria to define sarcopenia and obesity, they did not observe an association between sarcopenia and any of the self-reported functional tasks that were assessed. However, obese women were 44-79% more likely to experience functional limitations compared to women with a desirable body composition (Rolland, Lauwers-Cances et al. 2009). There are multiple biologic processes which are theorized to exacerbate this relationship.

Adipocytes secrete pro-inflammatory cytokines, which stimulate muscle catabolism and may therefore accelerate the negative effects of sarcopenia (Brinkley, Leng et al. 2009). Schrager and colleagues reported that sarcopenic obesity was significantly associated with elevated circulating concentrations of interleukin-6, C-reactive protein, interleukin-1 receptor antagonist, and soluble interleukin-6 receptor (Schrager, Metter et al. 2007). Therefore, it is feasible to postulate that obesity may accelerate sarcopenia through its direct catabolic effect of pro-inflammatory cytokines on skeletal muscle mass (Roubenoff, Freeman et al. 1997). The summation of this evidence highlights the importance to look further into the damaging effects of sarcopenia and obesity in order to develop the most effective intervention for the older adult population.

***Dietary Weight Loss***

Obesity has been reported to exacerbate declines in functional abilities, reduce quality of life, and increase the likelihood for institutionalization in older adults

(Frimel, Sinacore et al. 2008). Thus dietary-induced weight loss may have positive health implications for older adults. Research has shown that moderate reductions (5-10%) in body weight can ameliorate numerous metabolic abnormalities that increase CHD risk (Villareal, Apovian et al. 2005). For instance, it has been reported that lifestyle interventions facilitating relatively modest reductions in body mass (approximately 3.2 kg) can reduce the incidence of type 2 diabetes and decrease blood pressure in overweight and obese individuals (Powell, Calvin et al. 2007). Achieving this moderate weight loss not only has positive health benefits, but has also been effectively implemented and well tolerated in older overweight and obese populations (Villareal, Banks et al. 2004; Villareal, Apovian et al. 2005; Frimel, Sinacore et al. 2008).

Abdominal fat is an independent risk factor for disease and examining changes in waist circumference can help provide an estimation of increases or decreases in abdominal fat in the absence of changes in BMI (National Institutes of Health 1998). Centrally-deposited adiposity is associated with the development of metabolic abnormalities in older adults (Wahrenberg, Hertel et al. 2005). Additionally, waist circumference is an independent risk factor for cardiovascular disease. While the cut-off for high risk of cardiovascular disease is 102 cm and 88 cm in men and women respectively (Villareal, Miller et al. 2006), it has additionally been found that waist circumference is a very good predictor of insulin sensitivity; a waist circumference of below 100 cm prevents insulin resistance in both sexes (Villareal, Miller et al. 2006). Significant reductions in waist circumference have also been reported in interventions which targeted overweight and obese cohorts (Villareal, Apovian et al. 2005; Yassine, Marchetti et al. 2009).

Despite the importance of weight loss for overweight and obese older adults, it is of extreme importance that this intentional weight loss consists of decreased FM while preserving FFM in order to maintain functional ability, and therefore preventing negative health outcomes. Therefore, it is important to recognize that intentional weight loss alone is often accomplished through reductions in both FM and FFM (Ballor, Katch et al. 1988). This is because approximately 75% of dietary-induced weight loss is of FM while approximately 25% is loss of FFM (Villareal, Apovian et al. 2005). Previous randomized controlled trials have reported this phenomenon of both the control and intervention groups obtaining similar weight loss, while the intervention group achieved weight loss through reduction of FM alone and the control group achieved the similar weight loss through reductions of both FM and FFM. (Dunstan, Daly et al. 2002; Frimel, Sinacore et al. 2008; Avila, Gutierres et al. 2010). Therefore, intentional weight loss may exacerbate the sarcopenia-related decline in skeletal muscle mass that is typically evident in older adults due to accelerated loss of FFM. Traditional weight loss diets which achieve weight loss via low fat intake can be of concern, especially in an older population, because of the decreases in lean muscle mass and the negative impact on some lipoprotein measures (Delmonico and Lofgren 2010). Therefore, when inducing weight loss in an older obese population the importance to focus on the need for a well balanced diet may be further amplified.

***Dietary Approaches to Stop Hypertension***

Compliance with the DASH diet improves diet quality and lowers CHD risk by decreasing systolic and diastolic blood pressure (Appel, Moore et al. 1997) and improving lipid and lipoprotein concentrations (Obarzanek, Sacks et al. 2001). The DASH diet promotes healthy eating and recommends increased consumption of fruits, vegetables, low-fat dairy products, whole grains, nuts, poultry, and fish and reduced intake of fats, red meat, sweets and sugar-containing beverages (Appel, Champagne et al. 2003). The DASH diet recommends decreased consumption of total fat, saturated fat, and cholesterol, and increased consumption of potassium, calcium, magnesium, fiber, sodium, and protein (Karanja, Obarzanek et al. 1999). Recent studies have shown the DASH diet confers substantial cardioprotective benefits among older adults. For instance, the DASH diet has shown to be an efficacious intervention for improving blood pressure in hypertensive adults. Appel et al. conducted a randomized, clinical trial and found that consuming the DASH diet for eight weeks precipitated significant reductions in systolic and diastolic blood pressure in a cohort of men and women with elevated blood pressure (Appel, Moore et al. 1997).

In addition to cardioprotective health benefits, adherence to the DASH diet may also be a feasible strategy to elicit considerable weight loss in older adults. For example, Appel et al. conducted a randomized trial to investigate the effects of the DASH diet on blood pressure among older adults who were not taking antihypertensive medication. Participants were randomly allocated to one of three intervention groups: an “advice only” comparison group, a behavioral intervention that promoted conventional lifestyle recommendations such as weight loss and increased physical activity, or a behavioral intervention that implemented the same lifestyle recommendations plus the addition of the DASH diet. They found that older adults who received instruction and counseling on the DASH diet demonstrated a 5.8 kg reduction in body weight following a six-month intervention, which was significantly greater than the weight loss of the "advice only" comparison group. This demonstrates that the DASH diet, especially in conjunction with additional behavioral modifications, such as resistance training, may be an effective intervention for eliciting reductions in body mass, and may be feasible for implementation in a population of overweight and obese older adults (Appel, Champagne et al. 2003).

Smith and colleagues assessed the effects of the DASH diet, exercise, and caloric restriction on neuro-cognition in overweight adults, with body composition being a secondary outcome measure. In this study a total of 124 overweight and obese (BMI 25 to 40 $kg/m^2$) sedentary men and women with a mean age of 52 years were randomized into one of three groups. Participants randomized into the DASH group received instruction in modifying the content of their diet to meet DASH guidelines, but did not exercise to lose weight. Participants randomized to the DASH plus weight management group also received the DASH instruction, but additionally participated in a behavioral weight management program consisting of supervised AT and behavior modification. These participants engaged in a 30 minutes of supervised AT sessions three times per week along with weekly counseling sessions for behavioral weight loss strategies. Finally, participants in the control group maintained their usual dietary habits and did not lose weight or exercise for the four months of the intervention period. After completion of the intervention both total body weight ($8.9 \pm 1.4$ kg versus control group) and BMI ($3.3 \pm 0.2$ versus $0.1 \pm 0.5$ $kg/m^2$) significantly decreased in the combined DASH with weight management group as compared to the control group ($p < 0.0001$). The results of the secondary outcome measures of this study demonstrated that the DASH diet accompanied by AT training was successful at significantly decreasing both body weight and BMI in overweight and obese sedentary adults. Therefore, the studies mentioned above clarify the need for a nutritional component of an intervention with older adults to ensure an effective approach to address weight loss and attain maximum health benefits (Smith, Blumenthal et al. 2010). These data highlight the benefits of a nutritional component for weight loss, additionally there is accumulating evidence for the efficacy of resistance training in improving body composition.

***Resistance Training***

There is accumulating evidence in support of progressive RT as an intervention to delay or reverse sarcopenia, and studies with healthy older adults have consistently shown that high intensity progressive RT induces significant increases in FFM, muscle fiber area, and muscle cross-sectional area. Additionally some studies have shown that progressive RT can decrease total FM and visceral fat. The observed changes have varied between studies and depend on the intensity and duration of the intervention (Binder, Yarasheski et al. 2005). Therefore, RT exercise may be an efficacious therapeutic modality for preserving skeletal muscle mass and function during intentional weight loss.

Ibañez and colleagues examined the effects of a 16 week twice-weekly progressive RT program, without a weight loss diet, on abdominal fat in older men with type 2 diabetes. In this study nine overweight (BMI $28.3 \pm 2.7$ kg/m$^2$) older (aged 66.6 ± 3.1) men participated in a progressive RT program for all major muscle groups lasting between 45 to 60 minutes per session on RT machines. During the first eight weeks the participants trained with 10 to 15 repetitions of three to four sets with loads of 50 to 70% of their one repetition maximum. During the last eight weeks participants completed three to five sets of five to six repetitions with loads of 70 to 80% of their one repetition maximum. Height and weight were measured via standard protocol and whole-body fat was estimated according to the seven site skinfold thickness. Both visceral and subcutaneous adipose tissue volumes were measured by computed tomography. After 16 weeks of progressive RT no changes were observed in total body mass, but both visceral and subcutaneous abdominal fat decreased significantly by 10.3% ($p < 0.01$) and 11.2% ($p < 0.01$), respectively. This study found that 16 weeks of progressive RT, without a concomitant weight loss diet, was able to significantly decrease abdominal fat in older men with type 2 diabetes. This study was successful in decreasing abdominal fat in a cohort of overweight and obese older adults. One major limitation to this study is the lack of a concomitant weight loss diet. The addition of which, may have elicited changes in total body mass, and would have therefore been a more efficacious weight loss strategy (Ibanez, Izquierdo et al. 2005).

Castaneda and colleagues conducted a randomized controlled trial of high-intensity progressive RT to improve glycemic control in older adults with type 2 diabetes. A total of 62 community-dwelling Latino men and women over the age of 55 years diagnosed with type 2 diabetes participated in this study. Participants were randomized to 16 weeks of standard care/control group, or 16 weeks of progressive

RT three times per week. Those randomized to the progressive RT group completed three supervised RT sessions per week, each lasting for approximately 45 minutes. Each training session consisted of a five minute warm-up, 35 minutes of progressive RT, and a five minute cool-down. During the 35 minutes of progressive RT participants used five pneumatic RT machines (chest press, leg press, upper back, knee extension, and knee flexion). Participants performed three sets of eight repetitions on each machine every session. Training intensities during week's one through eight were 60-80% of baseline one repetition maximums, weeks 10 to 14 were 70-80% of participant's mid-study one repetition maximum, and in order to prevent overtraining weeks 9 and 15 reduced intensity approximately 10% lower than the previous week's workload. While no dietary intervention was implemented, total energy and macronutrient intakes were assessed by a food frequency questionnaire. Body weight, height, and BMI were measured via standard protocols. Waist circumference was measured by standardized technique, and whole-body and regional lean and FM were determined by DXA. This study found that participants randomized to progressive RT significantly increased whole body lean mass and decreased trunk FM as compared to control participants. Additionally, whole body lean tissue mass increased during the 16 weeks in the RT participants ($44.3 \pm 1.7$ to $45.5 \pm 1.9$ kg). Conversely, the control participants decreased from ($44.9 \pm 1.9$ to $44.8 \pm 1.7$ kg, $p < 0.04$). Additionally, trunk FM decreased during the 16 weeks in the RT participants from ($18.8 \pm 1.1$ to $18.1 \pm 1.2$ kg), while the control participants increased trunk FM from ($18.2 \pm 1.3$ to $19.0 \pm 1.1$ kg, $p < 0.01$). The conclusion of this study was that progressive RT as an adjunct to standard care is effective at improving both glycemic control and some of the abnormalities associated with metabolic syndrome. As with the previous study, one major limitation to this particular research is the lack of dietary intervention, which could accompany such a RT protocol in order to accommodate for more significant changes in body composition (Castaneda, Charnley et al. 1995).

Another study conducted by Binder and colleagues examined progressive RT without a concomitant weight loss diet tested the effects of progressive RT on body composition in frail older adults. The participants consisted of 91 overweight community dwelling sedentary men and women who were 78 years and older with established physical frailty that completed a six-month randomized controlled trial. Participants were randomly assigned to either a control group that performed a low intensity home exercise program or to a supervised exercise training group which performed three months of low intensity exercise and three months of progressive RT. The participants randomized to the home exercise control group were asked to exercise at home two to three times per week completing nine exercises which focused primarily on flexibility. Those randomized to the exercise training program completed two three month long phases where participants attended three exercise sessions per week. The first phase of exercises used a group class format and included 22 exercises which focused on improving flexibility, balance, coordination, reaction speed, and strength. The second phase added progressive RT. Participants performed one to two sets of six to eight repetitions of six exercises (knee extension, knee flexion, seated bench press, seated row, leg press, and biceps curl) at 65% of their one repetition maximum. The goal was for participants to progress their workload to three sets of 8-12 repetitions performed at 85 to 100% of their initial one repetition maximum. No specific diet was prescribed during the intervention, and participants were instructed to not make any drastic changes in their diet. Fat free mass and FM were assessed through total body DXA in order to assess total FFM, trunk fat, leg lean mass, and leg FM. After completion of the progressive RT total body FFM significantly increased in the exercise training group, but not in the home exercise control group (0.84 ± 1.4 kg versus 0.01 ± 1.5 kg, p = 0.005). The results of this study showed that supervised progressive RT was sufficient to induce improvements in whole body FFM in frail, community-dwelling elderly women and men. However, this program may not be sufficient to reduce whole-body or intra-abdominal fat area in this given population. Similar to the above studies a major limitation to this study design is a lack of dietary intervention. While this protocol was not sufficient to induce improvements in various measures of body composition, the addition of a dietary intervention may have been a sufficient stimulus to elicit such changes. While these studies show that RT can be effective in eliciting changes in body composition, even greater changes in body composition may occur when implementing the combination of both RT and dietary intervention (Binder, Yarasheski et al. 2005).

***Resistance Training combined with Dietary Intervention***

Many interventions have been conducted with overweight populations in order to assess the effects of aerobic training (AT) combined with dietary weight loss in older adults. The majority of combined exercise and weight loss interventions have utilized AT as a preferred weight loss modality. Chomentowski and colleagues reported that moderate AT attenuates the loss of skeletal muscle mass that occurs with intentional weight loss via caloric restriction in older, overweight and obese adults

(Chomentowski, Dube et al. 2009). Additionally, Yassine and colleagues examined the effects of AT and caloric restriction on cardiometabolic risk factors in older obese adults in a randomized controlled trial. At the conclusion of the interventions both groups experienced significant weight loss, but the reduction was significantly greater in the exercise combined with caloric restriction group than in the exercise alone group (Yassine, Marchetti et al. 2009). These data suggest that AT alone can be an effective treatment strategy for metabolic syndrome and CHD risk factors in older obese adults. With the exception of weight loss and subcutaneous fat there were no differences in the magnitude of changes in body composition between the two interventions, implying that while AT is effective at weight loss, this modality also has limitations in eliciting significant changes in some components of body composition. Another major limitation to AT is that it can be difficult for some overweight and obese older adults to adopt and therefore maintain (Delmonico and Lofgren 2010). While many studies have focused on the effects of AT on body composition and weight loss in overweight and obese older adults; more recently studies have begun to examine the effects of RT combined with AT modalities for weight loss, as well at RT alone.

Studies have examined the combined effects of AT and RT, however, one major limitation to these combined modality interventions is that the independent effects of each modality cannot be assessed. Frimel, Sinacore, and Villareal sought to evaluate the effect of adding exercise to a hypocaloric diet on changes in appendicular lean mass in frail obese older adults undergoing voluntary weight loss. In this randomized controlled trial, 30 frail older (age 70 ± 5 years), obese (BMI 37 ± 5 kg/m$^2$), adults were randomly assigned to six months of a diet and behavior therapy group or a diet and behavioral plus exercise group which incorporated progressive RT. Participants in the diet group were prescribed a diet which provided an energy deficit of approximately 750 kilocalories per day. This prescribed diet consisted of 20% protein, 30% fat, and 50% carbohydrate. The weight loss goal for each participant was approximately 10% of body weight. Participants met weekly with a study dietitian for caloric intake adjustments and standard behavioral strategies. During the course of the study, participants in the diet alone group were discouraged from initiating an exercise program during the course of the study. Those in the combined diet and exercise group received the weekly diet and behavioral intervention as the diet alone group, but additionally participated in a supervised exercise program. The exercise training sessions consisted of three weekly 90 minute training sessions. Each session consisted of 15 minutes of flexibility training, 30 minutes of low-impact AT, 15 minutes of balance activities, and 30 minutes of high-intensity progressive RT. In each session, participants completed nine RT exercises which targeted major muscle groups. The initial sessions consisted of two sets of each exercise with eight to 12 repetitions performed at approximately 65% of the participant's one repetition maximum. After approximately four weeks, participants increased to three sets of eight to 12 repetitions performed at approximately 85% of their initial one repetition maximum. Total body mass, FM, and FFM were assessed via DXA. Both groups had similar decreases in both body weight (approximately 9%) and FM (16.5% versus 20.7%). However, the diet and exercise group lost significantly less FFM ($1.8 \pm 1.5$ vs. $3.5 \pm 2.1$ kg), lower extremity lean mass ($0.9 \pm 0.8$ versus $2.0 \pm 0.9$ kg) and upper extremity lean mass (0.1 ± 0.2 versus 0.2 ± 0.2 kg) than the diet alone group ($p < 0.05$). Additionally, the diet and exercise group had greater increases in percent of weight as FFM then the diet group (7.9 ± 3.3 versus 5.4 ± 3.7%, $p < 0.05$). This study showed that regular exercise that incorporates progressive RT can be used to successfully attenuate muscle mass loss in frail obese older adults during weight-loss therapy. As mentioned previously, a major limitation to this study is that one cannot conclude which exercise modality elicited these favorable changes in body composition (Frimel, Sinacore et al. 2008).

While the previous study examined the effects of combined RT with AT on muscle mass, Villareal and colleagues examined the effects of a lifestyle intervention on metabolic CHD risk factors in obese older adults. The major outcomes of this study were CHD risk factors, one of which was body composition. This study was a six month outpatient randomized controlled trial conducted with 27 obese (BMI ≥ 30 $kg/m^2$) older (age ≥ 65) men and women, who were randomly assigned to a diet and exercise therapy group or a control group. Participants in the control group were instructed to maintain their usual diet and activities during the study period. Individuals in the diet and exercise therapy group were prescribed a balanced diet which provided an energy deficit of approximately 750 kilocalories per day. This diet contained approximately 30% fat, 50% carbohydrates, and 20% protein. In addition to the prescribed diet participants met weekly as a group with a dietitian to address behavioral strategies for weight loss. At completion of the study the goal was to achieve approximately 10% weight loss. The participants in this group also attended 90 minute exercise training sessions on three nonconsecutive days each week. The exercise sessions focused on improving balance, flexibility, endurance, and strength. The strength component included 30 minutes of strength training at approximately 80% of their one repetition maximum. Waist circumference was assessed via standard protocol, and body composition, including FM and FFM, was assessed by DXA. This study reported that body weight decreased by 8.4% in the treatment group, while it did not change significantly in the control group ($p < 0.001$ between groups). Also, waist circumference decreased by 10 centimeters in the treatment group, but did not change significantly in the control group ($p < 0.05$ between groups). Additionally, no significant changes in FM or FFM were reported. This study concluded that a six month lifestyle intervention was capable of decreasing multiple metabolic CHD risk factors simultaneously in obese older adults. Just as the previous study, a major limitation to this intervention being that one cannot assign the effects of the intervention to either of the exercise modalities alone (Villareal, Miller et al. 2006).

Additionally, Villareal and colleagues also examined the effect of weight loss and exercise on frailty in 27 sedentary frail obese (BMI $\geq 30kg/m^2$) older ($\geq$ 65 years) adults. Participants were randomized into either a treatment group or a control group for six months. Those randomized to the control group were instructed to maintain their usual diet and activity during the study period. Participants assigned to the treatment group were prescribed a balanced diet which provided an energy deficit of approximately 750 kilocalories per day. The diet consisted of approximately 30% of energy as fat, 50% as carbohydrate, and 20% as protein. At completion of the study the goal was to achieve approximately 10% weight loss. Participants also met weekly with a study dietitian. Additionally, participants attended three nonconsecutive group exercise sessions per week, which focused on improving flexibility, strength, endurance, and balance. Sessions lasted 90 minutes and included 15 minutes of a warm-up and flexibility followed by 30 minutes of endurance exercise, 30 minutes of strength training, and 15 minutes of balance exercises. Body composition including total FM, percentage of body fat, and FFM were all assessed by DXA. At the completion of the intervention the treatment group lost $8.4 \pm 5.6\%$ of body weight, whereas weight did not significantly change in the control group ($p < 0.001$). As compared to the control the treatment group significantly decreased FM ($-6.6 \pm 3.4$ versus $1.7 \pm 4.1$ kg; $p < 0.001$), without any significant change in FFM ($p = .75$). The results of this study therefore indicate that weight loss and exercise can improve frailty in obese older adults, while still providing significant weight loss. As with the previous studies, by implementing a combined modality training program there is no way to conclude the relative contribution of each component to the global outcome of decrease in FM and attenuation of FFM loss (Villareal, Banks et al. 2004).

Kemmler and colleagues conducted a study to determine the effects of a multipurpose exercise program on body composition in community dwelling elderly women. This study was an 18 month single-blinded randomized controlled trial comparing participants in an exercise program to those in an active control group. In this study, 246 previously sedentary independent living women 65-80 years of age were randomized into a “well being” non-sedentary control group or an exercise program group. The mean percent body fat of the women in the exercise program and control group was 36.3% and 37.4% respectively. The “well being” control group carried out four blocks of a 10-week low frequency wellness program addressing major topics of health and well-being interrupted by three blocks of 10 weeks of rest during the 18 month intervention period. Those in the exercise program group attended two supervised group sessions performed on nonconsecutive days of the week (approximately 60 minutes) and two home training sessions (approximately 20 minutes). The supervised group sessions included progressive aerobic dance, static and dynamic balance exercises, and 35 minutes of dynamic and static strength exercises. The strength training component included isometric strength exercises and dynamic strength training using elastic bands and gravity resistance. Each exercise was typically performed with two to three sets of 10 to 15 repetitions, with each repetition having a two second concentric phase followed by a one second static phase and a two second eccentric phase. The home training sessions consisted of one to two sets of six to eight isometric exercise and two to three of the elastic band exercises with two sets of 10-15 repetitions at 65-70% of their one repetition maximum. Body weight, height, and BMI were calculated by standard procedures, and body composition was assessed with DXA. After 18 months the researchers observed significant positive effects in favor of the exercise program from body composition. Statistically significant increases in appendicular skeletal muscle mass (absolute mean difference 0.299, $p < 0.007$) and lean mass (absolute mean difference 0.509, $p < 0.008$) were observed, along with reductions in abdominal fat (absolute mean difference 0.178 $p < 0.001$) and total body fat (absolute mean difference 0.688 $p < 0.014$). The final conclusion drawn from this research was that a high-intensity multipurpose exercise program was able to produce significant improvements in body composition in a cohort of previously sedentary elderly community-dwelling women over a period of 18 months. A major limitation to this study is that the combined exercise modalities prevent testing the independent effects of either exercise modality. Thus far most weight loss and exercise interventions have examined the effects of AT or combined AT and RT exercise on weight loss in older adults. While the literature is limited, there is some research which has demonstrated beneficial effects of RT on weight loss in older overweight and obese populations. However, there is still a need to determine the most effective way to target this population to deter the damaging effects of sarcopenic-obesity in older adults (Kemmler, von Stengel et al. 2010).

Implementation of effective intervention strategies to improve the negative effects of obesity in older adults is a public health priority. Traditionally, RT interventions have been recommended to prevent and treat sarcopenia-related declines in physical function (Evans 1999) and dietary modifications have been suggested to reduce the presence of overweight and obesity (Expert Panel on the Identification, Evaluation, and Treatment of Overweight in Adults, 1998). However, few published studies have reported the additive effects of combining these intervention strategies on body composition in overweight and obese older adults during intentional weight loss. Additionally, there is even a greater paucity of literature reporting the efficacy of community-based investigations that integrate RT and dietary changes to facilitate healthy weight loss, decreasing FM while preserving FFM, in overweight and obese older adults (Avila, Gutierres et al. 2010). This population is at risk for the development of obesity related disability, and community-based interventions that incorporate light RT and dietary intervention may be a feasible and efficacious strategy (Rogers, Sherwood et al. 2002; Fitzpatrick, Reddy et al. 2008). Despite the beneficial effects associated with regular RT and dietary education, the efficacy of community-based interventions for improving body composition in overweight and obese older adults has not been thoroughly examined.

While previous research has examined the combined effects of AT and RT exercise with weight loss, the independent effects of RT with weight loss have been studied far less extensively. One study which compared the independent effects of AT versus RT combined with weight loss was conducted by Hunter and colleagues. This study examined the effect that diet-induced weight loss in combination with either AT or RT has on body composition in premenopausal African-American and European-American women. That study was a longitudinal, randomized weight loss clinical intervention, where participants were assigned to AT, RT, or no exercise training groups. The participants were premenopausal overweight (BMI between 27 and 30 $kg/m^2$) women who underwent weight loss to a BMI below 25 $kg/m^2$. After assignment to groups participants began a diet-induced weight loss program consuming approximately 800 kcal per day to reduce BMI below 25 $kg/m^2$. The diet consisted of 20-22% of energy consumed as fat, 18-22% as protein, and 58-62% as carbohydrates. Participants were then assigned additionally to no exercise, or to a program of RT or AT three days per week. The AT group entailed continuous walking or jogging on a treadmill with a warm up followed be stretching and a cool down after exercising. The first week consisted of 20 minutes of exercise at 67% of their maximum heart rate. Every week the duration was increased by five minutes, until duration reached 40 minutes, and then intensity was increased. The RT group had exercise sessions which included a warm-up on the treadmill and stretching followed by ten RT exercises to target major muscle groups. Each exercise was performed as one set of 10 repetitions for the first four weeks, after which two sets of 10 repetitions were performed for following weeks. The training was progressive with intensity beginning at 65% of the participant's one repetition maximum and progressing to 80% of their one repetition maximum. Body composition was assessed via air displacement plethysmography. Women in the RT group maintained FFM following weight loss (46.9 ± 5.2 to 47.2 ± 5.0 kg), whereas those in the AT group (45.4 ± 4.2 to 44.4 ± 4.1 kg) and no training group (47.9 ± 4.7 to 46.4 ± 5.1 kg) significantly decreased FFM ($p \leq 0.05$). The conclusion drawn from this study was that RT was effective in preserving FFM during diet induced weight loss while AT was not. Thus, it is critical to establish the efficacy of programs that combine both RT to attenuate reductions in muscle mass and dietary modifications to reduce FM on improvements in body composition in overweight and obese older adults (Hunter, Byrne et al. 2008).

There are a limited number of investigations examining the efficacy of RT and weight loss for the attenuation of skeletal muscle mass loss and the decrease of FM in overweight and obese older adults. While there is limited published research on this topic, a few studies have reported the retention of skeletal muscle mass and reductions in FM in overweight and obese older adults following participation in interventions that combined regular RT and dietary interventions in order to facilitate weight loss (Dunstan, Daly et al. 2002; Frimel, Sinacore et al. 2008).

Campbell and colleagues examined changes in body composition following a 12 week progressive RT program in 12 previously untrained older men and women between the ages of 56 and 80 years of age. The RT program included to upper-body (chest press and front pull-down) and two lower-body exercises (knee flexion and knee extension). These exercises were performed at 80 percent of the subject's one repetition maximum for two sets of eight repetitions and a third set until fatigue or twelve repetitions, whichever occurred first. As for the dietary component participants were randomly assigned to groups that consumed either 0.8 or 1.6 grams of protein per kg of body weight, and all consumed adequate total energy to maintain baseline body weight. Height, weight, and BMI were all measured via standard procedures, and skinfold thicknesses and body circumferences were measured at both baseline and post 12 weeks of RT. Total body FM and FFM were estimated during baseline and post 12 weeks of RT from body density and total body water by using the three-compartment model Siri equation. Body density was assessed by hydrostatic weighing. Percent body fat was then calculated from body density and total body water. While total body weight remained stable to maintain baseline body weight, it was found that FM decreased ($1.8 \pm 0.4$ kg, $p < 0.001$) and FFM increased ($1.4 \pm 0.4$ kg, $p < 0.01$). The major conclusion of this study was that RT was an effective way to increase energy requirements, decrease body FM, and maintain metabolically active tissue mass in healthy older people, and therefore RT may be useful as an adjunct to weight-control programs for older adults. While this study did include a dietary component unlike the previously mentioned studies, the sole focus was on dietary protein and participants consumed enough to maintain baseline body weight. Additionally, the participants of this study were not overweight or obese. The examination of a similar RT protocol with the addition of a dietary component directed towards weight loss may prove this an efficacious strategy for a weight-loss program for older overweight and obese adults (Campbell and Leidy 2007).

One study which sought to combine healthy eating along with RT in order induce weight loss was conducted by Dunstan and colleagues, who examined the effects of a six month randomized controlled trial of high-intensity progressive RT combined with dietary-induced moderate weight loss on body composition in previously sedentary and overweight older men and women with type 2 diabetes. Participants were between the ages of 60 and 80 years of age and were randomized to a high-intensity progressive RT program plus moderate weight loss, or to a moderate weight loss control program. All participants were placed on a healthy eating plan, supplying ≤ 30% of total energy intake from fat (< 10% from saturated fat), and the remainder of intake distributed between carbohydrates and protein. This plan was designed to elicit a moderate weight loss and was individually prescribed by a dietitian. In addition to the healthy eating plan participants in the control program attended the exercise laboratory on three nonconsecutive days per week where they cycled on a stationary bike with no workload for five minutes followed by approximately 30 minutes of static stretching. In addition to the healthy eating plan participants in the RT group attended the exercise laboratory three nonconsecutive days per week. During each session participants warmed up for five minutes cycling followed by approximately 45 minutes of high-intensity RT followed by a five minute cool down. Each session included nine RT exercises of three sets of 8-10 repetitions. The first two weeks participants' resistance was 50 to 60% of the individual's one repetition maximum, thereafter the goal was to achieve resistance loads between 75 and 80% of their one repetition maximum. Height, weight, BMI, and waist circumference were all measured by standard procedure. Additionally, FM and lean mass were measured by DXA. After six months of RT similar reductions were seen between groups in body weight and FM. In contrast, FFM increased in the group with RT in addition to healthy eating ($0.5 \pm 1.1$ kg), and decreased in the group with healthy eating alone ($0.4 \pm 1.0$ kg), ($p < 0.05$ between groups). The results of this study indicated that high-intensity progressive RT, in combination with moderate weight loss, was effective in attenuating lean mass loss, and therefore is a feasible component in a management program from type 2 diabetes in older adults. While this study demonstrated the effectiveness of a combined RT and diet intervention, this study was held in a clinical setting, therefore the feasibility and generalizability of applying this in a community setting to a widespread number of individuals cannot be fully determined (Dunstan, Daly et al. 2002).

It is important to encompass the many aspects of the interventions mentioned above to develop the most effective intervention to improve health, encourage weight loss through RT and diet, all while maintaining FFM in an older adult population. The DASH diet has been reported to be effective at improving several health conditions (Appel, Champagne et al. 2003). Therefore, combining RT and the DASH diet may be an effective approach to achieving improvements in body composition and physical function in overweight and obese older adults. Thus far only one known investigation has examined the additive benefits of RT and the DASH diet in older adults. Avila and colleagues conducted a study to investigate the effects of a 10-week RT and dietary intervention on body composition and physical function in a cohort of overweight and obese adults aged 60-75 years. Participants were randomly assigned to either the experimental group which completed three RT exercise sessions per week and 30 minutes of dietary intervention on a modified version of the DASH diet, or the control group which received the 30 minutes per week of dietary intervention alone. While there were no significant weight loss differences between the DASH-RT and DASH groups following the intervention, the experimental group demonstrated a significantly greater reduction in body fat following the intervention compared to the control group (-4.1 ± 0.9 vs. -0.2 ± 1.0 kg, $p = 0.005$). Also, a significant difference between groups was observed in lean mass, as the experimental group attenuated reductions while the control group experienced a significant decrease (+0.8 ± 0.4 vs. -1.4 ± 0.4 kg, $p = 0.002$). Additionally, significant improvements were observed in the experimental group in maximal muscle strength and several indices of functional performance (Avila, Gutierres et al. 2010). Thus, a combined exercise and dietary intervention that decreases body fat while maintaining skeletal muscle function may result in considerable health benefits for overweight and obese older adults. It has been shown that RT has a favorable influence on physical function and body composition in older adults, but weight loss is still recommended as the optimal strategy for facilitating reductions in body mass and FM (Delmonico and Lofgren 2010). Therefore, programs that promote RT and dietary-induced weight loss in a community setting may be capable of targeting larger amounts of people while optimizing improvements in body composition in overweight and obese older adults at risk of sarcopenia-related negative health outcomes.

***Community-Based Resistance Training plus Weight Loss Interventions***

Although improvements have been observed in body composition following combined RT and dietary interventions, there is a need for community-based research investigating the combined effects of RT and a dietary-induced weight loss on body composition in overweight and obese community-dwelling older adults. Studies have demonstrated that light resistance training in a community-based setting to be well tolerated and feasible (Mikesky, Topp et al. 1994; Skelton, Young et al. 1995; Bates, Donaldson et al. 2009). Few studies have examined the efficacy of community-based and home-based programs that use a light training stimulus (e.g., resistance tubing, ankle cuff weights, elastic bands) for improving strength and function in the elderly population, but none thus far have examined the efficacy of such programs in improving body composition in an overweight and obese cohort.

Additionally, Rogers, Sherwood, Rogers, and Bohlken conducted a randomized, controlled trial to evaluate the effects of a four-week exercise program utilizing hand-held weights and elastic bands on physical function and muscle strength in a cohort of 22 older (aged 62-94 years) African-American women. During the intervention, participants attended three supervised training sessions per week and completed chair-based exercises for the upper- and lower-body using elastic bands and dumbbells. Physical function was measured via the 8-foot up-and-go test, a timed five-chair stand test, and a 30-second chair stand test while handgrip strength was assessed to provide an index of muscle strength. Following the four-week intervention period, significant improvements were observed in multiple measures of physical function and muscular strength. Height and weight were measured and BMI was calculated as an estimate of body composition, no significant changes were observed in these measures, but it is of importance to note that these participants were not overweight. These findings suggest that performing light RT using elastic bands and hand-held weights is an effective strategy for promoting improvements in physical function and muscle strength in older African-American women. It is of importance to note that this community-based RT training intervention lacked a dietary component in the intervention (Rogers, Sherwood et al. 2002).

Fitzpatrick and colleagues investigated the effects of a community-based physical activity program that encouraged increased consumption of fruits and vegetables on functional performance in men and women aged 60 years and older. The four-month intervention was comprised of chair-based exercises, promotion of walking, use of a pedometer, and monitoring of daily steps. Participants also received weekly dietary education that provided strategies for increasing consumption of fruits and vegetables. Physical function was assessed via the short physical performance battery and participants were categorized as poor, moderate, or good. Following the intervention, the cohort demonstrated a significant improvement in SPPB total score. Additionally, a significant increase was observed in the percentage of participants who were categorized as having good physical function. While these findings of this investigation suggest that a community-based intervention that integrates chair-based exercises and walking promotion is an efficacious stimulus for eliciting improvements in physical function in overweight older adults, it is important to note that body composition was not assessed in this investigation. There is a need for developing an intervention that measures body composition effectively to fully measure weight loss in aspects of FM and FFM (Fitzpatrick, Reddy et al. 2008).

Although favorable alterations in muscle strength and physical function have been observed following community-based interventions, there remains a lack of literature reporting the effects of community-based programs that integrate RT and dietary interventions for weight loss on body composition in overweight and obese older adults. The above studies did not incorporate behavioral-based dietary interventions for the purpose of facilitating reductions in FM. Additionally, Rogers et al., 2002 did not include men in their intervention, and only the investigation conducted by Fitzpatrick and associates, 2008 involved an overweight cohort, but did not assess weight loss. Thus, there is a need to establish the effectiveness of community-based RT and dietary education programs for improving body composition in overweight and obese older men and women.

***Conclusion***

Obesity and sarcopenic-obesity both play a significant role in the development of many adverse health outcomes, chronic diseases, functional limitations, physical disability and subsequent institutionalization or mortality in community-dwelling older adults, representing a major public health problem for the aging U.S. population. Dietary modifications for weight loss are a proven efficacious strategy for facilitating meaningful improvements in body composition. Additionally, RT has been shown to be an efficacious modality for delaying and treating sarcopenia-related decrements in muscle strength and physical function and limited evidence as to the efficacy of RT facilitating meaningful weight loss. However there is currently a lack of literature regarding the potential additive benefits of a program which incorporates RT and dietary changes on body composition on older adults in a community-based setting.

Thus, an investigation as to whether or not an effective community-based intervention that integrates a combination of RT and dietary modifications is capable of producing favorable changes in body composition (with the potential to prevent subsequent negative health outcomes) would be of paramount importance for the health of overweight and obese older adults in the U.S.

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## Appendix B: Detailed Phone Interview

Subject Name: ______________________ Eligible to Participate: ___ Yes ___ No
Date of Interview: ____________________ ___Need More Information or Review

University of Rhode Island

**THE UNIVERSITY OF RHODE ISLAND DIETARY EDUCATION AND ACTIVE LIFESTYLE (UR-IDEAL) STUDY PHASE II**

**Data Sheet for Detailed Subject Telephone Interview**

**AGE: ___________________**

- **Brief Explanation of Study**
- **Permission to Conduct Interview?** _____ Yes _____ No

Comment: __________________________________________________________________

- **Contact Information**

Name: Dr./Mr./Mrs./Ms. _______________________________________________________
Address: __________________________________________________________________
__________________________________________________________________________
Phone #: __________________________________________________________________
E-Mail: ___________________________________________________________________
Best Way and Time to Contact: _________________________________________________

- **Time Commitment** – Available
  ___ Yes ___ No Wants to be contacted after ________(Date) Comment: _________
  _________________________________________________________________

- **Center of Interest**
  Center _________________________ Session time is convenient: Yes ___ No ___

- **Age**
  Age: _____ yrs Date of Birth: ____/____/____

  Approximate Height: ______________ Approximate Weight: ________________

- **Race:**

___American Indian or Alaskan Native
___Asian or Pacific Islander
___Black, not of Hispanic origin
___Hispanic
___White, not Hispanic origin
___Other/Unknown

- **Smoking**
  Always Non-Smoker________ Non-Smoker for ________ Smoker for _________

- **Physical Activity**
  Sedentary Lifestyle_____ Sedentary Lifestyle for ___________________________________
  Active_____ Describe: _______________________________________________
  ______________________________________________________________________

Name: ________________________________________

Participates in regular, vigorous regular exercise? ______ Describe: ____________________
____________________________________________________________________________

- **Respiratory Conditions**
  ____No ____Yes (Record on Medical History/Treatment Form)
  Comments: __________________________________________________________________
  ____________________________________________________________________________

- **Heart and Cardiovascular (CV) Problems:**
  Did your doctor ever tell you that you had a heart of CV condition or problem? __Yes __ No
  If yes, what was the date of onset? ________________________________________
  What did the doctor call it? (Angina, heart failure, heart attack, rhythm disturbances, heart murmurs, enlarged heart, diseases of heart valves, others).
  ____________________________________________________________________________
  ____________________________________________________________________________

- **Osteoarthritis/Degenerative Arthritis**
  ___No ___Yes
  If yes, how long and what was the severity ________________________________
  ____________________________________________________________________________

- **High Blood Pressure**
  No_____
  Yes____ Controlled (record High BP and Treatment on Medical History/Treatment Form)
  Yes____ Uncontrolled

Comments: ______________________________________________________________________
________________________________________________________________________________

- **Lower Back Pain**
  ____No ____Yes
  If yes, how severe? ______________________________________________________

- **Frailty**
  No Incidents______
  Fracture as Adult? _____ Describe: ________________________________________
  ____________________________________________________________________________
  > 2 Falls in One Year? ______ Describe: ____________________________________
  ____________________________________________________________________________
  Comments: __________________________________________________________________
  ____________________________________________________________________________

- **Diabetes**
  ______ No
  ______ Yes – Type II. If type II, taking insulin now? __________________________

  ______ Yes – Type I – (Insulin Dependent – not qualified for the UR-IDEAL study)
  Comments: __________________________________________________________________
  ____________________________________________________________________________

- **Orthopedic Conditions (knee, neck, or back pain)**
  _____No

_____Yes (Record on Medical History/Treatment Form)
Comments: ______________________________________________________________
Name: _______________________________________

- **Surgical History**
  ___No ___Yes
  If yes, what type (surgeries of the joints, heart surgeries, angioplasty, bypass surgery, pacemakers) _____________________________________________________________
  _________________________________________________________________________

- **Other Medical Conditions**
  _____ No
  _____ Yes (Record on Medical History/Treatment Form)
  Comments:
  __________________________________________________________________
  _________________________________________________________________________
  ___

- **Information on where to send Physician Clearance Form**
  Name of Physician: __________________________________________________
  Specialty of Physician: _______________________________________________
  Phone Number: _____________________________________________________
  Fax Number: _______________________________________________________
  Address (if phone and fax unknown): ___________________________________
  _________________________________________________________________
  _________________________________________________________________

- **Summary**

Interviewer Printed Name: _____________________________________________________

Interviewer Signature: _________________________________________________________

Questions/ Comments: ___________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Reviewer Initials: ________

_______ Appears to Qualify _______ Needed More Information
_______ Needs Drs. Delmonico or Lofgren Review _____ Not Qualified

Questions/Comments: ____________________________________________________________
_________________________________________________________________________________

| | |
|---|---|
| **Name** | |
| **Date** | |
| **Sex/Age** | |
| **Interviewer** | |
| **Date Submitted** | |

| Date of Dx | Condition | Severity | Rx | Dose | Will Change |
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## Appendix C: Medical History form

The University of Rhode Island Dietary Education and Active Lifestyle (UR-IDEAL) Study

Name:____________ Sex: M F Initials: ___ ____ ____ ID#: _________

Name of Interviewer:______________________

Emergency contact name, address, and phone:

_________________________________

_________________________________

_________________________________

_________________________________

**DIRECTIONS:** Read the following questions out loud to each prospective volunteer and check "yes" or "no". Any answers that require qualification should be written in the space below the question or on the back of the sheet.

YES NO

**Section A**

**Musculoskeletal System:**

Have you ever been told by your doctor that you have any of the following

a. Osteoarthritis or degenerative arthritis ___ ___
b. Rheumatoid arthritis ___ ___
c. Osteoporosis ___ ___
d. Spondylitis ___ ___
e. Unknown or other type of arthritis ___ ___
f. Any other disease of joint or muscle ___ ___

Comments:_____________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

YES NO

**Section B**

**Cardiovascular System:**

1. Has any family member had a heart attack prior to the age of 55? ___ ___
   a. If so, how are they related to you?
2. Have you ever had frequent cramping in your legs while resting? ___ ___
   a. If yes, is it a current problem? ___ ___

3. Have you ever had pain or cramping in your legs while resting? ___ ___
    a. If yes, is it a current problem? ___ ___
4. If yes, is this pain relieved by rest or by discontinuing your walk? ___ ___
5. Have you ever been told that you have high blood pressure? ___ ___
    a. If yes,
        i. What was the date of onset? Diagnosis____________________
        ii. Were you given any medications?
6. Did a doctor ever tell you that you had a heart problem? ___ ___
    a. If yes,
        i. What was the date of onset? Diagnosis_____________________
        ii. What did the doctor call it? Angina, heart failure, heart attack, rhythm disturbances, heart murmurs, enlarged heart, diseases of heart valves, others.
        iii. Were you given any medications? ___ ___
        iv. Abbreviation, another name?______________________________
        v. Was Echocardiography ever done? ___ ___
7. Have you ever had any chest pain or discomfort other than breast pain (in women) or pain and discomfort due to a respiratory or digestive problem? ___ ___
    a. If yes,
        i. What was the month and year of the first occurrence__________
        ii. What was the month and year of the most recent occurrence__________________
        iii. How would you describe the pain or discomfort? Pressure, burning, squeezing, piercing, stabbing, shooting, or sticking_____________________________________________
        iv. How many minutes did it last?
        v. Does the pain or discomfort move? If yes, to where?
        vi. Does the pain or discomfort tend to occur:
            1. After meals ___ ___
            2. At nigh ___ ___
            3. When exercising ___ ___
            4. When walking in cold, windy weather ___ ___
            5. When upset, excited, or nervous ___ ___
            6. Other ___ ___
        vii. Is this pain relieved by
            1. A change in posture ___ ___
            2. Rest ___ ___
            3. Physical activity ___ ___
            4. Bicarbonate of soda, tums, antacids ___ ___
            5. Prescribed medications ___ ___
            6. Other____________
        viii. Did you ever consult a doctor for this pain or discomfort? ___ ___
            1. If yes,
                a. What was the diagnosis? ___ ___

b. Where you given any medications? ___ ___

8. Do you have any history of high cholesterol in your blood as evident by previous blood lipid tests?

   Comments:________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

YES NO

**Section C**

**Respiratory System:**

1. Have you ever had a persistent cough with sputum production (on most days) for 3 months or 2 consecutive years? ___ ___
   a. If yes,
      i. How long did it last?
      ii. Did your doctor prescribe any medications?
2. Have you ever had attacks of wheezing? ___ ___
   a. If yes,
      i. Is it seasonal/periodic? ___ ___
      ii. Have you ever required hospitalization to treat an acute attack? ___ ___

Comments:________________________________________________________________
________________________________________________________________

YES NO

**Section D**

**Endocrine System:**

1. Have you ever had any of the following problems?
   a. Thyroid problems? ___ ___
   b. Adrenal problems? ___ ___
   c. Diabetes mellitus? ___ ___
      i. If yes, which type? Type I or Type II
      ii. Date of onset______________________
      iii. Were you on any medications, diet control ___ ___

YES NO

**Section E**

**Reproductive System:**

Menstrual History

a. Have you attained menopause? ___ ___
    a. If so, move on to question b and then to section F. If not, proceed to the question c.
b. Are you on Hormone Replacement Therapy? ___ ___

Comments:______________________________________________________________
________________________________________________________________________
________________________________________________________________________

YES NO

**Section D**

**Neurological System:**

1. Do you have any problems with your memory? If yes, ___ ___
    a. When answering the telephone, do you recall what you were doing before it rang? ___ ___
    b. If someone calls you, can you give the directions to your house? ___ ___
    c. Can you keep appointments without a reminder? ___ ___
    d. Can you remember what clothes you wore yesterday? ___ ___

    If the subjects answers "no" to any of the above questions
2. Any problems with vision other than corrective lens changes? ___ ___

    Do you have:

3. Ringing in your ears? ___ ___
4. Faintness (other than feeling faint when changing posture) ___ ___
5. Vertigo (a feeling of spinning, or unsteadiness) ___ ___
6. Fainting spells (black outs) ___ ___
7. Seizure or convulsions ___ ___
8. Migraine or severe headaches? ___ ___
9. Paralysis of arm or leg? ___ ___
10. A head injury with loss of consciousness? ___ ___
11. Pain, numbness or tingling in your arm or hand? ___ ___
12. Pain in your lower back? ___ ___
13. Kidney stones? ___ ___

14. Ruptured vertebral disc in neck or back? ___ ___
15. Do you have pain in any part of your body including headaches while exercising? ___ ___
16. Numbness or pain in your legs? ___ ___
17. Have you been told that you have peripheral neuropathy? ___ ___
18. Tremors? ___ ___
19. Problems with walking? If yes, ___ ___
    a. Do you fall frequently? ___ ___
    b. Is your walking problem related to pain, weakness, or loss of balance? ___ ___
20. Parkinson'sDisease? ___ ___
21. Stroke? ___ ___
22. Epilepsy? ___ ___
23. Have you ever had an operation on your skull or brain? ___ ___
24. Do you have multiple sclerosis? ___ ___
25. Have you ever had meningitis or Brain fever? ___ ___
26. Any history of neurological consultation? ___ ___

Comments:____________________________________________________
_____________________________________________________________

YES NO

**Section H**

**Hematology/Immunology/Oncology:**

1. Have you ever been told by your physician that you had a problem with anemia or any disease of the red blood cells or the while blood cells? ___ ___
2. Any family history of this problem? ___ ___
3. Do you have any history of bleeding disorders? ___ ___
4. Have you ever been diagnosed as having cancer? ___ ___
    a. If yes, what type, which site, date of onset?____________________
5. Were you given any medications, radiation or undergone any surgery? ___ ___

Comments:____________________________________________________
_____________________________________________________________

YES NO

**Section I**

**Surgical History:**

1. Have you undergone any surgeries? ___ ___
    a. If yes,
        i. Where and for what purpose?
        ii. Date of surgery?
        iii. Length of stay in hospital?
        iv. Any complications of surgery?

Comments:______________________________________________________________
________________________________________________________________________

Has your doctor ever told you that you have been suffering from:

1. Cystic medial degeneration ___ ___
2. Any other connective tissue disorder? ___ ___
3. Has any of your family members had an intracranial aneurysm or bleeding? ___ ___
4. Have you ever been diagnosed with an abdominal aneurysm? ___ ___
5. Do you have a:
    a. History of severe pain in the abdomen? ___ ___
        i. If yes, please specify
    b. Do you have a history of severe headache? ___ ___
        i. If yes, what was the date of onset?________________
        ii. Was it associated with neurological signs like blurred vision, nausea/vomiting, seizures, drowsiness, memory impairment, sensory or motor loss (weakness)? ___ ___
        iii. Was it a new or different type of headache other than tension, migraine, etc? ___ ___
        iv. Was it the worst ever experienced? ___ ___
        v. Did it occur after exertion, coughing, or straining? ___ ___

YES NO

**Section J**

Do you have any other health problems no covered in this questionnaire? ___ ___
If yes, please do specify.

Comments:______________________________________________________________
________________________________________________________________________

**Appendix D: Informed Consent**

The University of Rhode Island
Department of Kinesiology
210 Flagg Road, Kingston, RI 02881

Department of Nutrition & Food Sciences
106 Ranger Hall, Kingston, RI 02881

## CONSENT FORM FOR RESEARCH

*Title of Project*: The University of Rhode Island Dietary Education and Active Lifestyle Study II (UR-IDEAL-2).

You have been asked to and have elected to take part in a research project described below. The researchers will explain the project to you in detail. You should feel free to ask questions. If you have more questions later, Drs. Matthew Delmonico (Phone: 401-874-5440) and Ingrid Lofgren (401-874-5706), from the Departments of Kinesiology and Nutrition and Food Sciences at the University of Rhode Island, the persons mainly responsible for this study, will discuss them with you.

*Description of the project:*

You understand that the primary purpose of this study is to assess the role that high-velocity ("muscle power") resistance exercise training plays in improving physical functioning, retaining muscle mass, and improving heart disease risk factors when combined with dietary education for weight loss in overweight and obese older adults. You understand that another purpose of the study will be to assess the influence of intentional weight loss, with resistance exercise training, on changes in body composition, blood pressure, blood sugar metabolism, blood fats, and muscle strength.

*What will be done:*

You understand that if you choose to participate, the study requires your involvement in three phases. During the first phase, you will undergo preliminary testing (a one-hour visit). Your blood pressure, height, weight, waist and hip girths, body composition, muscle strength, and ability to complete selected tasks similar to common activities of daily living will be assessed during this first phase. These activities of daily living tasks include rising from a chair, standing balance tests, and short (4-meter) brisk walks. Any risk of injury during the completion of these tasks will be minimized by having all sessions supervised by an exercise physiologist qualified to direct this type of testing. In addition, you will be asked to complete several questionnaires. These include the National Cancer Institute fat screener questionnaire, a food behavior checklist, a physical activity survey, and a general health survey.

You will also complete two finger sticks that will be used to analyze blood sugar, fats, and C-reactive protein (CRP, a blood protein associated with heart disease risk). Analysis of blood will be conducted using a portable Cholestech machine. For the twelve hours prior to the finger sticks, you will be asked to refrain from eating and/or drinking anything, unless it is plain water. For example, if your finger sticks are scheduled for 10:00am on a Wednesday, you are asked to not eat and/or drink anything besides plain water after 10:00pm on Tuesday evening. We do encourage you to drink as much plain water as you would like. The total amount of blood drawn for these tests over the course of the study will be equivalent to less than one teaspoon.

You understand that trained personnel, using universal precautions and established methods, will conduct the two fingersticks. You understand that the two fingersticks require a very small amount of blood. You understand that there is a risk of bruising, pain, and in rare cases, infection or fainting as a result of blood sampling. However, these risks to you will be minimized by allowing only qualified people to draw your blood.

You understand that strength assessments will be performed using portable devices that measure how much force you can exert force through a typical knee extension motion and your grip strength. You understand that you may experience some temporary muscle soreness as a result of the muscle testing. There is also a risk of muscle soreness or skeletal injury from strength testing as well as from resistance training. The investigators of this study will use procedures designed to minimize this risk.

Your percent body fat will be performed using bioelectrical impedance analysis, which is a battery powered, portable, handheld device that uses a very low electrical current (~ 50 kHz) in order to estimate fat mass and percentage body fat. This test only takes about 10 seconds to complete but is a valid and reliable measure of body composition with very few risks. Even though the risk is low, as a precaution, individuals with a pacemaker will not be tested on the bioelectrical impedance analysis device.

During phase two, you understand that you will be responsible for arriving for intervention group meetings at your senior center two times weekly (days and times vary depending on which senior center you attend), during the time allotted. You will participate in a dietary education program designed to produce a moderate weight loss of 5-10 pounds (about 3-5% of your current weight). You will be encouraged to consume a well-established, lower calorie, balanced diet in which the goal will be to reduce your food intake by about 500 calories per day. You will meet as a group with an expert in nutrition once per week (~ 30 minutes per session following one of your exercise sessions) for ~ 10 weeks who will give you instructions and expert advice on food selection, preparation, and overall lifestyle changes. Your weight will be monitored weekly in order to determine weight change.

In addition, during phase two you will be asked to participate in two (2) supervised exercise sessions per week (~ 30-40 minutes per visit) for the ~ 10-week program. During these sessions, you will receive instructions from trained exercise staff and will undergo resistance exercise training for all of your major muscle groups. Your progress will be monitored and you will always be instructed by an exercise specialist regarding proper use of the equipment and exercise techniques. No special clothing is required. You will also be instructed to stop exercising immediately if you experience chest pain, muscle injuries, or any other unexpected symptoms. Although you will always have supervision when doing resistance exercise training during this study, if you ever experience chest pain while exercising at other times, you should immediately call 911 to seek emergency care and notify your primary care physician. If you have any problems or injuries, you should also notify a member of the study team. Study team members and their phone numbers are noted on the first page of this consent form.

You will be asked to exercise using basic resistance exercise training equipment (e.g. rubber bands, hand and ankle weights), which offers resistance against extending and flexing your arms, legs, and trunk region for approximately 40 minutes or less a day. All sessions will start with a brief warm-up. The first several resistance training sessions will begin with lighter resistances to get you used to the resistance training program. Your blood pressure will also be monitored before and after each training session. Your overall progress will be monitored by an exercise specialist so that you are able to tolerate the exercise.

During phase three, you will repeat the measures that we took during the first phase including height, weight, blood pressure, body composition, muscle strength, ability to complete selected tasks, and questionnaires. You will also complete two more fasting finger sticks (on the same day) that will be used to analyze blood sugar, fats, and CRP.

*Risks or discomfort:*

You understand that it is also possible that heart or blood vessel problems could arise during your participation in the testing or training involved in this study. Although highly unusual, it is possible that these problems could lead to a heart attack or even death. Therefore, prior evaluation and written clearance with a signature from your personal physician will be strongly encouraged for you to participate in this study. You also understand that it is possible that these risks will not be eliminated completely, even with a medical evaluation prior to participation in the study. However, the investigators believe the risk of harm from study participation is small and that the benefits of the study will likely outweigh any potential risks.

*In case there is any injury to the subject:*

In the event of physical injury resulting from participation in this study, upon your consent, emergency treatment will be available at the nearest local hospital with the understanding that any injury that required medical attention becomes your financial responsibility. You understand that the University of Rhode Island at Kingston will not provide any medical or hospitalization insurance coverage for participants in this research study, nor will they provide compensation for any injury sustained as a result of this research study, except as required by law.

You understand that if you are injured while participating in this research project as a result of negligence of all state employees who are involved in this research project, you may be able to be compensated for your injuries in accordance with the requirements of the Federal Tort Claims Act. If you are a federal employee acting within the scope of your employment, you may be entitled to benefits in accordance with the Federal Employees Compensation Act.

If this study causes you any injury, you should call the principal investigators, Drs. Matthew Delmonico at (401) 874-5440 and Ingrid Lofgren at (401) 874-5869. In addition, you may also call the office of the Vice President for Graduate Studies, Research, and Outreach, 70 Lower College Road, University of Rhode Island, Kingston, Rhode Island, telephone: (401) 874-4328.

*Confidentiality:*

You understand that all information collected in this study is confidential, and your name will not be identified and linked to any study data at any time to anyone other than the PIs of the study. All study data, including this consent form, will be locked in a file cabinet and also stored in a study computer with a password secured in our study office (25 West Independence Way, room 225, Kingston, RI 02881).

*Benefits of this study:*

You understand that although this study may help you personally, it may also help the investigators better understand which interventions are the most effective in helping overweight and obese older adults improve their physical function, body composition, and heart disease risk factors. Because of what is already known regarding the individual effects of dietary education for weight loss and resistance exercise training, it is likely that you will notice some benefits. These potential benefits include increased understanding of nutrition, a reduction in overall weight and body fat, and improved mobility.

For your participation in the study and after the study is completed, you will receive, free of charge, information about your blood pressure, blood test results, body composition, muscle strength and power, physical function, and you will be paid in two $25 local supermarket gift cards.

*Decision to quit at any time:*

You understand that is your decision and your decision alone whether or not you consent to participate in this study. You understand that you are free to ask questions about this study before you decide whether or not to consent to participate in it. You understand that if you consent to participate in the study you are free to withdraw from participation at any time without penalty or coercion, or without any requirement that you provide an explanation to anyone of your decision to withdraw.

*Rights and Complaints:*

If you are not satisfied with the way this study is performed, you may discuss your complaints with the principal investigators, Drs. Matthew Delmonico at (401) 874-5440 and Ingrid Lofgren at (401) 874-5869, anonymously, if you choose. In addition, you may contact the office of the Vice President for Graduate Studies, Research, and Outreach, 70 Lower College Road, Suite 2, University of Rhode Island, Kingston, Rhode Island; telephone: (401) 874-4328.

You have read and understand the above information in the Consent Form and have been given adequate opportunity to ask the investigators any questions you have about the study. Your questions, if any, have been answered by the investigators to your satisfaction. Your signature on this form means that you understand the information and you agree to voluntarily participate in this study.

| | |
|---|---|
| ___________________________ | ___________________________ |
| Signature of Participant | Signature of Researcher |
| ___________________________ | ___________________________ |
| Typed/printed Name | Typed/printed name |
| ___________________________ | ___________________________ |
| Date | Date |

***Please sign both consent forms, and keep one for yourself.***

# Appendix E: Medical Clearance

**Medical Clearance to Participate in Weight Loss and Exercise Research Project**

It is my understanding that _________________(name of the volunteer), a patient under my care, has volunteered to participate in a weight loss and exercise study entitled **"The University of Rhode Island Dietary Education and Active Lifestyle (UR-IDEAL) Phase II Study."** The volunteer is strongly recommended to have the clearance of his or her physician to participate in this study.

The aim of this study is to evaluate the impact of a resistance exercise training program when combined with a weight loss (~ 5%-10%) intervention (modified Dietary Approaches to Stop Hypertension – DASH program) in overweight and obese (BMI: 25.0-39.9 kg/m²) men and women.

**Exclusionary criteria for eligibility:**

___ Severe cardiovascular disease
___ Unstable angina
___ Uncontrollable hypertension
___ Uncontrolled dysrhythmias
___ Severe COPD or other signs of significant pulmonary dysfunction
___ Musculoskeletal diseases that cause severe joint pain upon exertion
___ History of bone fragility fracture
___ Having any condition that is likely to be aggravated by muscular exertion
___ Severe stenotic or regurgitant valvular disease
___ Hypertrophic cardiomyopathy
___ Symptomatic peripheral arterial disease
___ Intracranial aneurysm
___ Disease that promote muscle protein breakdown
___ Joint, vascular, abdominal or thoracic surgery in the past year
___ Being unable to engage safely in mild to moderate exercise, such as independently walking up at least one flight of stairs or walking two blocks on level ground.
___ Not within age range for study (55-80 years)

Although we are unaware of any cardiac complications that have resulted from strength testing or resistance exercise training, there is only limited amount of data available in older adults. There is one report of non-fatal subarachnoid hemorrhage associated with strength training in three patients who had pre-existing intracranial aneurysms. For this reason, any patient who has known or suspected intracranial aneurysm or who is at high risk for having an intracranial aneurysm should not participate in this study.

**Please check one of the following:**
**___ Clearance granted**
**___ Clearance not granted**
**___ Please send me the following information about the study:**

Volunteers in this study will participate in a 10-week lifestyle modification program for weight loss and might participate in resistance exercise training under the supervision of exercise specialists trained specifically for this study under the direction of the Principal Investigators, Matthew J. Delmonico, Ph.D., M.P.H., Department of Kinesiology, 25 West Independence Way, University of Rhode Island, Kingston, RI 02881, Ph: (401) 874-5440, and Ingrid E. Lofgren, Ph.D., M.P.H., R.D., Department of Nutrition and Food Sciences, 106 Ranger Hall, University of Rhode Island, Kingston, RI 02881, Ph: (401) 874- 5869.

**Physician's name:** ______________________________

**Physician's signature:** ______________________________ **Date**_______________

**Appendix F: Fasting Assessment**

**Date**: ___________ **Time**: _________ a.m. or p.m. **Visit**: □ Baseline □ Post

**Participant: ___________________ Subject ID No.__________________**

**Interviewer Initials__________________**

**Assessment Checklist**

1. Participant is wearing appropriate clothing and footwear to complete assessment. □ Yes □ No

**Questions to ask participant**

2. At what time did you last have something to eat? _________ a.m. or p.m.

3. At what time did you last have something to drink? _________ a.m. or p.m.

4. Have you had any caffeine, tobacco, or tobacco products today? □ Yes □ No
   If yes, please have participant explain:
   What: _______________________________________
   When: _________ a.m. or p.m.

5. Have you participated in any structured exercise either yesterday or today?
   □ Yes □ No
   If yes, please have participant explain:
   ______________________________________________

6. Are you currently ill? □ Yes □ No

7. Is there any reason you feel you are unable to participate in testing today?
   □ Yes □ No
   If yes, have participant explain:
   ____________________________________________________

8. Has anything changed over the last 3 months that might have affected your weight or body composition? □ Yes □ No
   If yes, have participant explain:

_____________________________________________________________________

_______________________________________________________

9. Please ask participant if there is any additional information they would like to provide to the assessment staff member: ________________________________________________________________ ______________________

**Reasons to Reschedule**

1. Reschedule if participant is wearing clothing and/or footwear that is inappropriate for testing.
2. Reschedule if participant has eaten in the last 4 hours.
3. Reschedule if participant drank something in the last 4 hours (exception water).
4. Reschedule if participant had any caffeine, tobacco, or tobacco products in the last 4 hours
5. Reschedule if participant has participated in structured exercise the day of or day before assessment.
6. Reschedule if the participant is ill.
7. Reschedule if participant states they are unable to participate today.

**Results**

- ❑ Participant is cleared for their assessment today.
- ❑ Participant will need to be rescheduled because ______________________________________________

## Appendix G: Body Composition Data Sheets

**ID#_____________**
**Date____________**
**Center___________**

**Blood Pressure and Questionnaires:**

| | |
|---|---|
| **Blood Pressure 1** | |
| **Blood Pressure 2** | |
| **Y-PAS** | |

**Anthropometrics and Body Composition:**

| | |
|---|---|
| **Height (in)** | |
| **Weight (lbs)** | |
| **Waist Circumference (in)** | |
| **Hip Circumference (in)** | |
| **Pacemaker?** | |
| **Omron- Percent Body Fat (%)** | |
| **Omron- BMI** | |
| **Notes: Clothing, Food, Time of Day, etc.** | |

**Appendix H: Surveys and Questionnaires**

# Dietary Screening Tool

Date________ Participant ID________ Site___________

DIRECTIONS: Please check one response to each question that best describes how you eat.

**How often do you usually eat fruit as a snack?**
____ Never
____ Less than once a week
____ 1 or 2 times a week
____ 3 or more times a week

**How often do you usually eat whole grain breads?**
____ Never **or** less than once a week
____ 1 or 2 times a week
____ 3 or more times a week

**How often do you usually eat whole grain cereals?**
____ Never **or** less than once a week
____ 1 or 2 times a week
____ 3 or more times a week

**How often do you usually eat candy or chocolate?**
____ Never
____ Less than once a week
____ 1 or 2 times a week
____ 3 or more times a week

**How often do you eat crackers, pretzels, chips, or popcorn?**
____ Never
____ Less than once a week
____ 1 or 2 times a week
____ 3 or more times a week

**How often do you eat cakes or pies?**
____ Never
____ Less than once a week
____ 1 or 2 times a week
____ 3 or more times a week

**How often do you eat cookies?**
____ Never
____ Less than once a week
____ 1 or 2 times a week
____ 3 or more times a week

**How often do you eat ice cream?**
____ Never
____ Less than once a week
____ 1 or 2 times a week
____ 3 or more times a week

**How often do you eat cold cuts, hot dogs, lunchmeats or deli meats?**
____ Never **or** less than once a week
____ 1 or 2 times a week
____ 3 or more times a week

**How often do you eat bacon or sausage?**
____ Never **or** less than once a week
____ 1 or 2 times a week
____ 3 or more times a week

**How often do you eat carrots, sweet potatoes, broccoli, or spinach?**
____ Never
____ Less than once a week
____ 1 or 2 times a week
____ 3 or more times a week

**How often do you eat fruit (not including juice)? Please include fresh, canned or frozen fruit.**
____ Never **or** Less than once a week
____ 1 or 2 times a week
____ 3 to 5 times a week

____ Every day or almost every day

**How often do you eat hot or cold breakfast cereal?**
____ Never
____ Less than once a week
____ 1 or 2 times a week
____ 3 to 5 times a week
____ Every day or almost every day

**How often do you drink some kind of juice at breakfast?**
____ Never **or** Less than once a week
____ 1 or 2 times a week
____ 3 to 5 times a week
____ Every day or almost every day

**How often do you eat chicken or turkey?**
____ Never **or** less than once a week
____ 1 or 2 times a week
____ More than 3 times a week

**How often do you drink a glass of milk?**
____ Never **or** Less than once a week
____ 1 or 2 times a week
____ 3 to 5 times a week
____ Every day or almost every day
____ More than once every day

**Do you usually add butter or margarine to foods like bread, rolls, or biscuits?**
____ Yes
____ No

**Do you usually add fat (butter, margarine or oil) to potatoes and other vegetables?**
____ Yes
____ No

**Do you use gravy (when available) at meals?**
____ Yes
____ No

**Do you usually add sugar or honey to sweeten your coffee or tea?**

____ Yes
____ No

**Do you usually drink wine, beer or other alcoholic beverages?**

____ Yes
____ No

**How often do you eat fish or seafood that <u>IS NOT</u> fried?**

____ Never
____ Less than once a week
____ Once a week
____ More than once a week

**How many servings of milk, cheese, or yogurt do you usually have each DAY?**

____ None
____ One
____ Two or more

**How many different vegetable servings do you usually have at your main meal of the day?**

____ None
____ One
____ Two
____ Three or more

**Which of the following best describes your nutritional supplement use.**

____ I don't use supplements
____ I use supplements other than vitamins and mineral
____ I use a multivitamin/mineral preparation (e.g. Centrum)

YALE PHYSICAL ACTIVITY SCALE

Interviewer: I will ask you about some common types of physical activities. Please tell me if you did them during a typical week in the last month. Our interest is learning about the types of physical activities that are a part of your regular work and leisure routines.
For each activity you did, please tell me how many hours you spent doing the activity during a typical week.

**Work: (Number of hours per week)**

1. _____ Shopping (e.g., grocery shopping, clothes)

2. _____ Stair climbing while carrying a load

3. _____ Laundry (time loading, unloading, hanging, folding only)

4. _____ Light housework: tidying, dusting, sweeping, collecting trash in home; polishing; indoor gardening; ironing

5. _____ Heavy housework: vacuuming, mopping; scrubbing floors and walls; moving furniture, boxes, or garbage cans

6. _____ Food preparation (10+ minutes in duration): chopping, stirring, moving about to get food items, pans

7. _____ Food service (10+ minutes in duration): setting table; carrying food; serving food

8. _____ Dish washing (10+ minutes in duration): clearing table; washing/drying dishes, putting dishes away

9. _____ Light home repair: small appliance repair; light home maintenance and repair

10. _____ Heave home repair: painting, carpentry, washing/polishing car

11. _____ Other: ________________________________________

**Yard Work: (Number of hours per week)**

12. _____ Gardening: planting, weeding, digging, hoeing

13. _____ Lawn mowing (walking only)

14. _____ Clearing walks/driveway: sweeping, shoveling, raking

15. _____ Other: ________________________________________

**Caretaking: (Number of hours per week)**

16. _____ Older or disabled person (lifting, pushing wheelchair)

17. _____ Childcare (lifting, carrying, pushing stroller)

**Exercise: (Number of hours per week)**

18. _____ <u>Brisk</u> walking (10+ minutes in duration)

19. _____ Pool exercise, stretching, yoga

20. _____ Vigorous calisthenics, aerobics

21. _____ Cycling, exercycle

22. _____ Swimming (laps only)

23. _____ Other: _________________________________

**Recreational Activities: (Number of hours per week)**

24. _____ Leisurely walking (10+ minutes in duration)

25. _____ Needlework: knitting, sewing, needlepoint, ect.

26. _____ Dancing (mod/fast): line, ballroom, tap, square, ect.

27. _____ Bowling, boccie

28. _____ Golf (walking to each hole only)

29. _____ Racquet sports: tennis, racquetball

30. _____ Billiards

31. _____ Other: _________________________________

## YALE PART 2

**Now I would like to ask about certain types of activities that you have done *during the past month.* I will ask you about how much vigorous activity, leisurely walking, sitting, standing, and other things that you usually do.**

32. About how many times during the month did you practice in *vigorous* activities that lasted at least *10 minutes* and caused large increases in breathing, heart rate, or leg fatigue *or* caused you to sweat?

| | | | | |
|---|---|---|---|---|
| Not at all<br>(go to Q34) | 1-3 Times Per Month | 1-2 Times Per Week | 3-4 Times Per Week | 5 or more Times Per Week |

33. About how long do you do this vigorous activity each time?

| | | | |
|---|---|---|---|
| Not applicable | 10-30 minutes | 31-60 minutes | 60 or more minutes |

34. Think about the walks you have taken during the past month. About how many times per month did you walk for *at least 10 minutes* or more *without stopping* which *was not* strenuous enough to cause large increases in breathing, heart rate, or leg fatigue *or* cause you to sweat?

| | | | | |
|---|---|---|---|---|
| Not at all (go to Q36) | 1-3 Times Per Month | 1-2 Times Per Week | 3-4 Times Per Week | 5 or more Times Per Week |

35. When you did this walking, for how many minutes did you do it?

| | | | |
|---|---|---|---|
| Not applicable | 10-30 minutes | 31-60 minutes | 60 or more minutes |

36. About how many hours a day do you spend moving around on your feet while doing things? Please report only the time you are *actually moving.*

| | | | | | |
|---|---|---|---|---|---|
| Not at all | Less than 1 hr per day | 1 to less than 3 hrs per day | 3 to less than 5 hrs per day | 5 to less than 7 hrs per day | 7 + hrs per day |

37. Think about how much time you spend standing or moving around on your feet on an average day during the past month. About how many hours per day do you *stand?*

| | | | | | |
|---|---|---|---|---|---|
| Not at All | Less than 1 hr per day | 1 to less than 3 hrs per day | 3 to less than 5 hrs per day | 5 to less than 7 hrs per day | 7+ hrs per day |

38. About how many hours did you spend sitting on an average day during the past month?

| | | | | |
|---|---|---|---|---|
| Not at All | Less than 3 hrs | 3 hrs to less than 6 hrs | 6 hrs to less than 8 hrs | 8+ hrs |

39. About how many flights of stairs do you climb *up* each day?
(Let 10 steps= 1 flight) ____________________
40. Please compare the amount of physical activity that you do during other seasons of the year with the same amount of activity you just reported for a typical week in the past month. For example, in the summer, do you do more or less activity than what you reported doing in the past month? (Interviewer – mark the right category for each season)

| | Lot More | Little More | Same | Little Less | Lot Less |
|---|---|---|---|---|---|
| Spring | 1.3 | 1.15 | 1 | .85 | .7 |
| Summer | 1.3 | 1.15 | 1 | .85 | .7 |
| Fall | 1.3 | 1.15 | 1 | .85 | .7 |
| Winter | 1.3 | 1.15 | 1 | .85 | .7 |

41. What is the highest level of education you have completed?

________Less than some high school

________High School/GED

________Some college

________2 year college degree (associates)

________4 year college degree (BA/BS)

________Master's Degree

________Doctoral Degree

________Professional Degree

## Appendix I: Resistance Training Protocol

Leg Press: Option 1 – Unilateral Resisted Knee Press (AROM or Tubing)

- Sitting in chair
- Loop tubing around the bottom of the foot as shown
- Hold tubing in both hands
- Begin with knee at approximately 90 degrees of flexion
- Push leg down straightening at knee
- Slowly return leg to starting position; repeat
- 2 sets of 8-12 repetitions
- 1 repetition every 4 seconds: ~1sec. or less concentric, 3 sec. eccentric
- 1 minute rest interval between sets
- Repeat both sides

Leg Press: Option 2- Resisted Bilateral Knee Squat (AROM or Dumbbell)

- Standing
- Hold weights in both hands with arms by side
- Slowly bend knees to approximately 90 degrees
- Straighten knees quickly
- Repeat
- 2 sets of 8-12 repetitions
- 1 repetition every 4 seconds: ~1sec. or less concentric, 3 sec. eccentric
- 1 minute rest interval between sets

Knee Extension: Unilateral Resisted Knee Extension (AROM or Tubing)

- Sitting in chair
- Attach Elastic to ankle of involved leg
- Secure behind leg of chair as shown
- Sit with both legs bent to 90 degrees
- Straighten involved leg at the knee
- Slowly return to start position
- 2 sets of 8-12 repetitions
- 1 repetition every 4 seconds: ~1sec. or less concentric, 3 sec. eccentric
- 1 minute rest interval between sets
- Repeat both sides

Leg Curl: Unilateral Resisted Knee Flexion Standing Behind Chair (AROM or Tubing)

- Stand behind chair holding the back for support
- Attach elastic to chair leg
- Loop tubing around ankle
- Bend knee backwards (heel to buttock)
- Slowly return leg to starting position
- 2 sets of 8-12 repetitions
- 1 repetition every 4 seconds: ~1sec. or less concentric, 3 sec. eccentric

- 1 minute rest interval between sets
- Repeat both sides

Overhead Press: Option 1-Unilateral Overhead Press (AROM or Dumbbell)

- Done sitting or standing
- Hold the weight in the hand of the involved arm with arm at side and elbow bent as shown
- Lift weight up and over head (fist to ceiling)
- Return arm to starting position
- Alternate arms
- 2 sets of 8-12 repetitions
- 1 repetition every 4 seconds: ~1sec. or less concentric, 3 sec. eccentric
- 1 minute rest interval between sets
- Repeat both sides

Overheard Press: Option 2- Bilateral Resisted Overhead Press (AROM or Dumbbell)

- Stand with feet hip width apart
- Hold weights in hand as shown with palms forward
- Raise both arms straight up overhead towards the ceiling
- Slowly lower to starting position
- 2 sets of 8-12 repetitions
- 1 repetition every 4 seconds: ~1sec. or less concentric, 3 sec. eccentric
- 1 minute rest interval between sets

Overhead Press: Option 3- Bilateral Resisted Overhead Press with Tubing

- Stand on tubing with both feet
- Grasp tubing in hands with arms at side and elbows bent as shown
- Push arms straight up overhead
- Slowly return to start position
- 1 repetition every 4 seconds: ~1sec. or less concentric, 3 sec. eccentric
- 1 minute rest interval between sets

Chest Press: Wall Pushups

- Stand facing the wall approximately 12-18 inches away
- Place hands on the wall at shoulder height approximately shoulder width apart
- Slowly bend elbows bringing face towards wall
- Push against the wall back to starting position; repeat
- 2 sets of 8-12 repetitions
- 1 repetition every 4 seconds: ~1sec. or less concentric, 3 sec. eccentric
- 1 minute rest interval between sets

Lat Pull-down/Rows: Unilateral Resisted Shoulder Bent Row (Tubing or Dumbbell)

- Secure tubing under uninvolved foot
- Hold tubing in involved arm
- Slightly bend hips and knees
- Support upper body with other arm as shown
- Pull up on tubing raising elbow to shoulder height, not allowing trunk to twist
- Slowly return to start position
- 2 sets of 8-12 repetitions
- 1 repetition every 4 seconds: ~1sec. or less concentric, 3 sec. eccentric
- 1 minute rest interval between sets
- Repeat both sides

Abdominals: Unilateral Resisted Lumbar Side Bend (AROM, Tubing, or Dumbbell)

- Stand holding tubing in involved hand secure other end of tubing below foot on the same side
- Bend to opposite side of tubing keeping involved arm straight
- Slowly return to start position and repeat
- 2 sets of 8-12 repetitions
- 1 repetition every 4 seconds: ~1sec. or less concentric, 3 sec. eccentric
- 1 minute rest interval between sets
- Repeat both sides

## Appendix J: Dietary Intervention Outline

Week 1: Introduction to Study and Introduction to DASH Diet

I. Welcome
II. Introduction to the Study
III. Introduction to the DASH Diet
    a. Grains
    b. Vegetables
    c. Fruits
    d. Dairy
    e. Meats, Poultry, Fish
    f. Nuts, Seeds, Legumes
    g. Fats and Oil
    h. Sweets and Added Sugars
    i. Other Important DASH Recommendations
IV. Importance of Following the DASH Diet
V. Goal Setting
VI. Wrap up

Week 2: Eating Out the Healthy Way and Eating Healthy During the Holidays

I. Review of Previous Session
II. Discussion of Some Barriers to Staying on a Healthy Eating Plan While Eating Out or During the Holidays
III. Tips for Eating Out
IV. Tips for Preparing Healthier Holiday Meals
V. Discussion of Lower Calorie Alcoholic Beverages
VI. Goal Setting
VII. Wrap up

Week 3: Cutting Calories, Healthy Food Substitutions, Food Label Reading

I. Review of Previous Session
II. Nutrient Density
III. Cutting Calories
IV. Healthy Food Substitutions
V. Food Label Reading
VI. Goal Setting
VII. Wrap up

Week 4: Fruits and Vegetables

I. Review of Previous Sessions
II. DASH Diet Recommendations for Fruits and Vegetables
    a. Food Preparation

III. Goal Setting
IV. Wrap up

Week 5: Grains and Protein

I. Review of Previous Session
II. Whole Grains
III. Refined Grains
IV. Protein
V. Goal Setting
VI. Wrap up

Week 6: Fats

I. Review of Previous Session
II. Fat
    a. Saturated
    b. Unsaturated
    c. Trans fatty acids
    d. Cholesterol
III. Goal Setting
IV. Wrap up

Week 7: Dairy

I. Review of Previous Session
II. Dairy
III. Goal Setting
IV. Wrap up

Week 8: Maintenance of Lifestyle Changes and DASH Diet Review

I. Review of All Sessions
II. Maintaining Lifestyle Changes

## Appendix K: Participant Food Log

| Foods and Beverages | Amount | Grains | Veggies | Fruits | Low-fat Dairy | Lean meats, fish, poultry | Nuts, seeds, legumes | Fats, oils | Sweets, added sugar |
|---|---|---|---|---|---|---|---|---|---|
| Coffee | 12 oz | | | | | | | | |
| With cream and sugar | 2/1 tbsp | | | | | | | 1 | 1 |
| Pizza with pepperoni | 2 slices | 2 | 0.5 | | | | | 1 | |
| French fries | 2 cups | | 4 | | | | | 4 | |
| Regular Coke | 12 oz | | | | | | | | 3 |
| **Breakfast:** | | | | | | | | | |
| **Lunch:** | | | | | | | | | |
| **Dinner:** | | | | | | | | | |
| **Snacks:** | | | | | | | | | |
| **Day's Total** | | | | | | | | | |
| Compare to DASH Guidelines | | 6-8/day | 4-5/day | 4-5/day | 2-3/day | ≤6/day | 4-5/week | 2-3/day | ≤5/week |
| **Physical Activity Log:** Record the minutes completed of each activity. Recommendation: ≥ 30 min/day on most days, of moderate to vigorous exercise. | | | | | | | | | |

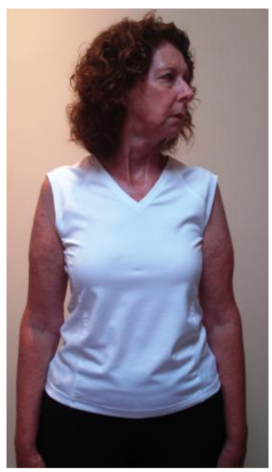
## Appendix L: Stretching Manual

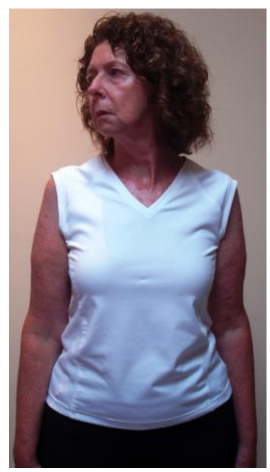
Thing to know before getting started…

- Although stretching does not improve your strength or endurance, it is important because it allows for more flexibility and freedom of movement.
- Always warm up before doing any stretching exercises. You can accomplish this through simple walking or by doing a few strength exercises.
- Stretching exercises should never cause any pain, but mild discomfort and soreness is normal.
- When stretching, move into positions very slowly, and do not force yourself into a position; if it is causing pain, do not repeat the stretch.
- Stretching exercises should be repeated three to five times within a session.
- Each stretching position should be held for 10 to 30 seconds. Relax out of the position and then try to stretch further for another 10 to 30 seconds.

Neck:

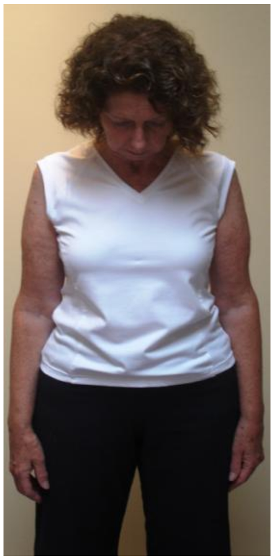
**Look Right and Left**





1. Stand or sit with your head and neck upright.
2. Turn head to the right.
3. Turn head to the left.

**Flexing and Extending**



1. Stand or sit with your head and neck upright.
2. Flex your neck by lowering your head towards your chest. If the chin touches your chest, try to move your chin further down your chest.
3. Extend the neck by leaning your head backwards in an attempt to touch your back with your head.

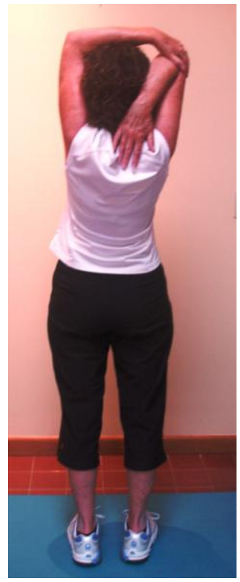
Shoulders and Chest:

**Straight Arms Behind Your Back**

1. While standing, place your arms behind your back.
2. Hold your hands together by interlocking your fingers with your palms facing each other.
3. Straighten your elbows until they are over your head and you feel a stretch.

4. During the stretch keep your neck and head upright and relaxed.
Upper Arm:

**Behind-Neck Stretch (Chicken Wing)**



1. While sitting or standing, lift your right arm over your head and lay your palm on your upper back by bending your elbow.
2. Lift your left arm and grasp your right elbow.
3. Pull the elbow behind your head with your left hand.

Note: Repeat this exercise by now lifting your left arm over your head.

Wrist:

**Wrist Stretch**

1. Place hands together in a praying position, with your fingers pointing upward.
2. Slowly raise your elbows to they are parallel to the floor, keeping your hands flat against each other.

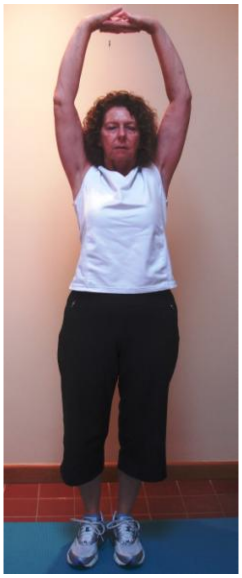
Upper Back:

**Cross Arm in Front of Chest**

1. Stand or sit with your left arm loosely hanging across your chest with the elbow slightly bent.
2. Hold your left arm just above the elbow with your right hand.
3. Pull your left arm across your chest with your right hand.

Note: Repeat with your right arm loosely hanging across your chest.

**Arms Straight Up Above Head (Pillar)**



1. Stand with your arms in front of your body with your fingers interlocked and your palms facing out.

2. Slowly lift your arms above your head while having them stay straight. Have your palms face up while keeping your fingers interlocked.
3. Continue to reach upward with hands and arms for an additional stretch.
4. While reaching upward, also try to reach backward slightly.

Note: It is important to relax your legs and bend your knees to increase your lower back stretch and decrease involvement of your leg muscles.

<u>Hips:</u>

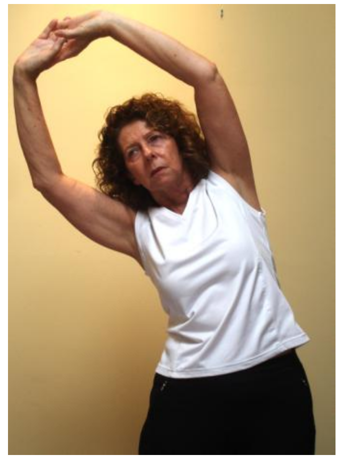
**Forward Lunge (Fencer)**

1. While standing, take a long step forward with your right leg.
2. Bend your right knee until it is directly over the right foot.
3. Keep the right foot flat on the floor.
4. Keep your left (back leg) straight.
5. Keep the back foot pointed in the same direction as the front foot and lift your heel off the floor.
6. Keep your chest upright and rest your hands on your hips or your front leg.
7. Slowly move your hips forward and downward.

Note: Repeat this exercise by putting your left foot forward.

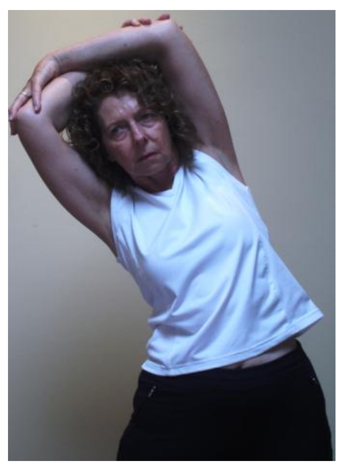
<u>Torso:</u>

**Side Bend with Straight Arms**



1. Stand with your feet hip width apart.
2. Interlock your fingers with your palms facing outward.
3. Straighten your arms and reach them above your head.
4. While keeping your arms straight, lean from the waist to the right side and then to the left.
5. Do not bend your knees during this exercise.

**Side Bend with Bent Arms**



1. Stand with your feet hip width apart.
2. Bend your right arm and raise it over your head.
3. Grasp your right elbow with your left hand and pull the elbow behind your head.
4. Keeping your arms in position, lean from the waist to the left side and then to the right side.
5. Do not bend your knees during this exercise.

Calf:

**Wall Stretch**

1. Stand facing a wall with your feet shoulder width apart and toes close to the wall.
2. Lean forward and place your hands on the wall.
3. Step back 2 feet with your right leg and bend your left knee.
4. Make sure your right heel is on the floor to feel the stretch in your calf muscle.

Note: Repeat this exercise by stepping back with your left leg and bending your right knee.