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Effects of a Community-Based Tai Chi and Dietary Weight Loss Intervention on Body Composition in Obese Older Women

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EFFECTS OF A COMMUNITY-BASED TAI CHI AND DIETARY WEIGHT LOSS INTERVENTION ON BODY COMPOSITION IN OBESE OLDER WOMEN

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ABSTRACT

Background: Obesity is a risk factor for many chronic diseases in older women. Tai Chi is an alternative exercise that has not been thoroughly investigated in this population in a community setting for its effects on body fat mass when combined with dietary weight loss. **Methods:** A 16-week community-based intervention using Tai Chi and behaviorally-based dietary weight loss (TCWL, n=29) in older (68.2 ± 1.5 yr) obese (BMI=35.4 ± 0.8kg/m^2) women was conducted compared to a control group (CON, n=9; BMI=38.0 ± 1.5 kg/m^2; age=65.5 ± 2.7 yr). Primary and exploratory outcomes included were body fat mass, BMI, percent fat (via bioelectrical impedance), fat-free mass, hip circumference, waist circumference, and waist to hip ratio. Participants in the TCWL group engaged in twice weekly Tai Chi sessions (~50 min) and once weekly nutritional weight loss meetings. The CON group was asked to continue with their daily routines. **Results:** The TCWL group did not see changes ($p < 0.05$) when compared to the CON group in weight (-1.6 ± 0.5 kg vs. -1.1 ± 0.9 kg, p=0.66), body fat mass (-3.0 ± 1.5 kg vs. 1.5 ± 2.8 kg, p=0.16), BMI (-0.7 ± 0.2 kg/m^2 vs. -0.4 ± 0.3 kg/m^2 p=0.53), or waist circumference (-4.8 ± 1.2 cm vs. -3.0 ± 2.2 cm, p=0.48). There was also a lack of significant change ($p < 0.05$) between groups in percent body fat (-0.3 ± 0.2 % vs. -0.4 ± 0.4% p=0.10), fat-free mass (-0.7 ± 0.4 kg vs. -0.9 ± 0.7 kg, p=0.81), hip circumference (-0.2 ± 0.8 cm vs. -0.9 ± 1.4 cm, p=0.67) and waist to hip ratio (-0.03 ± 0.01 vs. -0.03 ± 0.02, p=0.69). **Conclusion:** The results from this study show that the combination of Tai Chi and dietary weight loss is not effective in altering key measures of body composition in obese older women. There

is need for further research with more substantial weight loss and when combined with other exercise modalities.

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PREFACE

This thesis is written to comply with the University of Rhode Island graduate school Manuscript Thesis Format. This thesis contains one manuscript: *The Effects of a Dietary and Tai Chi Intervention on Body Composition in Obese Older Women.* This manuscript has been written in a form suitable for publication in *The Clinical Journal of Sport Medicine.*

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INTRODUCTION

The rise in obesity prevalence in the United States has become a public health problem seen more often in older women when compared to younger women (1) as 42.5% of women aged 60-69 yr are currently considered obese (2). Obesity is measured as having a body mass index (BMI) $\geq$ 30 kg/m^2 (1) and is related to an increased risk of excessive body fat mass (3) and chronic diseases (4). Postmenopausal women have a higher rate of disability (5) and show a greater decline in physical function when carrying excess body fat (6). Field et al. (7) found a higher likelihood of chronic disease, including hypertension, heart disease and diabetes, in obese women when comparing overweight and normal weight women (7). The increase in weight in older adults can be attributed to an imbalance of energy expenditure, and while it is considered to be a normal part of the aging process, decreases in their energy expenditure in addition to an increase in food intake often results in a high percentage of body fat (8).

There are numerous treatments for obesity, however not all methods are considered as a safe or effective option as side effects can at times be more dangerous than the benefits of the weight loss (9). Current treatments have included weight loss surgery, however in this population, the potential risk from medications and the procedure is higher when compared with younger populations (10). Research has shown the success of using a diet only intervention for weight loss. However, there are also significant findings in the amount of fat free mass that is lost in this process which can often lead to an age related decrease in muscle mass in older adults; also known as sarcopenia (11). This can be particularly detrimental to older women as

they tend to have less muscle mass then men, so a further loss will only create more health concerns (11). Studies have shown there to be considerable success in the use of regular exercise (most days per week for a total of 150 min/wk) when combined with a well-balanced, hypocaloric diet for losing fat mass and attenuating fat-free mass loss (12). In the past 10 years, the combination of exercise and dietary changes have been widely studied; some have included the use of aerobic exercise, while others used resistance training (13,14,15,16) and have seen successful reductions in body fat. However, there is a need to determine the full complement of exercise modalities to improve body composition in obese older women that are both appealing and feasible (17).

Tai Chi, a form of low-impact exercise based on traditional Chinese martial arts, has become increasingly popular worldwide, especially with older adults (18). Its benefits include improvements in psychological and physiological function, aerobic capacity, muscle strength, and cardiovascular disease risk factors (19), as well as reductions in tension, anxiety and mood disturbance (18). Several other studies (19, 20) have reported that Tai Chi reduces body fat. However these studies did not include a dietary component.

In a recent randomized study by Katkowski et al. (21), the added effects of Tai Chi during dietary weight loss on body composition in obese older women were examined, where the results showed that the combined effect of Tai Chi and weight loss led to a reduction in body weight, BMI, waist circumference, body fat mass, and percent body fat (21). Despite that study showing some improvements in body composition, it is unclear how these laboratory based results would translate into a

community-based intervention. Thus, the purpose of this study was to determine the combined effect of Tai Chi plus behaviorally based dietary weight loss on body fat mass in obese older women in a community-based setting. It was hypothesized that the Tai Chi during dietary weight loss (TCWL) group would have a significant decrease in fat mass compared to a control (CON) group. Exploratory aims were to determine the effect of Tai Chi plus dietary weight loss on other anthropometric measures related to body composition, including waist circumference, retention of lean mass, BMI, and waist-to-hip ratio compared to the CON group.

METHODS

Study Design

This non-randomized, extension intervention study with pre- and post-measures was conducted over a 16-week period at two suburban Rhode Island senior centers. Upon completion of the preliminary interviews and baseline testing, participants were placed in the TCWL or CON group on a first come first served basis. This study was approved by the Institutional Review Board of the University of Rhode Island.

Participants

Each potential participant was required to complete a phone screening, attended an orientation session, complete a medical history, and sign an informed consent. This study's inclusion criteria were 1) females, 2) aged 55-80 years, 3) a BMI of 30.0-50.0 kg/m^2, 4) postmenopausal by self-report, 5) not engaged in a regular physical activity program within the last six months, and 6) weight stable within 5% over the previous three months. The exclusion criteria included 1) significant or suspected cognitive impairment, defined as known diagnosed dementia, 2) severe

hearing loss, speech disorder, language barrier or visual impairment, 3) Progressive, degenerative neurologic disease, 4) terminal illness with life expectancy of < 12 months, as determined by a physician, 5) severe pulmonary disease, uncontrolled diabetes, blood pressure, or anemia, 6) medications not taken for > 3 weeks, lipid lowering medications for > 6 months, 7) major joint, vascular, abdominal, or thoracic surgery within three months, 8) significant cardiovascular disease, 9) inability to safely engage in mild to moderate exercise with muscular exertion. Participants were recruited in the South County and URI area using ads in local newspapers, by word of mouth, through online community sites, flyers sent to the URI faculty, staff, homes in the surrounding area, and posted in the affiliated community centers. If they appeared to qualify, the participants met with a study coordinator to have their height, weight, and BMI measured to ensure that they were qualified. Participants who matched the inclusion criteria were asked to sign an informed consent, and complete baseline testing, and participate in the intervention.

Primary Outcome

Body Fat Mass: Body fat mass, fat-free mass, and percent body fat were measured using a Tanita BF-556 model bioelectrical impedance analysis (BIA) device. This BIA device required each participant's age, gender, height, and activity level to be entered before they stepped on foot-to-foot with bare feet. This BIA device closely resembles a bathroom scale often found at home; it is battery operated and uses a very low (50 kHz) electrical current to pass through the body to determine the resistance and reactance values to calculate the amount of body fat (22). For safety precautions each participant was asked if they have a pacemaker, there were however no

participants to whom this applied. Fat-free mass was calculated by subtracting total fat mass from their weight.

Exploratory Outcomes

The following measures were used for descriptive data and also served as potential covariates in the analyses of the primary and exploratory outcome measures.

Additional Anthropometric Measures: The additional anthropometric measures included in this study were the height (inches) and weight (lbs) taken on a balance-beam scale (Detecto, Webb City, MO, USA) used during the screening measures in pre and post testing, and later converted to centimeters and kilograms for analyses. Hip and waist circumference measures were taken using a Gulick non-stretch tape measure with an attached tensometer (Creative Health Products, Ann Arbor, MI) in inches around the umbilical line, and the broadest part of the hips above the gluteal fold. Each measurement was taken twice to the nearest .25 inch, and the average of the two was recorded and converted to cm for analyses (14). Body mass index, which is a strong predicator of obesity-related health risks, was determined using the standard equation of calculating weight (kg) divided by height (m) squared.

Other Measures

Physical Activity: The Yale Physical Activity Survey (YPAS) was used to evaluate physical activity energy expenditure and has been validated in older adults (23). The YPAS determines total hours of activity as well as total kcal expenditure per week for each individual along with a physical activity index, which assesses the sum of the of 5 groups (vigorous activity, leisurely walking, moving, standing and sitting) to better evaluate activity dimensions (23). The activities included in the

questionnaire include regular physical activity, such as walking and activities of daily living, such as housework (23).

Dietary Intake: Dietary intake was measured using the Dietary Screening Tool (DST). The DST was created to assess diet quality and dietary patterns among older adults and to relate the patterns to markers of general health and nutrition status (24). While a simple tool, it has been shown to be very practical and categorizes older adults into one of the following: at nutritional risk, possible nutritional risk, and not at nutritional risk (24).

Education: The level of education was assessed by a one-question survey. Each participant was given nine options to best describe their highest level of education completed: high school or GED, some college, two-year college degree, four-year college degree, masters degree, doctoral degree, professional degree, or other and asked to specify. For analysis purposes, these groups were consolidated into three groups: 1) High School, GED or Less; 2) Associates or Some College; and 3) Bachelors Degree or Higher.

Group Assignment

After recruitment and baseline testing there were 54 participants, 39 in the TCWL group and 15 in the control group (Figure 1). Participants were placed in their group on a first-come, first-placed basis. Additionally, some participants were eligible but had scheduling conflicts, or there was a lack of room in the intervention site, so they were placed in the control group.

Intervention

Tai Chi: The Tai Chi intervention took place twice per week on non-consecutive days for 16-weeks for the TCWL group. A principal investigator (FX) with over six years of experience in Tai Chi instruction, including extensive Tai Chi experience with obese older women, taught the modified form of the 24-movement Yang style of Tai Chi. Study team members were trained in the Tai Chi protocol to also lead the sessions. Each session began with a warm-up lasting approximately 10 minutes, followed by the 24-movement Yang style Tai Chi, for 30-35 minutes. The session concluded with a 5 minute cool-down of stretches incorporating whole body movements and muscle groups. Study team members worked with participants to teach a progressive approach by increasing the intensity of the exercise gradually over the duration of the study. Using this structured approach allowed the participants to learn the movements in its correct form, while in a safe manner. Once the instructor felt confident the participants had learned enough Tai Chi to be practiced outside the senior center, a DVD including warm-up and the Tai Chi movements were distributed to the intervention group. Participants were asked to practice at home as often as they were able, but there was no required amount of time set to be completed outside of the intervention days. The amount of time practiced at home was recorded once per week before Tai Chi began during the weigh-in sessions. The amount practiced each week at home was recorded as a reference to see how many women were actually applying what they learned in class, to continuing at home. These data were collected solely for the purpose of seeing if the participants were practicing at home, but was not examined in our results. Handouts including pictures and descriptions of each

movement were given to participants with the DVDs to help them learn the Tai Chi forms. During different points in the intervention, incentives were given to the participants in this group that included a study t-shirt, the DVD to practice Tai Chi at home, supermarket gift card, and a binder of nutritional information on the DASH diet.

Behaviorally-Based Weight Loss: The participants in the TCWL group met once per week for a 45-minute dietary meeting over the 16-weeks. Each dietary intervention session took place following a TCWL class where participants' attendance was recorded. If participants were not present at this meeting then a study member phone would later reach them by phone to complete a phone make-up of the session. A modified Dietary Approaches to Stop Hypertension (DASH) diet was implemented through discussion and presentation during the meeting. Each participant received handouts to keep in binders to use as additional information and assistance when applying the diet. Each session was taught by a graduate student in nutritional sciences from the University of Rhode Island and supervised by a registered dietitian. There was a weight loss goal of 5-10% by the end of the intervention and this modified diet had goals of: 1) low intake of saturated fat (≤ 7% of caloric intake) and moderate intake of total fat (≤ 35% of caloric intake); 2) high intake of fresh fruits, vegetables, and whole grains; 3) consumption of low-fat dairy and meat products, and 4) moderate intake of sodium (3,000 mg or less/day). In these dietary sessions, there were also topics on how to estimate portion sizes, healthy choices when dining out or eating in, how to read food labels, decreasing saturated and trans fat via recipe modification, decreasing sodium intake and promoting an increase

in vegetables and fruits, lean meats and dairy. The nutrition study staff monitored all participants' food intake through the use of food logs that participants were encouraged to complete each week and turned in during the following week's session.

Control Group: The CON group of 15 participants was included in the study to help strengthen and improve the design. They did not receive the 16-week intervention or weekly dietary sessions and dietary assessments and were asked to maintain their current daily lifestyles, and upon their participation in post-testing, they received the same incentives as the intervention group. These incentives included a study t-shirt, DVD, supermarket gift card, and a binder of nutritional information on the DASH diet. They were also given an option to participate in two weeks (four sessions) of Tai Chi practice led by study staff at the senior centers upon the conclusion of the post testing.

Statistical Analyses

Sample Size. All of our sample size calculations were completed using the SAS Analyst version 9.2. In order to detect a significant between-group difference in fat mass loss using a statistical power of 0.80 and an alpha to 0.05, we estimated a baseline fat mass value of 45kg. We predicted a change of ~10% total body fat which equaled a 4.6 kg loss of fat mass in the TCWL group. We had no reason to believe there would be any change in the CON group. In order to detect this change with a standard deviation of 3.4, we would have needed a sample size of at least 9 participants per intervention group (25). We also estimated an attrition rate of 15%, but this study was a community extension project, so our goal was to recruit as many participants as possible to maximize the impact on the community.

Data Analysis. The significance was set for $p < 0.05$, and all data was analyzed using SAS version 9.2. Between-group differences in baseline values s were determined using independent samples t-test and were represented using a mean scores and standard deviations. Tests for normality on changes in primary outcome variables were done using a Shapiro Wilk test. Paired samples t-tests were conducted to examine within-group changes for normally distributed data and Wilcoxin Rank Sum tests were run for non-normally distributed data. Outliers were determined in the changes in the primary outcome variables of greater than 3 standard deviations above or below the mean for any data point. All outliers that were found were kept in our final results as this was a community extension study, where the goal was to get as true of a representation of the studied population as possible. Categorical data in the 3 education groups, and the DST measures were analyzed using Fisher's exact test.

Between group differences in changes in outcome measures (including weight, BMI, fat change, body fat mass, fat-free mass, waist circumference, hip circumference, waist to hip ratio, and percent body fat) were determined using analysis of covariance (ANCOVA) adjusted for baseline values. Additionally, because of the variability in weight loss the TCWL group, we stratified participants for further analysis by weight loss of more than 3% (weight losers, TCWL-WL) or not (non weight losers, TCWL-NWL) to better determine the effect of weight loss in those who better complied with the dietary weight loss intervention.

RESULTS

Our final analytical sample size for those who completed this 16-week study was 39 participants; 29 participants in the intervention group and 9 participants in the

control group. Explanations for participant dropouts are shown in the flow chart in Figure 1. There were a total of 39 participants who began in the TCWL group, and fifteen in the control group. Over the course of the intervention, there was an attendance rate of 76.5% in the TCWL group for the Tai Chi sessions, and 86.5% in the TCWL dietary sessions.

The baseline characteristics of all participants are presented in Table 1. There were no statistically significant differences in these baseline variables between groups. Other outcomes measured and presented in this table include the Education levels of participants, which were broken into three groups. There were no participants who did not complete high school, TCWL group vs. CON group showed 13.8% vs. 0% of participants completed high school, GED or less, 41.4 % vs. 22.2% completed their Associates or some college, while 44.8% vs. 77.8% completed their Bachelors or higher. These results show the education levels to be not significantly different between groups, with the majority of participants in both groups having completed their bachelors or higher. The amount of kcals expended via physical activity at baseline were compared between groups, where the TCWL had 8020.9 ± 784.6 kcals, and the CON group had 7610.7 ± 1408.3 kcals, $p = 0.80$. Since the amount of kcals expended in the TCWL group was higher than those in the CON group, it may have been attributed to these participants being more active than those in the CON.

The changes in body composition and anthropometric variables between the TCWL group and CON group are shown in Table 2. There were no significant changes found between the TCWL and CON group body composition and anthropometric variables. However, there was a significant within group change ($p <$

0.05) in the TCWL in body fat mass (-3.0 ± 1.5 kg, p = 0.05), when compared to CON group. There was also significant changes (p <0.01) in within group measures for TCWL changes in weight (-1.6 ± 0.5 kg, p = 0.003), BMI (-0.67 ± 0.2 kg/m^2, p < 0.001), waist circumference (-4.8 ± 1.2 cm, p < 0.001) and waist-to-hip ratio (-0.03 ± 0.01, p = 0.001).

Due to the variability of weight losers to non-weight losers within the TCWL, the groups were divided into three categories; TCWL-WL (n=9, weight losers in the TCWL group with a >3% change of baseline weight), TCWL-NWL (n=20, non weight losers in TCWL group having a < 3% change of baseline weight) and the CON group (n=9). The changes in anthropometric variables in body composition between these groups are shown in Table 3. There were significant between-group findings in the weight (p <0.0001), BMI (p <0.0001) and body fat mass (p < 0.003). There were no other significant changes in any other anthropometric variables.

DISCUSSION

The main finding of this investigation was that the combination of Tai Chi and a dietary weight loss intervention did not significantly change body fat mass or other measures in body composition compared to the control group. This study is the first to report on a community-based Tai Chi and weight loss intervention in this population and extends the knowledge base on the effect of these combined intervention strategies on body fat mass changes.

Despite no significant between-group changes, there were within-group decreases in changes in the TCWL-WL group for weight, BMI, body fat mass, waist circumference that were similar to the results in the laboratory-based study by

Katkowski et al. (21). In that study, the effects of Tai Chi during dietary weight loss on body composition in obese, postmenopausal women were examined where results showed participants in the TCWL group also experienced a significant within-group reduction in body weight, BMI, body fat mass, and waist circumference. Comparing the similarities of significant results from the TCWL-WL group in the current study to the intervention by Katkowski et al. (21), gives further evidence that despite the present study's lack of significant changes between groups, the use of Tai Chi combined with a dietary intervention has the potential to improve body composition.

A plausible explanation for the lack of change in body composition in the TCWL group is that each participant participated in approximately 50 minutes twice per week (100 minutes total) of exercise while in the senior centers along with additional practice at home for an unspecified recommended amount of time. Despite a previous study by Straight, et al (14) who also used twice weekly exercise in overweight, older adults had produced where a change in body mass (-1.0±1.8 kg, $P<.001$) was seen, the use of Tai Chi in the current study may not have been enough physical activity to aid in the loss of fat mass. All TCWL participants were encouraged to practice the Tai Chi on their own time outside of the intervention days, however, most participants were not actively engaging in the extra activity when asked each week. Dietary restriction has shown to be the main cause of weight loss (28), and significant changes occur more often when combined with physical activity (14). However, in order for physical activity to be considered enough for a change in weight and body composition, current physical activity guidelines recommend at least 30 minutes of moderate intensity activity per day to prevent and limit health risks and

chronic disease (coronary heart disease, diabetes, etc), which totals 150 minutes, over 5 days per week (25).

For example, in a study by Dechamps et al. (20), 21 obese (BMI 38 ± 6 kg/m^2) women (44.4 ± 11.9 years) participated in a 10-week Tai Chi intervention. All participants were given food logs to help with the individualized hypocaloric diet plan, which were monitored by a dietician. For exercise, participants were randomized into a Tai Chi group (TC, n = 11) or a structured exercise program (E, n = 10); both of which practiced for 2 hours each week. All participants were encouraged to do extra activity, such as walking, outside of the 2 hours per week of TC or E groups. Upon completion, there were lower levels of fat mass (-4 ± 3.5kg vs.1.8 ± 9.3kg) and percent body fat (-2.9 ± 2.4% vs. -2.2 ± 5.4%) in the TC group when compared with the E group (20). The combination of TC and a diet plan showed to have lower fat mass and percent body fat levels when compared with a structured exercise and diet program.

When comparing the current study with other diet and exercise studies such as Avila, et al. (13), there were similar amounts of time spent with exercise and dietary sessions as the present study. Avila et al. had three resistance exercise sessions for 45 minutes each week over 10 weeks, where the present study only had two exercise sessions for 50 minutes. With these differences of frequency in training, Avila, et al. (13) observed a greater decrease in body fat mass in the exercise plus diet group compared with the diet only group ($p = 0.005$), and larger improvements in their lean mass ($p = 0.002$). The present study did not see changes in these variables when compared with the control group. However, this may be because the study by Avila et

al. (13) included one extra day of exercise whereas the present study did not and the intensity level of the resistance training intervention may have been higher than that of the Tai Chi in the current study.

This study has several strengths, which include a relatively homogenous population of obese older women who were participants with no significant between group differences at baseline. Next, we used an intervention method of combining dietary weight loss and exercise that has been shown to be successful changing body weight, body fat mass, BMI, waist circumference, and an increase of fat-free (21). Additionally, this study included a control group, which allowed for controlling for other potential confounders that might have resulted in spurious within-group findings. Lastly, the duration of the study is comparable to other studies that implemented a physical activity and dietary weight loss intervention for older obese women (27, 28, 29).

Despite the strengths listed above, the weaknesses of this study included the use of the non-randomized design, a higher drop-out rate, and a relatively small sample size. Although the current study was non-randomized, there were no significant baseline differences between groups, which created a strong foundation and improved the interventions strength. The use of a non-randomized design was chosen out of convenience, as this was a community outreach study, where we wanted to include as many participants as space in the community centers would allow. Participants were later assigned to their group based on a first come first serve basis. Our dropout rate was noticeably higher than expected beginning with 54 participants, and ending with 38 (30% attrition rate) when compared with previous studies (21).

In conclusion, this study is the first to show the effects of a community-based, combined Tai Chi and dietary weight loss intervention on body composition with obese older women. The combination of Tai Chi with dietary weight loss did not significantly reduce body fat mass or improve other measures of body composition in the TCWL group when compared to the CON group. However, the changes that were found were marginal within-group measures in participants' weight, BMI, body fat mass, waist circumference, and waist to hip ratio. The participants in the TCWL-WL group showed the most improvement in body composition and weight loss changes when compared to those in the TCWL-NWL and CON groups. However, due to the increasingly high number of obese older women currently in the U.S., there is a need for an effective weight loss strategy and prevention of further weight gain. Future studies should include incorporate dietary weight loss with other forms of physical activity along with increased frequency of Tai Chi, to better improve the chances of reducing body fat mass.

Table 1: Baseline participant characteristics for the Tai Chi Weight Loss (TCWL) and Control (CON) groups.

	TCWL (n = 29)	CON (n = 15)	Between-group *p*
Age (years) [1,2]	68.2 ± 1.5	65.5 ± 2.6	0.39
Education: [3]			0.24
High School, GED or Less	4 (13.8%)	0 (0%)	
Associates or Some College	12 (41.4%)	2 (22.2%)	
Bachelors or Higher	13 (44.8%)	7 (77.8%)	
Weight (kg) [1,2]	92.2 ± 5.7	100.9 ± 10.2	0.12
Height (cm) [1,2]	161.0 ± 0.1	162.6 ± 0.2	0.54
BMI (kg/m^2) [1,2]	35.4 ± 0.8	38.0 ± 1.5	0.13
% Body Fat [1,2]	47.6 ± 0.7	48.0 ± 1.2	0.79
Body Fat Mass (kg) [1,2]	44.1 ± 1.7	48.8 ± 3.0	0.18
Fat-Free Mass (kg) [1,2]	48.0 ±1.2	52.2 ± 2.1	0.10
Waist Circumference (cm) [1,2]	108.7 ± 1.9	114.7 ± 3.6	0.15
Hip Circumference (cm) [1,2]	121.0 ± 1.7	128.4 ± 3.0	0.04
Waist to Hip Ratio [1,2]	0.90 ± 0.01	0.89 ± 0.02	0.84
Physical Activity (kcals/wk)	8,021± 785	7,611± 1408	0.80
Physical Activity Index	35.7 ± 3.6	40.3 ± 6.5	0.54
Dietary Screening Tool			1.00
At nutritional risk (≤ 60)	6	2	
At possible risk 60-75	26	11	
Not at nutritional risk (≥ 75)	7	2	

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared).
[1] Data analyzed using independent samples *t*-test
[2] Data are expressed as mean ± SD
[3] Data analyzed using Fisher's exact test.

Table 2: Adjusted changes in anthropometric variables, body composition with the 16-week intervention in the Tai Chi Weight Loss (TCWL) vs. Control (CON) groups. [1,2]

	TCWL (n = 29)	CON (n = 9)	Between-group *p*
Weight (kg)	-1.6 ± 0.5**	-1.1 ± 0.9	0.66
BMI (kg/m^2)	-0.7 ± 0.2**	-0.4 ± 0.3	0.53
% Body Fat [3]	-0.3 ± 0.2	0.4 ± 0.4	0.10
Body Fat Mass (kg) [3]	-3.0 ± 1.5*	1.5 ± 2.8	0.16
Fat-Free Mass (kg) [3]	-0.7 ± 0.4	-0.9 ± 0.7	0.81
Waist Circumference (cm)	-4.8 ± 1.2**	-3.0 ± 2.2	0.48
Hip Circumference (cm)	-0.2 ± 0.8	-0.9 ± 1.4	0.67
Waist to Hip Ratio	-0.03 ± 0.01**	-0.03 ± 0.02	0.69
Physical Activity (kcals)	7,674± 5,792	892.4 ± 10,402	0.57
Physical Activity Index	5.5 ± 2.9	0.7 ± 5.2	0.42

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared).

[1]Data were analyzed using analysis of covariance adjusted for baseline values.

[2] Data expressed as mean ± SE

[3] Data missing from one participant in these variables.

*$p < 0.05$ within group

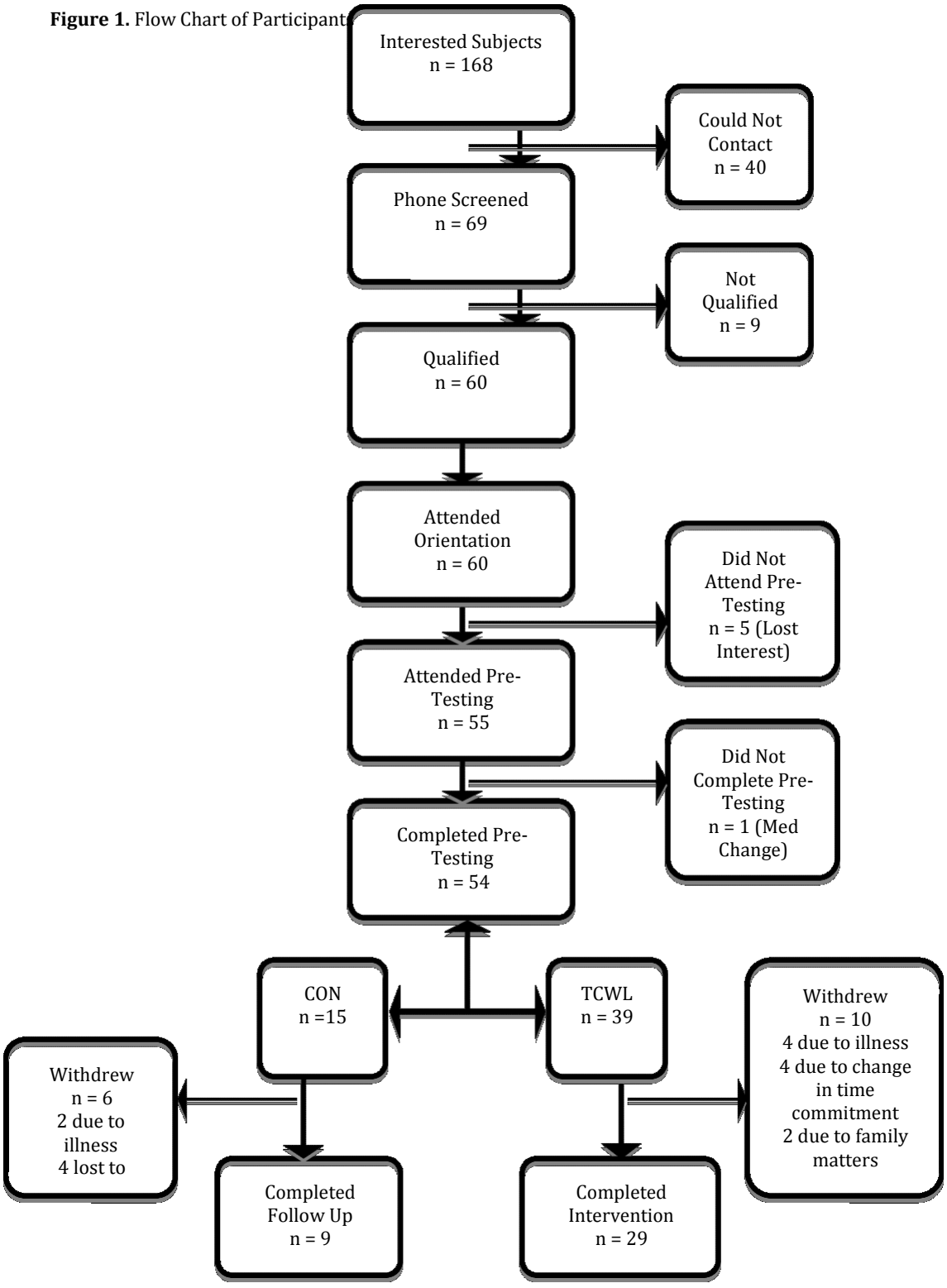
**$p < 0.01$within group

Table 3: Between-group adjusted changes (± SD) in anthropometric with the 16-week intervention in the Tai Chi Weight Loss group Weight Losers (TCWL -WL), Tai Chi Weight Loss group Non Weight Losers (TCWL-NWL) and Control (CON) groups.[1,2]

Variable	TCWL-WL (n = 9)	TCWL-NWL (n = 20)	CON (n = 9)	Between-Group *p*
Weight (kg)	-5.4 ± 0.5**	0.1 ± 0.4	-1.3 ± 0.5*	<0.001
BMI (kg/m^2)	-1.8 ± 0.3**	-0.2 ± 0.2	-0.4 ± 0.3	<0.001
% Body Fat [3]	-0.6 ± 0.4	-0.1 ± 0.3	0.4 ± 0.4	0.18
Fat-Free Mass (kg) [3]	-1.5 ± 0.7*	-0.4 ± 0.5	-0.9 ± 0.7	0.47
Body Fat Mass (kg) [3]	-4.2 ± 1.0**	0.4 ± 0.6	1.2 ± 2.4	0.003
Waist Circumference (cm)	-7.2 ± 2.1**	-3.7 ± 1.4*	-3.1 ± 2.1	0.30
Hip Circumference (cm)	-2.2 ± 1.3	0.7 ± 0.8	-0.9 ± 1.4	0.19

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared).
[1] Data were analyzed using analysis of covariance adjusted for baseline values.
[2] Data are expressed as mean ± SD
[3] Data missing from one participant in these variables.
Non-weight loser defined as weight loss < 3% of baseline weight.
Weight loser defined as weight loss ≥ 3% of baseline weight.
*p < 0.05 within group
**p < 0.01 within group

Figure 1. Flow Chart of Participant



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APPENDIX A: REVIEW OF LITERATURE

Introduction

The purpose of this review of literature is to discuss the research literature rising rate and prevalence of obesity particularly in postmenopausal women as well as existing and potential treatment methods for obesity. Additional topics to be examined will include the causes of obesity in the postmenopausal population, as well as the negative consequences associated with obesity and excessive body fat mass. The current treatment options as well as other potential future methods in treating obesity in postmenopausal women will be discussed. This review will also include previous research on various treatments for obesity including dietary weight loss, physical activity, the additive and combined effects of physical activity and diet, the effects of Tai Chi exercise, and the potential for Tai Chi during dietary weight loss to improve obesity and body fat mass.

Obesity in Older Adults

Obesity is a growing public health problem in older women (1) as 42.5% of women aged 60-69 are considered obese (2). In obese individuals, there has been shown to be an increased risk of excessive body fat mass (3) and numerous chronic diseases (4). However, research shows that obesity can be prevented and treated through regular exercise and healthy diet and weight loss (5). While most exercise interventions have utilized traditional exercise modalities such as aerobic or resistance training, there is a need to examine alternative forms of physical activity that have not yet been thoroughly studied to determine if they are effective in modifying body composition in older women (6).

The rise of obesity has become prevalent over the last past 20 years where there has been a dramatic increase in obesity in the United States and rates are remaining high. More than one-third of U.S. adults (35.7%) are obese (7) and 42.5% of women aged 60-69 have a body mass index (BMI) of 30 kg/m^2 or more (2). Currently, 7% of the total population is over the age of 65 (8) and that number is expected to increase to 20% by 2030 (8) with older women outnumbering older men, 23.0 million to 17.5 million (9). Body mass index and body weight gradually begin to increase throughout a lifetime, particularly through adulthood and then reaches a peak for most adults around ages 50-59 (10). This is especially important to monitor in older adults as fat mass levels have a tendency to increase with age, even without a change in body weight (11). Older adults can see an increase of independent risk factors for chronic health diseases (1) such as cardiovascular disease, diabetes, early mortality, and physical disability including frailty and poor physical function (2) with the decrease of fat-free mass and increase of fat mass (12).

A cross sectional study by Sims et al. (13) examined the changes in physical activity levels and body mass between younger and older postmenopausal women. A total of 58,610 women, aged between 50-79 years, would visit one of 40 US clinical centers where they would be weighed once each year during the 8-year study. After completing a series of questions, the women were categorized into one of four groups depending on their levels of physical activity: sedentary (≤ 100 MET/min/wk; low activity >100-500 MET/min/wk; moderate activity >500-1200 MET/min/wk, or high activity >1200 MET/min/wk) (13). Over the duration of this time, results showed a mean weight gain of 1.3 kg in women aged 50-59 years, as well as a weight gain of

.05 kg in women aged 60-69 years, however those women aged 70-79 years saw a mean loss of .75 kg (13). The waist-to-hip ratio increased (mean 0.015) over the 8-year study regardless of age or physical activity levels. The amount of weight gain was influenced on the level of activity expended. There was less weight gain ($p = 0.08$) in women who expended >500-1200 MET/min/wk as well as those in the >1200 MET/min/wk group when compared with women in the ≤ 100 MET/min/wk group. In conclusion it was reported that the use of regular exercise in postmenopausal women could show differential body weight changes, most seen through ages 50-59 (13).

In a longitudinal comparison focused on the energy balance and body composition in menopause, 35 sedentary healthy premenopausal women aged 44-48 years were examined (14). Upon the 6-year follow up, 18 women entered menopause, while 17 women remained premenopausal. Those who experienced menopause showed greater decreases in fat-free mass when compared to those still premenopausal (-3.0 ± 1.1 kg versus -0.5 ± 0.5 kg, $p \leq 0.01$), and physical activity time (-127 ± 79 kcal/day versus 64 ± 60 kcal/day, $p \leq 0.01$) (14). There were greater increases in fat mass (2.5 ± 2 kg versus 1.0 ± 1.5 kg, $p \leq 0.01$), and waist-to-hip ratios (0.04 ± 0.01 versus 0.01 ± 0.01, $p \leq 0.01$) (14). This study was able to show the reduction of energy expenditure levels associated with the onset of menopause. Although this study was not tested on overweight or obese women, it is evident that the addition of menopause to a woman who is overweight or obese my have increased health risks if their health is not improved prior. However, whether overweight, obese or normal weight, the onset of menopause typically results in decreased energy expenditure levels and has the potential for weight gain.

Causes of Obesity in Older Adults

Obesity is clinically defined by a BMI of ≥ 30 kg/m^2, where one of the main contributing factors lies in the excess amount of body fat mass. This excess fat stems from an imbalance of the amount of energy taken in and what is then expended. The obesity problem for a person typically begins when they consume more calories than they can expend, which, after a long duration of time can begin to add up and result in weight gain (15). As adults continue to age, their dietary intake does not always decrease along with their energy expenditure. Therefore, those whose dietary habits remain the same as when they could expend more calories, are at a higher risk of overweight and obesity (15). Along with the continued dietary patterns, there are other factors that can influence the weight gain in an older person, including hormonal changes. During the aging process, it is natural for hormones (most often growth and thyroid) to begin to shift and change, often resulting in an increase of fat (15). Also associated with the increase in age, is a decrease in physical activity levels. Research evidence suggests that the combination of these two variables can exacerbate weight gain in older inactive adults.

In a cross-sectional study by Williamson et al. (16) 3,515 men and 5,810 women between the ages 25-74 were evaluated to determine the amount of change that recreational activity plays in weight loss over 10 years. Upon completion, results showed that over the 10 year span, recreational physical activity had a strong correlation to a >13 kg weight gain. The relative risk for those who did not participate in regular exercise at baseline or follow-up was 2.3 (95% CI = 0.9-5.8) in men, and 7.1 (2.2-23.3) in women (16). The relative risk of major weight gain between those

who had low levels of physical activity at baseline, compared with those who had high levels at follow up, was 3.1 (95% CI = 1.6-6.0) in men, and 3.8 (2.3-6.5) in women (16). The results of this study suggest that the lower the levels of physical activity tend to create a higher chance of weight gain (16).

Hughes et al. (4) examined the natural longitudinal patterns of change in body composition (fat mass and fat-free mass) in older adults. The effects of physical activity, weight change and age were also examined as variables affecting change in body composition. A total of 53 men and 78 women aged 60.7 ± 7.8 years at baseline were included and were measured twice over a total of 9.4 ± 1.4 years (4). Levels of fat –free mass were not significant in women with a change of -0.1 ± 2.1 kg (baseline: 41.9 ± 4.4 kg, follow-up: 41.8 ± 4.3 kg), however the levels of fat mass increased by 7.5% (baseline: 22.4 ±8.0 kg, follow-up: 23.6 ± 8.7 kg) with a change of 1.3 ± 4.3 kg. Weight was also recorded, where there was an increase of 1.2 ± 5.0 kg (baseline 64.3 ± 10.7 kg, follow-up: 65.5 ± 11.5 kg) in the women (4). Measures of energy expenditure in sports and recreational activity were estimated by using a questionnaire (Harvard Alumni Health Study) that measured the amount of physical activity exerted over the previous year (4). At baseline, women expended 3816 kJ/wk, and at 3657 kJ/wk, a change of -88 kJ/wk (4). This study's results showed that there is an association between aging and increases in fat mass in women. There was minimal change in fat-free mass amongst both men and women, however it was concluded that with continued weight stability, minimal weight gains, or increased levels of activity there is less risk for a loss in fat-free mass during the aging process.

Maintaining a healthy body and lifestyle throughout one's lifetime is particularly important. Without doing so, research shows the potential for excess amounts of body fat, especially in an older person can lead to an increased risk of chronic heath problems.

Consequences of Obesity

Consequences associated with a large amount of body fat mass include multiple types of health concerns: disease (cardiovascular disease, diabetes, cancer, etc), disability, and even mortality. A method commonly used for classifying body composition, particularly in the obese population, is BMI (17). Data suggests that having a high BMI in older women is a strong predictor of long-term risk for mobility disability and that this risk will continue and increase with age (18).

In a study by Visser et al., (17) 2,714 older women aged 72.4 ± 5.4 years were examined to determine their BMI and whether body composition can predict disability rates. Using bioelectrical impedance analyis they were able to determine body composition as well as the effect that changes in body composition have on the risk for disability. Results showed the women in the obesity highest quintile were 3.04 times more likely (95% CI: 2.18, 4.25) to be disabled than women in the lowest quintile. Three years later, women with a higher fat mass at baseline were 2-3 times more likely to become disabled. The results from this study show that there is an increased risk of disability where there are higher levels of overall body fatness.

Additionally, Riebe et al. (19) conducted a study involving 821 healthy weight to obese community-dwelling older adults (76.9 ± 6.3 years old, men = 234, women = 587). The primary goal of this study was to observe the relationship between normal

weight, overweight and obese adults and how they affect various factors including physical functioning. Overweight participants (BMI = 25 – 29.9 kg/m^2) were considered to be at a much higher risk for limitations in physical function when compared with those in the normal body weight range (BMI = 18.5-24.9 kg/m^2) (19). Results also showed that those individuals who were not physically active (sedentary) were more likely to have abnormal physical functioning scores when compared with participants who engaged in physical activities on a more consistent basis. Comparing the men to women, women showed lower scores of physical functioning ability, which can ultimately place them in a higher risk category for future disability (19). Lastly, the correlation of age to physical functioning was strong as it showed that with age there is a higher risk of decline in physical functioning and can be exacerbated with the onset of additional weight (20).

Studies have shown that over time, women are more likely to become obese when compared with men (21), as well as having an increased risk of disability (22). With older women currently outnumbering older men 23.0 million to 17.5 million, there is a need to find a way of reducing these numbers.

In a study by Field et al. (22), a 10 year follow up from the Nurse's Health Study was conducted to determine the health risks associated with being overweight. After examining 77,690 women aged 52.9 ± 7.1 years over 10 years, those who had an obese BMI of 35.0 or more, were approximately 20 times more at risk for developing diabetes (relative risk (RR) 17.0; 95% confidence interval (CI) 14.0-20.5) when compared with women in a healthy weight BMI range of 18.5-24.9 (22). Results also showed increased incidences of gallstones (RR, 1.9; 95% CI, 1.7-2.0), hypertension

(RR, 1.7; 95% CI, 1.6-1.7), heart disease (RR, 1.4; 95% CI, 1.2-1.5), and high cholesterol (RR, 1.1; 95% CI, 1.1-1.2) in the group of obese women compared with their peers in a normal BMI (22). Field et al. also found a significant difference ($p<.001$) when the number of leaner women (11%) increased amongst the heavier women (25%), showing they were less likely to develop one or more diseases when compared to those subjects who were overweight but not quite obese (22).

In a different study by Koster et al. (23) there was a relationship between high levels of abdominal fat and morbidity and mortality in older obese adults. After adjustments were made for BMI and other covariates, Koster et al., saw an association with a large waist circumference (≥88 cm) having an approximate 25% increased risk in mortality in women aged 51-72 years (women: hazard ratio (HR) 1.28, 95% confidence interval (CI): 1.16, 1.41) (23). As women age, the fat-free mass levels begin to decrease (0.16 ± 0.06 kg; $p < 0.01$) and fat mass levels increase (16.1 ± 0.9 kg; $p < 0.0001$), particularly in the abdominal area (4). A waist circumference of 88 cm or higher in women is considered a marker for abdominal obesity and is an independent risk factor for cardiovascular disease (1).

Unfortunately, due to lifelong dietary, exercise and lifestyle habits it is difficult to induce behavior changes of adding physical and dietary improvements into the older populations (24). The risk of obesity in older adults is becoming more apparent as it may create an early onset of frailty, impairing the general quality of life, and can result in an increased number of admissions to nursing homes (24). Obesity is also used as a predictor of decline later in life, including the risk of being limited to living at home (25) or the likelihood of being admitted to a nursing home (26).

With the medical cost to treat obesity in 2008 around $147 billion (27), and is becoming increasingly more expensive, there is a need for prevention and further treatment. With the baby-boomer generation entering old age, there is currently 7% of the total population over the age of 65 (15). However, in a few short years that number is expected to increase to 20% by 2030 (15). The number of older adults will be increasing rapidly, as will the number of nursing home admissions.

A study performed by Jensen et al., (24) reviewed 21,645 community-dwelling older adults (≥ 65 years old, 55.3% female), where their goal was to determine if obesity was associated with a higher likely hood of being kept homebound. Any person considered obese had a BMI ≥ 35 kg/m^2, which was also an independent risk factor when finding which older adults had become homebound. In a similar study by Zizza et al., (25) 960 middle-aged to older adults between 45-74 years were examined. Their goal was to determine if there was a link from obesity to an increase in the number of admissions to nursing-care facilities. Zizza et al. (25) found that the prevalence of obesity where a BMI ≥ 35 kg/m^2, had a high association (Hazard ratio 1.69, 95% CI: 1.22, 2.34) with an increase in the admission rate into nursing homes (25).

With these potential consequences, there is a need for weight loss options to assist in the prevention of a decline in fat-free mass while aiding in a loss of fat mass. By accomplishing this, there will be a decrease in the risk of future disability, as well as declines in function and disease.

Obesity Treatments

With the high risk for disease and disability associated with obesity and being overweight, there is a critical need for more treatment options that reduce body weight, particularly in the older adult population. Obesity rates have increased substantially has due to its association with an increase in the prevalence of obesity comorbidities (such as type 2 diabetes, hyperlipidemia, hypertension, heart disease, stroke, asthma, etc) (27). Because of these comorbidities, there are more than 2.5 million deaths per year worldwide (15). This plays a major impact on life expectancy rates where when compared to a normal-weight person, a 25-year-old morbidly obese person has a 22% reduction in their expected remaining lifespan, which equals a loss of approximately 12 years of life (15).

Studies have shown that not all weight loss changes need to be dramatic, but even smaller more achievable amounts between 5-10% of the person's body weight can be significant in improving metabolic abnormalities and reducing the risk for coronary heart disease (28). Other studies have come to show that even lower amounts of weight loss, around 3-5% of total body weight, can show a significant decrease in the risk for other chronic disease (type 2 diabetes, hyperlipidemia, hypertension and more) while also increasing the patients longevity (29).

Popular choices for weight loss in obese persons include weight loss surgeries, and between 1998 and 2002, the number of people who chose to utilize weight loss surgeries had quadrupled (30). Bariatric surgery has been shown as a successful form of weight loss, especially in those who are obese and morbidly obese and has a high success rate with treating common comorbidities associated with obesity (15). This

form of weight loss has shown to be effective with an average weight loss of 45-65 pounds commonly maintained up to 10 years post surgery (31). However the limitation of this method is that it requires clinical follow up and lifestyle changes including dietary changes which some individuals have difficultly adhering to with the long-term commitment of maintaining weight loss (30). Choosing a surgical intervention to lose a significant amount of weight is usually a safe method for older adults, however there has been a higher success rate and outcomes in younger patients where a larger amount of weight loss was achieved and greater amount of comorbidities were resolved (32) when compared with an older population.

Other forms of weight loss have included different types of dietary supplements, as well as prescription and non-prescription medications. Studies that have included the use of dietary supplements for aiding weight loss have shown to be mostly unsuccessful and unconvincing (33). Despite not always being FDA approved, the use of supplements for losing weight is still common amongst a large number of the US adult population (34). Studies have found the majority of the users are adults who have been using supplements for an extended period of time and most refrains from discussing this practice with their physician (35). The major issue with using these weight-loss supplements is that they often contain stimulants, which for someone who is already at risk for numerous health concerns can create a potentially dangerous outcome such as a further increase in blood pressure or heart rate (34). The amount of negative outcomes possible with the consumption of these supplements greatly outweighs the positive. Until safer and more promising research becomes

available in this field, there is a need for a different and effective form of alternative weight loss aids.

Dietary Weight Loss

Previous studies have examined the effect of dietary weight loss alone to decrease body mass in older adults and have shown promising results. For example, Frimel et al. (36) reported a significant amount of weight loss of ~10% in a span of 6 months in a diet-only group of sedentary, obese adults (36). This 6 month randomized study involved 30 older (70 ± 5 years) obese (BMI 37 ± 5 kg/m^2) adults who were assigned between two groups: the diet alone (n = 15) or diet and exercise (n = 15). Measures in body composition and muscle strength were recorded at baseline and follow-up. Results showed both groups had similar decreases in overall weight (diet: 10.7 ± 4.5 vs. exercise and diet: 9.7 ± 4.0 kg) and fat mass (diet: 6.8 ± 3.7 vs. exercise and diet: 7.7 ± 2.9 kg) (36). While a weight loss approach using diet alone can be effective in reducing body mass, the negative consequence of this is the loss of lean muscle mass. One of the main concerns in this study was that the use of dietary weight loss alone would accelerate sarcopenia, especially when used in frail, older adults.

Similar findings were found in 48 postmenopausal women aged 55-75 years when Bouchard et al. (37) examined changes found in body composition were due to the addition of dietary weight loss. Participants were randomly assigned to one of four groups, resistance training (RT) alone (n = 12), calorie restriction (CR; n = 12), calorie restriction plus resistance training (CR+ RT; n = 12), or a control group (C; n = 12). Participants in the CR and CR+RT groups attended weekly group sessions that

provided information on nutrition, while those in the RT and CR+RT participated in a resistance-training program. After 3 months of the intervention, the subjects had shown a significant decrease in their body fat mass, body weight, percent fat mass, and BMI ($p < 0.01$) however they also experienced a decrease in fat-free mass ($p < 0.05$) (36).

As previously noted, this loss is detrimental to adults, women in particular as it can lead to a functional decline and accelerate sarcopenia (38). Another disadvantage of dietary weight loss through the use of calorie restriction alone is not only the decreasing lean muscle mass, but also a potentially negative impact on various lipoprotein measures (39).

Brochu et al. (40) performed a six-month intervention where they looked at the effects of calorie restriction amongst 71 overweight and obese (BMI 32.3 ± 4.6 kg/m^2) postmenopausal women aged 58.0 ± 4.7 years. They wanted to determine how effective this method was on body composition and their metabolic profile. Their goal outcome was a 10% decrease in body weight over a six-month period while their dietary plan was decreased to only consuming 500-800 kcal per day. With these changes, participants saw a significant decrease in their body weight (-5.1 ± 4.7 kg, $p<.0001$), waist and hip circumferences (-4.3 ± 3.8 cm, -4.5 ± 4.4 cm, $p < 0.05$), total fat mass (-4.0 ± 3.5 kg $p < 0.05$), and lean body mass (-0.9 ± 2.4 kg, $p < 0.05$) which was measured using dual energy x-ray absorptiometry (40). Also noted was a significant decrease in the participant's triglycerides (-0.23 ± 0.70 mmol/L). Brouchu et al. concluded that they had found the calorie restriction to be beneficial with participant's blood profile as well as the aiding in loss of fat mass. However, as seen

in other studies where diet is the main change in the intervention, the loss of lean body mass could later become a health concern especially in older women (40).

A minimal weight loss of 5-10% of total body weight has shown to be effective in improving an individual's metabolic profile. The way in which weight loss is achieved is important, as there has been successful studies performed using a diet only approach, but without physical activity the fat free mass tends to decrease. For example, in the study by Brouchu et al. (40), they found that those participants who continued with a diet only induced weight loss had a loss of approximately 75% of fat mass, but the remaining 25% was due to a loss in fat-free mass (40).

In order for obese postmenopausal women to appropriately lose weight, they must do so by eliminating as much fat mass as possible, while preserving and improving their fat free mass. Implementing a strong, well balanced diet during weight loss is very important as it helps in the protection of any loss in nutrients, while keeping the body energized and healthy for exercise.

The Dietary Approaches to Stop Hypertension Diet was introduced and examined in a study that focused on changing dietary patterns to prevent and decrease blood pressure. In 1997, Appel et al. (41) focused their study on 459 adults (22+ years), with blood pressure of 131.3 ± 10.8 mmHg and 84.7 ± 4.7 mmHg and currently not on any blood pressure altering medications. Participants were randomized into one of three groups. The first group was focused around what the average American diet consists of; including potassium, magnesium and calcium levels near to the 25th percentile of US consumers (44 ± 11 years, BMI 28.3 ± 4.0 kg/m^2). The second group consisted of fruits and vegetables, providing the

participants with potassium, fiber and magnesium levels close to the 75th percentile (45 ± 11 years, BMI 28.9 ± 4.3 kg/m^2). The last group was the combination diet, filled with fruits, vegetables and low-fat dairy foods (all of which had reduced amounts of fat levels including saturated fat, total fat and cholesterol). It also had potassium, magnesium, fiber, protein and calcium levels close to the 75th percentile of US consumers (44 ± 10 years, BMI 29.0 ± 3.9 kg/m^2). All study members were blinded to which participant received which diet, and during their 8-week intervention, study members measured each participant's blood pressure once per week. Upon completion of the study, there were statistically significant results seen in decreases of systolic blood pressure in all three groups; control diet (-5.5 mmHg, $p < .001$), fruits-and-vegetables (-2.7 mmHg, $p < .001$) and the combination group (-2.8 mmHg, $p << .001$). There were decreases in diastolic for the control group (-3.0 mmHg, $p < .001$), fruits and vegetables (-1.9 mmHg, $p = .002$), and combination group (-1.1 mmHg, $p = .07$) (41).

The study found that even those who were without hypertension prior to the study, but had followed the combination diet, had seen a positive correlation in the prevention of high blood pressure (41). The participants who began the study with high blood pressure also saw a decrease in blood pressure levels with the use of the combination diet. These results were particularly useful as it shows the DASH diet could be used as an alternative form from drug therapy in treating hypertension. The implementation of this diet throughout the US could result in an increase of prevention rates, and a decrease in blood pressures on a large-scale (41). While this study was

effective in showing results in the changes of blood pressure, it did not discuss the potential effects it had on changes in body composition or weight loss.

In a study by Blumenthal et al. (42), the effects of the DASH diet alone (DASH-A), versus DASH plus weight management (DASH- WM) and a control group (UC) were examined. This randomized study included 144 overweight (BMI 33.1 ± 3.9 kg/m^2) participants with a consistently elevated blood pressure (130-159 mm Hg systolic or 85-99 mm Hg diastolic) over four different screening measures. The use of antihypertensive medication, caffeine and smoking was not allowed during screening or participation in this study. Upon completion, there were significant changes in the DASH-WM group body fat percentage (-4.5 %, $p < .001$), trunk fat (-4.1 kg, $p < .001$) and lean body mass (-1.7 kg, $p < .001$) when compared to the DASH-A and UC groups (42). Most notably was the DASH-A group did not show any significant differences when compared to the UC group. This indicates that the addition of exercise to an overweight or obese person's lifestyle can show positive changes in body composition.

Avila et al. (39) examined the effect of a dietary and exercise intervention in overweight and obese older adults and found that a weight loss-only group lost a significant amount of lean mass over 10-weeks with little change in fat mass (39). Using a randomized design, a total of 27 overweight and obese (BMI 31.7 ± 3.6 kg/m2) older adults (67 ± 4 years) were placed into two groups; the Dietary Approaches to Stop Hypertension for weight loss diet (DASH, n=12) or the DASH plus moderate intensity resistance training (DASH-RT, n=15). Upon completion of the 10-week intervention, participants were measured again for outcomes in weight

loss, body composition, and physical function. There was a larger amount of loss in body fat in the DASH-RT compared with the DASH group (−4.1 ± 0.9 vs. −0.2 ± 1.0 kg, p = 0.005), as well as also having a larger change in lean mass (+0.8 ± 0.4 vs. −1.4 ± 0.4 kg, p = 0.002). There were no significant differences in weight loss between the two groups (−3.6 ± 0.8 vs. −2.0 ± 0.9%, p = 0.137). While there were small results found in the DASH group, there were greater results found when physical activity was involved, thus it shows the importance of including exercise for changes in body composition.

Physical Activity

While the benefits of a modified dietary pattern have shown to be helpful in many ways, the benefit of using physical activity (particularly in older, obese women) is important for its role in strengthening muscles, improving cardiorespiratory status, increasing fat free mass levels and decreasing fat mass levels (43).

In a randomized controlled trial by Irwin et al. (43), the effect of an exercise intervention on older (aged 50-75 years), overweight and obese (average BMI 30.5 kg/m^2 exercisers group, 30.6 kg/m^2 control), sedentary (<60 min/wk of moderate- and vigorous-intensity recreational activity) women was conducted. The women in the exercise group (n = 87) participated in moderate-intensity exercises and sports for 3.5 ± 1.2 days per week for 176 ± 91 minutes per week over a 12-month period. Participants in the control group (n = 86) attended weekly 45-minute stretching classes over the 12-month intervention, and were asked to maintain their current eating and exercise habits. At the 3-month check-in, the exerciser groups saw changes in weight (-.5 kg [-1.0 to 0.1] p < .01), BMI (-0.2 kg/m2 [-0.4 to 0.0] p < .004), waist

circumference (-0.5 cm [-1.2 to 0.2) p < 0.49), and hip circumference (-0.1 cm [-0.6 to 0.6) p < .003) (43). At the 12-month check in, the differences became even greater. The exercisers saw a further change in weight (-1.3 kg [-2.0 to -0.5] p <.01), BMI (-0.3 kg/m2 [-0.6 to -0.1] p < .004), waist circumference (-1.0 cm [-1.8 to -0.1) p < 0.49), and hip circumference (-1.5 cm [-2.3 to -0.7) p < .003) (43). Overall, there was an average 1.3 kg weight loss amongst the exercisers where the control group had a weight gain of 0.1 kg (p < .01). The small, yet significant changes in body weight and body fat were enough to show that the implementation of increased exercise done on a consistent basis can result in positive changes in body composition.

The amount of exercise administered to a participant will play a large role on the amount of changes in body composition and weight loss. In a randomized 6-month study by Villareal et al. (10) involving 27 frail obese older adults, the effects of a 3 times per week exercise intervention was given, and compared with a control group. Results showed the exercise group had a reduction in body weight of -8.4% ± 5.6% (-8.2 ± 5.7 kg) when compared to the control who lost .05% ± 2.8% (0.7 ± 2.7 kg, between group p <.001) (10). Differences were also see in fat mass (Exercise: -6.6 ± 3.4 kg, -17.1 ± 11.3%; Control: 1.7 ±4.1 kg, 2.6 ± 6.9%, between group p <.001) (10). These results are important as they show that the inclusion of physical activity in an older adults' lifestyle can create decreases in body weight and fat mass when compared with older sedentary adults.

In a randomized controlled study looking specifically at women, Slentz et al. (44) studied 120 postmenopausal (52.8 ± 6.4 years) overweight and obese women (BMI 29.7 ± 3.2 kg/m^2) (44). These participants were examined through three groups

of varying levels of exercise intensity (Low Amount/Moderate Intensity, Low Amount/Moderate Intensity, and High Amount/Vigorous Intensity), and a control group. Over the 8-month exercise program, each group was required to complete their given levels of exercise (high amount/vigorous intensity (n = 27) ~20 miles of jogging/week, low amount/vigorous intensity (n = 28) ~ 12 miles of jogging/week, and low amount/moderate intensity (n = 28) ~ 12 miles walking per week) (44). The control group (n = 37) remained non-exercising and was asked to continue with their current dietary patterns. The results showed the high amount group with the most significant results when compared to the low amount/moderate intensity group in weight change (-3.5 ± 2.8 kg, $p < 0.01$), percent lean body mass (4.7 ± 3.3%, $p < 0.01$), fat mass (-4.9 ±3.0 kg, $p < 0.01$), and hip circumference (-3.0 ±2.7 cm, $p < 0.01$). Through the comparison of the two lower intensity groups, it was noticed that there is an increase of lean body mass in the high intensity group ($p < 0.05$). This preservation and increase of lean body mass is particularly important in the postmenopausal population.

Foster-Schubert et al. (45) found similar results in lean mass through their study. This intervention examined obese, postmenopausal women for the effects of physical activity on body composition and weight. Using a randomized design, participants were placed into the exercise group (n = 117, BMI 30.7 ± 3.7 kg/m^2, aged 58.1 ± 5.0 years), which used a facility-based aerobic exercise program, ≥45 minutes 5 days/week for 12 months, or a control group (n = 87, BMI 30.7 ± 3.9 kg/m^2, aged 57.4 ± 4.4 years) (45). The exercise group was asked to complete 3 supervised sessions of ≥ 45 minutes of moderate-to-vigorous physical activity per week over 12 months.

When compared to the controls, the participants in the exercise group had a significant decrease in body weight (mean -2.0 kg, $p < 0.034$), waist circumference (-2.0 cm, $p < 0.0001$), % body fat (-1.6%, $p < 0.0001$) (45). The participants in the exercise group were also the only ones to see an increase in lean body mass (+0.3 kg). Despite seeing positive results and changes in that study, there is much more to be accomplished for a successful and safe weight loss or change in body composition through the addition of a diet with an exercise program.

Physical Activity and Dietary Weight Loss

As shown previously, there has been success seen through the use of diet only and exercise only interventions on changes in body composition and weight loss. However, there is also a great amount of research that shows how beneficial the combination of these two interventions can be. As seen in the previous study by Foster-Shubert et al. (45) there was some success rate in using exercise alone. That study also included a diet plus exercise group (n = 117) which involved the combination of a moderate-intensity, facility based aerobic exercise program doing ≥45 minutes 5 days/week for 12 months, combined with a calorie reduced, low-fat diet. When compared to the control (n = 87), exercise (n = 117) and diet alone groups (n = 118), there were significantly higher improvements in body composition and weight loss. Measures were taken at baseline and at the completion of the 12-months where the diet plus exercise group lost a mean of 8.9 kg (-10.8% $p < 0.0001$) compared to the exercise alone (-2.0 kg, -2.4%, $p < 0.034$) diet alone (-7.2 kg, -8.5% $p < 0.0001$) and control group (-0.07 kg) (45). When compared with the non-significant results of the control group (+0.9 cm), the waist circumference measures were seen to

have decreased the most in the diet plus exercise group (-7.0 cm, $p < 0.0001$. Diet: -4.5 cm $p < 0.0001$; exercise: -2.0 cm, $p < 0.001$) (45).

Brochu et al. (40) were able to show that a calorie restriction was successful for a change in weight loss. There were further results showing that the addition of resistance training with caloric restriction resulted in a greater loss in hip circumference (-7.5 ± 9.9 cm) percent fat mass (-3.7 ± 3.3%) and trunk fat mass (-3.3 ± 2.6 kg) when compared with the calorie restriction group only (40). There were significant changes ($p < 0.0001$) made from baseline measures as well as significant ($p< 0.05$) between group in all three variables. Significant changes ($p<0.0001$) were also seen in body weight (-5.8 ± 4.9 kg), BMI (-3.3 ± 5.0 kg/m^2) and waist circumference (-5.6 ± 4.7 cm) (40).

As mentioned above, in a study by Avila et al. (39) examined the impact of resistance training during dietary weight loss on 27 overweight and obese (BMI 31.7± 3.6 kg/m^2), older (age 67 ± 4 years) adults (39). Participants were randomized into a weight loss only (WL) group or a weight loss plus resistance training (RT) group for resistance training for 10 weeks. The RT group had a greater reduction in body fat (-4.1 ± 0.9 vs. -2.0 ± 1.0 kg, $p < 0.005$) and greater increased in lean mass (+0.8 ± 0.4 vs. -1.4 ± kg, $p < 0.002$) compared to the WL group (39).

In another study by Villareal et al., (46) significant differences between groups were found in a study including a diet group (n = 26), diet-exercise group (n = 28), exercise only group (n = 26), and control (n = 27). This was a 1 year randomized, controlled study that examined the effects of weight loss, exercise or both on 107 obese (≥ 30 kg/m^2), older (≥ 65 years) adults. Participants were randomly placed into

one of the 4 groups (46). The diet group was given a balanced diet with an energy deficit of 500-750 kcal/day from their current calculated energy requirement (46). The exercise group was given information on how to maintain their weight in a healthy manner, while also incorporating group exercise training sessions for ~90 minutes, 3 times per week. The diet-exercise group was a combination of the diet only group, and the exercise portion from the exercise only group. All measures were recorded at baseline, and again after 6 months, then lastly upon completion. A significant decrease was found in body weight in the diet group of 9.7±5.4 kg, (10% decrease from baseline) and the diet–exercise group showed a total weight loss of 8.6 ± 3.8 kg, (9% decrease from baseline) (46). The diet group also saw a greater decrease in fat mass (-7.1 ± 3.9 kg, $p<0.001$) compared with the diet-exercise group -6.3 ± 2.8, $p<0.001$) (46). However, despite the similar weight loss between groups, there was a greater loss of lean mass in the diet group (-3.2 ± 2.0 kg, $p<0.001$) compared with the diet-exercise group (-1.8 ± 1.7 kg, $p<0.001$) (46). While the results seem favorable for the benefits that diet alone may offer, the diet-exercise group still had significant results when compared with the exercise alone, and control groups as well as having the least amount of loss in lean muscle mass.

Chomentowski et al. (47) focused their research on the how moderate exercise can reduce the loss of skeletal muscle mass that occurs with intentional calorie restriction in older, overweight and obese adults. A total of 29 overweight to obese (BMI 31.8 ± 3.3 kg/m^2) older (aged 67.2 ± 4.2 years) adults (men = 13, women = 16) participated in a 16-week intervention. Consisting of two groups, the diet-induced weight loss alone group (WL; n = 11 68.4 ± 1.5 years, BMI 32.9 ± 1.0 kg/m^2), which

received a low fat, 500-1,000 kcal/d caloric restriction, and the exercise group (WL/EX; n= 18, 66.4 ± 1.1 years, BMI 31.9 ± 1.0 kg/m^2), consisting of additional aerobic exercise of moderate-intensity walking 3-5 times per week at 35-45 minutes each session (47). Despite the results showing minimal differences between groups, they were significant in body weight (WL/EX -9.2 ± 1.0%, WL -9.1 ± 1.0%) and in body fat mass (WL/EX -16.5%, WL -20.7%) (47). There were significant decreases in the level of fat free mass within the weight loss group (-4.3 ± 1.2%, $p = 0.044$), but this was not seen in the exercise group (47). The combination of the exercise and dietary change lead to more positive and healthy results for the participants as it decreased their body fat mass and weight, but protected their fat-free mass from decreasing further.

In addition to the laboratory-based studies above, Straight et al. (48) examined the effects of resistance training during dietary weight loss in a community-based setting. A total of 95 overweight and obese (BMI = 33.4 ± 4.0 kg/m^2) older adults (69.1 ± 6.2 years) participated in a resistance training plus weight loss program using a modified DASH diet at four Rhode Island senior centers (48). Using resistance tubing, dumbbells, and ankle weights, participants completed resistance training two times per week for eight weeks. Once per week a dietary weight loss session was held to provide help with understanding the DASH diet. Upon completion, there were improvements in body mass (-1.0 ± 0.8 kg $p < 0.001$), waist circumference (-5.2 ± 3.8 cm, $p < 0.001$) percent body fat (-0.5 ± 1.4 %, $p < 0.001$), and fat mass (-0.8 ± 1.6 kg, $p < 0.001$) (48). This study showed that the combination of the DASH diet with a resistance-training program could create small, yet statistically significant

improvements in body composition. However the addition of resistance or aerobic training can become too strenuous or not preferable for some older adults when implemented their exercise routine (49). Thus, there is a need to determine the full complement of exercise modalities to improve body composition in obese older women that are both appealing and feasible (6).

Tai Chi

Tai Chi is a form of low-impact exercise based on traditional Chinese martial arts. It has become increasingly popular worldwide, especially within older adult populations (50). Benefits from this exercise include improvements in psychological and physiological function, as well as decreases in tension, anxiety and mood changes (50) and the ability to improve muscle strength, balance, and cardiovascular disease risk factors (51). Other studies have also shown that Tai Chi can be a more feasible and enjoyable form of exercise for older women while also enhancing their quality of life and exercise capacity (52). Both the American College of Sports Medicine and the American Heart Association have guidelines for the use of physical activity in older adults. Currently they recommend older adults living a sedentary lifestyle should begin an exercise routine with balance, flexibility and strength training in order to strengthen energy levels before continuing on to more intense forms of physical activity (53). The use of Tai Chi for improvements in balance and physical function has been shown to be effective in older women.

Song et al. (54) performed a 12-week intervention using 72 older women with osteoarthritis for its effects on balance, muscle strength, and physical functioning. Participants were randomly assigned into the Tai Chi group or sedentary control.

Those in the Tai Chi group reported fewer difficulties in physical functioning ($p < 0.008$) and also saw improvements in their balance ($p < 0.009$) when compared to the control group who had no change in either group (54). This study confirms the safety of this form of exercise in an older population, and its benefits towards improving balance and physical functioning skills. The study did not examine overweight or obese women, body composition, weight loss or the use of a dietary component for potential outcomes.

Audette et al. (55) examined the effects of Tai Chi versus brisk walking in 19 community-dwelling, sedentary, older women. Participants were randomly assigned to the Tai Chi group ($n = 11$, age = 71.5 ± 4.6 years), or brisk walking group ($n=8$, age = 71.3 ± 4.4 years) while a third group of women in the same population were in a group as sedentary controls ($n = 8$, age = 73.5 ± 5.7 years) (55). Both the Tai Chi and brisk walking groups met for 1 hour, 3 times per week over the 12-week study. At baseline, participant's aerobic capacities were estimated with the use of a submaximal cycle test. At follow up, compared with the control group, those in the Tai Chi group experienced a noticeable improvement in their aerobic capacity (0.2 ± 3.03 vs. -4.4 ± 3.01 ml/kg/min, $p < 0.003$), while when compared to the brisk walking group there was a trend towards significance (4.2 ± 3.03 vs. 0.2 ± 2.63 ml/kg/min, $p < 0.08$) (55). This study was important for its results showing that the through the use of regular Tai Chi practice, participants can see an improvement in their aerobic capacity. It did not however measure body composition or include a dietary component.

To date, there have been very few studies that have examined the effects of Tai Chi on body composition changes. It has been seen through other research its benefits

on physical functioning and psychological health, however there is little evidence in the effects Tai Chi has on measures including weight loss, percent body fat, BMI, hip and waist circumference measures, fat mass or fat-free mass.

A study by Lan et al. (56) examined the effect of changes over 5 years in aerobic capacity on fat ratio and flexibility in older adults who regularly practice Tai Chi. A total of 69 community dwelling older (mean age 68.6 ± 6.3 years) adults were divided into two groups; those who practiced Tai Chi (18 men, 17 women) regularly for the past 6.3 ± 3.7 years, and a sedentary control group (16 men, 18 women) who remained inactive throughout the study. Baseline and follow up measures were recorded for the Tai Chi group (4.9 ±0.43 years between measures) and the control group (4.86 ± 0.41 years between measures) (56). At baseline, those in the Tai Chi group had lower levels of body fat ratio compared to the control group. Results at follow up showed both groups had increases in body fat ratios ($p < 0.05$), however the increase was smaller in the Tai Chi group (56). The results of this study suggest that although substantial changes were not seen in body fat ratio levels, the use of regular Tai Chi practice could reduce the onset of weight gain associated with the aging process.

Upon completion of the previous study, Lan et al. (51) then examined the effect of Tai Chi on body composition in 38 community-dwelling older (58-70 years) women. Using a randomized design, the overweight participants were placed into a Tai Chi group, consisting of practice for 1 hour per day, 4.6 ± 1.3 days per week over 12 months, or they were placed in a sedentary control group (51). The women in the Tai Chi group had decreased levels in percent body fat (28.8 ± 4.5% vs. 27.5 ± 4.8%;

$p < 0.068$) when compared to the control group (29.0 ± 4.6% vs. 29.5 ± 5.1%; $p < 0.089$) (51). As mentioned previously in their earlier study, it is common for older adults to gain weight as they age. However, despite these results lacking a significant change in body fat, the increasing trend towards a change in body fat gives evidence that excess fat mass in women may be preventable through the use of Tai Chi.

Thomas et al. (57) compared the benefits of 3 types of exercise, first being a 24-form Yang style Tai Chi (TC), second as a resistance training (RT) group, and the third group would remain active as a control group. Using a total of 207 men and women (68.8 ± 2.9 years) participants in the Tai Chi and resistance training groups were asked to complete 1 hour of their given exercise, 3 visits per week, while the control group maintained their usual physical activity for a total of 12 months. There were no between-group differences in changes in waist circumference (TC group -1.5 cm vs. RT group -1.7 cm vs. control -0.1 cm, $p = 0.35$) or percent body fat, which was measured using dual energy x-ray absorptiometry (TC group -0.1 % vs. RT group -0.2% vs. control -0.4% $p < 0.43$) (57). There was an increase in BMI in all groups (TC group 0.3 kg/m^2 vs. RT 0.1 kg/m^2 vs. control 0.1kg/m^2 $p < 0.82$) (54). While there were insignificant changes between groups in all variables, there was a significant change within group for a decrease in waist circumference (TC: -1.5 cm, $p < 0.05$, RT: -1.7 cm, $p < 0.05$) (57). Despite the overall result of this study led to success in a minimal within group change of waist circumference, there was otherwise no change seen between intervention and control groups. This shows that there is a need for an intervention that includes the combination of Tai Chi with dietary changes for the improved effects on body composition.

Tai Chi and Dietary Weight Loss

While there has been research done showing the effects Tai Chi has on both psychological and physiological factors, there is still little information on its effect on body weight and composition when combined with dietary weight loss. For example, Dechamps et al. (58) were the first to examine the effects of a weight loss program using dietary changes incorporated with Tai Chi. Their focus was on 21 obese, sedentary women (44.4 ± 11.9 years), with a BMI of 38 ± 6 kg/m². Participants were randomized into one of two groups; a Tai Chi plus hypocaloric diet, or a conventional structured exercise program. During this 10-week intervention, the Tai Chi participants were closely monitored through once weekly meetings with a dietician to assist with their dietary changes. Each week participants in the Tai Chi group were also asked to exercise for 2 hours of walking, or Tai Chi (58). When compared to the structured exercise plus diet group, the Tai Chi plus diet group saw a decrease of 3.4 ± 3.9 kg in body weight, whereas the exercise plus diet group saw a 1.9 ± 10 kg gain in body weight (58). The Tai Chi plus diet group also showed changes in loss of fat (-4.0 ± 3.5 kg), and increases in fat-free mass (+0.6 ± 2.8 kg) while the structured exercise plus diet group had a change in fat mass (+1.8 ± 9.3 kg) and fat-free mass (+0.1 ± 5.2 kg) (46). Upon a 30-week follow-up post the completion of the intervention, those who were included in the Tai Chi plus diet group were able to maintain the fat mass loss (-2.7 ±7.4 kg), while those in the structured exercise plus diet group also decreased their fat mass (-0.97 ±8.5 kg). Although there were changes seen in the levels of fat mass, there were not any that changed enough to be considered statistically significant at both the end of the intervention or follow-up.

Most recently, in a study by Katkowski, et al. (59), the additive effects of Tai Chi during dietary weight loss on body composition were examined in obese, postmenopausal women. Participants were randomized into two groups, the weight loss (WL) (n = 13, 62.7 ± 6.0 years, BMI: 34.8 ± .9 kg/m^2) and a Tai Chi plus weight loss (TCWL) (n = 14, 60.4 ± 5.9 years, BMI: 34.3 ± 5.1 kg/m^2). Over the 16-week intervention, participants attended a one-day per week, 45-minute behaviorally-based weight loss session based on the modified DASH diet. They participated Tai Chi, three times per week for 45 minutes per session. Results showed the intervention and WL groups had a significant within-group reduction in body weight (-2.2 ± 0.9 kg, $p < 0.017$ vs. WL: -3.7 ± 0.9 kg, $p < 0.0004$) (59). There were more within-group differences in the TCWL group also observed in BMI (-0.9 ±0.3 kg/m^2, $p < 0.018$), waist circumference (-3.4 ± 1.1 cm, $p < 0.006$), body fat mass (- 2.0 ± 0.7 kg, $p < 0.011$), and percent body fat (-4.8 ± 1.7 %, $p < 0.010$) (59). This study was the first of its kind to examine the additive benefits of Tai Chi to dietary weight loss in older, obese postmenopausal women in a laboratory based setting. While their study had many strengths, including the randomized design, a homogenous sample, and objective measures of body composition, they also had weaknesses. These limitations included not having a true control group, and a relatively small sample size. Thus, there is need for research to explore the combined effect of Tai Chi plus behaviorally based dietary education on body composition in obese older women in a community-based setting.

Conclusion

Obesity rates in the United States are high and are continuing to increase (1). The effects associated with an excess amount of body fat in older, postmenopausal women have the potential to accelerate the aging process (4), and increase health risks and disease (1). Numerous studies have been performed that examine the effects of exercise alone, and diet alone on its benefits for change in body composition and weight loss. More effective are the studies that have combined the two variables (45, 40, 39) and seen greater changes compared to the use of one variable alone. Through the use of exercise and a dietary weight loss intervention is the ability to prevent any fat-free mass loss, while decreasing excess amounts of fat mass in a healthy way (29, 47). Since not all forms of aerobic activity or resistance training are appealing to an older, obese population (52), a different form of exercise was needed. Tai Chi has been used for centuries offering benefits not only in psychological aspects, but physiological as well (50). However, there currently is little research surrounding the use of Tai Chi for changes in body composition and weight loss. To date there are no community-based studies that have examined the combined effect of Tai Chi and dietary weight loss in obese, older women for its effect on body composition measures. It is necessary for research to examine these combined effects on an obese, postmenopausal population in order to find a suitable intervention to prevent further fat mass gains and unhealthy changes in body composition.

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APPENDIX B: CONSENT FORM FOR RESEARCH

Title of Project: A community-based Tai Chi and weight loss study obese in women at Rhode Island senior centers

You are invited 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), Ingrid Lofgren (401-874-5706), and Furong Xu (401-874-2412) 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. The general eligibility criteria for inclusion to this study include having/being 1) female, 2) age 55-80 years, 3) a body mass index (BMI) of 30-50 kg/m^2, 4) body weight stable, 5) no recent medication changes, 6) post-menopausal, and 7) free of diseases or conditions that would prevent safe weight loss and/or participation in a Tai Chi exercise program.

Description of the project:

You understand that the primary purpose of this study is to assess the role that a 16-week Tai Chi exercise program plays in improving physical functioning, retaining muscle mass, losing fat mass, and improving heart disease risk factors when combined with intentional weight loss (~ 5-10%). Tai Chi is a form of martial arts that is a slow and low-impact exercise and has been shown to be effective for improving health outcomes in older women, including physical functioning. Another purpose of the study will be to assess the influence of intentional weight loss with Tai Chi training on changes in bone density, blood pressure, blood sugar metabolism, blood fats, muscle function, and other important health-related measures. Your participation will vary depending on which group you are assigned. However, the study may require your participation of 2-3 hours per week. All of the testing and intervention sessions will take place at your local senior center (North Kingstown, South Kingstown, or Warwick). You are responsible for your own transportation to all of the testing and intervention sessions.

What will be done:

You understand that if you choose to participate, the study requires your involvement in three phases.

PHASE 1: During the first phase, you will undergo preliminary testing (a 1-2 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 dietary screening tool, a food frequency questionnaire, a physical activity survey, a sleep quality questionnaire, a cognitive function test, life and body satisfaction surveys, 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 12 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 9:00am on a Wednesday, you are asked to not eat and/or drink anything besides plain water after 9:00pm 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 finger sticks. You understand that the two finger sticks 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 exercise training. The investigators of this study will use procedures designed to minimize this risk. The flexibility of your leg muscles will also be tested by using a simple test that requires you to attempt to touch your toes while seated.

Your percent body fat will be performed using bioelectrical impedance analysis, which is a battery powered, portable 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 20 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.

At the end of the first phase (testing), you may be assigned (based on group availability) to either a weight loss plus Tai Chi group or to a control group.

PHASE 2: INTERVENTION

Dietary Sessions (Weight Loss plus Tai Chi Group)

For those assigned to the weight loss plus Tai Chi intervention, you will be asked to participate in a diet designed to produce a moderate weight loss of 5-30 pounds (about 5-10% of your current weight). You will be instructed to consume a well-established, lower calorie, low fat diet, in which the goal will be to reduce your food intake by about 500 to 1000 Calories per day. In your senior center, you will meet in a group (~ 10-20 other participants) with an expert in nutrition once per week (~ 45 minutes per session) for 16 weeks who will give you instructions and expert advice on food selection, preparation, and other dietary changes. Weight gain or loss will be monitored weekly, and you will be instructed to keep careful records of your food intake.

Tai Chi Sessions (Weight Loss plus Tai Chi Group)

If you are assigned to the weight loss combined with Tai Chi exercise group, you will also be asked to participate in two (2) supervised exercise sessions per week (40-45 minutes per visit) for the 16-week intervention in your local senior center. Tai Chi is considered a soft form of Chinese martial arts (not for self-defense) that incorporates slow and low-impact exercise movements while you are standing on your feet. You will be asked to come to assigned room at your local senior center. During these sessions, you will receive instructions from trained exercise staff and will undergo Tai Chi exercise training using a modified Tai Chi protocol specifically designed for older adults. Your progress will be monitored and you will always be instructed by an exercise specialist regarding proper form for Tai Chi 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 Tai Chi 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.

During each Tai Chi exercise training session you will be asked to exercise for approximately 40-45 minutes per session. All sessions will start with a brief warm-up. The first several Tai Chi training sessions will begin with lighter intensities focusing on learning different Tai Chi movements. The difficulty will be gradually increased based on individual progress. The difficulty of the Tai Chi exercise will be adjusted so that you are exercising an effort level that is judged to be appropriate to improve your fitness level. Your blood pressure will also be monitored at each training session. You will be able to provide feedback using standardized pain and discomfort rating scales. Your overall progress will be monitored by an exercise specialist so that you are able to tolerate the exercise. Each session will end with a final blood pressure measurement and five minutes of stretching. You will be given printed diagrams and a DVD of the Tai Chi exercises so that you may practice the movements on your own between exercise sessions if you choose. Once you have mastered several of the movements, we will encourage you to practice Tai Chi on your own, and we will have you keep a journal of any extra Tai Chi practice that you perform.

Control Group

If there is no space available in the intervention group, you understand that you may be asked be in the "waitlist control" group. If you assigned to this group, we will ask you to participate in the baseline (phase 1) and follow-up (phase 3) testing phases, but you will not be participating in the 16-week intervention phase. However, by serving as a control participant you will receive the results of your health-related testing and the other participation incentives that the intervention group will receive. Additionally, as another incentive once the follow-up testing is complete, we will offer you four supervised Tai Chi exercise sessions at your local senior center along with the Tai Chi DVD so that you may continue to practice Tai Chi. These Tai Chi

sessions will be very similar to the sessions conducted as part of the Tai Chi plus weight loss group and are intended to give all participants the opportunity to learn Tai Chi. You understand that participation in these sessions is not part of the research investigation and is optional.

PHASE 3: The third and final phase will be a repeat of all previously taken measures after the 16 week intervention. All data will be sent and stored with a study number only at the University of Rhode Island and without any personal identifiers (including initials or birth dates). You will receive a copy of your results 2-3 months after the study is complete, although some of the results will be available immediately.

Risks or discomfort:

You understand that it is possible that heart, blood vessel, or other health 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 is strongly recommended, but not required, to participate in this study. Your local senior center may also require that you sign their liability waiver prior to participation. 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. Additionally, you understand that with the testing described above, Tai Chi, and exercise in general there is a risk of muscle soreness or other muscle injury as well as skeletal injury. Because Tai Chi does require some degree of balance, there is also a risk of falling associated with this type of exercise. However, the investigators will take precautions in order to reduce the likelihood that these adverse events will occur.

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.

Confidentiality:

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 principal investigators of the study. Your data will be coded with an ID number only, which

will be linked back to you only by the principal investigators 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 (Independence Square building, Suite P, room 225). Study records are retained securely for ten years after study end.

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 obese older women improve their physical function, body composition, and heart disease risk factors. However, because of what is already known regarding the individual effects of weight loss and Tai Chi 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 physical function.

Compensation:

You will receive a $20 supermarket gift card and a study t-shirt for your participation in the study.

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 are free to ask questions about this study before you decide whether or not to consent to participate. Also, 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, Ingrid Lofgren at (401) 874-5869, or Furong Xu (401) 874-2412 (anonymously, if you choose). In addition, if this study causes you any injury or if you have questions about your rights as a research subject you may contact the office of the Vice President for the Division of Research and Economic Development, 70 Lower College Road, Suite 2, University of Rhode Island, Kingston, Rhode Island; telephone: (401) 874-4328.

Alternatives to study participation: You understand that you might achieve similar results by another method i.e., a healthy diet plan and other exercise programs, which may be discussed with your physician. If you choose not to participate in this study, you are encouraged to discuss with your physician about weight loss and exercise strategies.

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, keeping one for you.

APPENDIX C: PHONE SCREENING

RHODE ISLAND DIETARY EDUCATION AND ACTIVE LIFESTYLE (UR-IDEAL) STUDY – PHASE 5

Data Sheet for Detailed Subject Telephone Interview

⑥ **Brief Explanation of Study**
⑥ **Permission to Conduct Interview?** _____Yes _____No
Comment:_____
_____
How they heard about us?:
_____

⑥ **Contact Information**

Name: Dr./Ms./Mrs._

_____

Address: _____

_____

Phone_____

#: E-_____

Mail:

Best Way and Time to Contact:_____

- **Time Commitment** – Available
____Yes ____No Wants to be contacted after _____ (Date)

Comment:

_____

- **Preference for Senior Center Location**
S. Kingstown (M/F) 8-9:30____ N. Kingstown (W/F) 8-9:30___or 10-11:30-____
- **Age**
Age: _____ yrs Date of Birth: _____/_____/_____
MM DD YY

Approximate Height: _____
Approximate Weight:_____
Calculated BMI: _____

- **Race**

___ American Indian or Alaskan Native
___ Asian or Pacific Islander

___ Black, not of Hispanic origin
___ Hispanic
___ White, not of Hispanic origin
___ Other/Unknown

- **Smoking**
  Always Non-Smoker_____
  Non-Smoker for _____
  Smoker_____

- **Physical Activity**
  Participates in regular (>1x/wk for past 3 months) exercise? ____Yes _____No

  If yes, describe in detail (e.g. frequency, intensity, duration, mode)

_____
_____
_____
_____

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

- **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 or other orthopedic conditions (knee, neck, or other back pain)**
  ___No ___Yes

If yes, describe including severity

_____

_____

_____

- **Frailty**

  No Incidents_____

  Fractures as an adult? _____

  If yes, describe: _____

_____

  ≥ 2 Falls in One Year? _____Yes _____No

  If yes, describe:

_____

_____

- **Diabetes**

  _____No

  _____Yes – Type 2. If type 2, taking insulin now? _____

  _____Yes – Type 1 (Insulin Dependent)

  Comments:_____

- **Surgeries as an adult?**

  ___No ___Yes

  If yes, what type (e.g. surgeries of the joints, heart surgeries, angioplasty, bypass surgery, pacemakers, etc.) and date(s)

  _____

  _____

  _____

  _____

- **Other Medical Conditions (especially those that would make exercise difficult or unsafe)**

  _____No

  _____Yes (Record on Medical History/Treatment Form)

  Comments:_____

_____

- **Medication Info – See last page**

  _____No

  _____Yes (Record on Medical History/Treatment Form)

  Comments:_____

_____

- **Personal Physician Info**

  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 _____Need More Information

_____Needs Drs. Delmonico, Xu, or Lofgren to review _____ Not Qualified

Questions/ Comments:_____

UR-IDEAL Study - Medication/Dietary Supplement Form

Name	
Date	

Condition/Reason	Severity	Name of Medication/Supplement	Date started	Dose (mg/times/day)	Expected to Change?

APPENDIX D: MEDICAL HISTORY
The University of Rhode Island Dietary Education and Active Lifestyle (UR-IDEAL) Study

Name:_____ **Sex: M F Initials:** ___ ___ ___
ID#: ___ ___

Name of Interviewer:_____
Date:_____

Emergency contact name and address & 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.

SECTION *A*

YES NO

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:_____

_____

_____

_____

SECTION *B*

Cardiovascular system: **YES NO**

1. Has any family member had a heart attack prior to the age of 55? _____ _____

   If so, how are they related to you?

2. Have you ever had frequent cramping in your legs while resting? _____ _____

   If yes, is it a current problem? _____ _____

3. Have you ever had pain or cramping in your legs while resting? _____ _____

   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 _____ _____

   If yes,

   a. What was the date of onset? Diagnosis _____

   b. Were you given any medications? _____ _____

6. Did a doctor ever tell you that you had a heart problem? _____ _____

   If yes.

   a. What was the date of onset? Diagnosis _____

   b. What did the doctor call it? Angina, heart failure, heart attack, rhythm disturbances, heart murmurs, enlarged heart, diseases of heart valves, others.

   Were you given any medications? _____ _____

   Abbreviation, another name? _____

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? _____ _____

If yes,

a. What was the month and year of the first occurrence?

_____

b. What was the month and year of the most recent occurrence?

_____

c. How would you describe the pain or discomfort? Pressure, burning, squeezing, piercing, stabbing, shooting or sticking.

_____

d. How many minutes did it last?

_____

e. Does the pain or discomfort move? If yes, to where?

If yes, to where? _____ _____ _____

_____ _____

Does the pain or discomfort tend to occur: _____ _____

After meals- _____ _____

At night- _____ _____

When Exercising-

When walking in cold windy weather-

When upset, excited or nervous- _____ _____

Other- _____ _____

f. Is this pain relieved by

A change in posture-

Rest-

Physical activity-

Bicarbonate of soda, Tums or antacids-

Prescribed medications-

Other-

g. Did you ever consult a doctor for this pain or discomfort? _____ _____

If yes,

What was the diagnosis?

Were you given any medications?

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

Comments:_____
_____
_____
_____

SECTION *C*

Respiratory System: YES NO

1. Have you ever had persistent cough with sputum production (on most days) _____ _____ for 3 months for consecutive 2 years?

   If yes,

   a. How long did it last?

b. Did your doctor prescribe any medications?

2. Have you ever had attacks of wheezing?

If yes,

a. Is it seasonal/periodic?

b. Have you ever-required hospitalization to treat an acute attack?

Comments:_____
_____
_____

SECTION *D*

Endocrine system:

Have you ever had any of the following symptoms? **YES** **NO**

a. Thyroid problems?

b. Adrenal problems? _____ _____

c. Diabetes mellitus? _____ _____

If yes, which type? Type 1 Type II _____ _____

Date of onset- _____ _____ _____

Were you on any medication, diet control

_____ _____

SECTION *E* **YES NO**

Reproductive system:

Menstrual History

a. Have you attained menopause?

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:_____
_____
_____
_____

SECTION *F* **YES NO**

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 subject answers "no" to any of the above questions _____ _____
2. Any problems with vision other than corrective lens changes?
   If yes, which of the following conditions- Blindness, temporary loss of vision, double vision, glaucoma, cataract, macular degeneration or others.

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?

	YES	**NO**
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 body including headaches while exercising?	_____	_____
16. Numbness or pain in your legs?	_____	_____
17. Have you been told that you have a peripheral neuropathy?	_____	_____
18. Tremors?	_____	_____
19. Problems with walking? If yes,	_____	_____
a. Do you fall frequently?		
b. Is you walking problem related to pain, weakness or loss of balance?	_____	_____
20. Parkinson's disease?	_____	_____
21. Stroke?	_____	_____

22. Epilepsy?

23. Have you ever had an operation on 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:_____

_____

_____

SECTION *H*

YES NO

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 white 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? _____ _____

If yes, what type, which site, date of onset? _____ _____ _____

5. Were you given any medications, radiation or undergone any surgery?

Comments:_____

_____

_____

_____ _____

SECTION *I*

Surgical History:

Have you undergone any surgeries?

If yes,

a. Where and for what purpose?

b. Date of Surgery?

c. Length of stay in hospital

d. Any complications of Surgery?

Comments:_____
_____
_____

Has your doctor ever told that you have been suffering from

i. Cystic medial degeneration

ii. Any other Connective tissue disorder?

	YES	**NO**
Has any of your family member had an intracranial aneurysm or bleeding?	_____	_____
Have you ever been diagnosed with an abdominal aneurysm?	_____	_____
Do you have a: History of severe pain in the abdomen ? If yes, Please specify	_____	_____
Do you have a history of severe headache?	_____	_____

If Yes, What was the date of onset? _____

Was it associated with neurological signs like blurred vision, nausea/vomiting, seizures, drowsiness, memory impairment, sensory or motor loss(weakness)?_____

Was it a new or different type of headache other than tension, migraine etc?_____

Was it the worst ever experienced?	_____	_____
Did it occur after exertion, coughing or straining?	_____	_____

SECTION *J*

YES NO

Do you have any other health problems not covered in this questionnaire?

If yes, please do specify.

Comments:_____
_____
_____

APPENDIX E: MEDICAL CLEARENCE

Medical Clearance to Participate in Dietary Education and Exercise Research Project

It is my understanding that _____ (name of the volunteer), a patient under my care, has volunteered to participate in a dietary weight loss and exercise study entitled "**The University of Rhode Island Dietary Education and Active Lifestyle (UR-IDEAL)** Study." It is strongly recommended that volunteers 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 16-week Tai Chi exercise program when combined with dietary weight loss (~5-10%) intervention (Dietary Approaches to Stop Hypertension-based diet) in obese (BMI: 30.0-50.0 kg/m^2) older women aged 55-80 years.

Exclusionary criteria for eligibility

___Severe cardiovascular disease, ___Severe stenotic or regurgitant valvular disease, ___Unstable angina Uncontrollable hypertension uncontrolled dysrhythmias, ___ hypertrophic cardiomyopathy, ___Severe COPD or other signs of significant pulmonary dysfunction, ___Musculoskeletal diseases that cause severe joint pain at rest or upon exertion, ___Having any condition that is likely to be aggravated by muscular exertion, ___Major joint, vascular, abdominal or thoracic surgery in the past three months, ___Being unable to engage safely in mild to moderate exercise, such as independently walking up at least one flight of stairs or walking 1/4 mile on level ground, ___Not within age range for study (55-80 years)
Although we are unaware of any cardiac complications that have resulted from Tai Chi, strength or physical functioning testing, there is only a limited amount of data available in older adults.

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 either participate in 1) a 16-week dietary weight loss program plus Tai Chi (a low-impact martial art) exercise training or 2) a waitlist control group. Both groups will be 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, Room 214, University of Rhode Island, Kingston, RI 02881, Ph: (401) 874-5440, Ingrid E Lofgren, PhD., M.P.H., R.D., Department of Nutrition and Food Sciences, 106 Ranger Hall, University of Rhode Island, Kingston RI 02881, Ph: (401)874-5706, and Furong Xu, Ph.D., Department of Kinesiology, 25 West Independence Way, Room 214, University of Rhode Island, Kingston, RI 02881, Ph: (401) 874-2412

Physicians Name_____

Physicians Signature_____ Date_____

APPENDIX F: 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, 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

1. _____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/repair

10. _____Heavy 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

APPENDIX G: DIETARY SCREENING TOOL

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 IS NOT 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)

APPENDIX H: EDUCATION SURVEY

Name _____ **Date:** _____ **Study ID#:** _____

EDUCATION

Highest level of education completed

___ Less than high school

___ High school or GED

___ Some college

___Two-year college degree (e.g. Associates)

___ Four-year college degree (e.g. B.S., B.A.)

___ Masters degree

___ Doctoral degree

___ Professional degree (e.g. M.D., J.D.)

___ Other (please specify) _____

APPENDIX I: WEEKLY DIET EDUCATION SESSIONS OUTLINE

WEEK 1
Topic: Common food beliefs.
Hand-outs: Common food beliefs questionnaire (to be completed at beginning of class) Nasco Read Food Labels handout.
Interactive component: Food Beliefs questionnaire, icebreaker: ask participants what they believe are common food myths. (Undergrads to make note of these for later sessions using Myth Buster handouts and posters for respective topics)
Food: Hidden health foods: Quinoa, complete protein, emphasize its versatility (provide recipe)
Props/Models: portion size models, measuring cups, food models
Participant Assignment: Complete food records and bring in any confusing food labels from home along with Read Food Labels handout.

WEEK 2
Topic: Food label reading
Hand-outs: Nasco Food Labels (from previous week), nutrition label terminology (to be handed out at the beginning of class)
Interactive component: Label reading exercise
Food: Yogurts: lite and full sugar (fruit on bottom or blended) Emphasis on fat and sugar content and subjectivity of serving size in large containers.
Props/Models: Two yogurts

WEEK 3
Topic: Introduction to food guide pyramid/serving size
Hand-outs: Mypyramid for older adults (print in color), "Nasco handy portions" and portion distortion handouts. Nasco portion puzzle handout
Interactive component: Use of computer for on line tutorial of MyPyramid.gov (use conference room overhead and personal laptop) – use actual food such as All Bran Cereal, coffee bread, pasta – have ppts dish out what they normally would and guess their portion size.
Food: some type of 100 cal pack (Quaker rice cakes, other).
Props/Models: serving size models/measuring cups
Free Item: Equal Easy Everyday Carb Counting Guide

WEEK 4
Topic: Introduction to the DASH Diet
Hand-outs: DASH diet eating plan sample serving sizes, nutrition to go: eating healthy the DASH way, ADA DASH nutrition fact sheet, Nasco sodium content of foods brochure.
Interactive component: Designing a DASH diet using food models based off "DASH diet eating plan" handout
Food: Breakfast items: low fat grain cereals, whole grain bagels, bran muffins
Props/Models: Food models (could be used to design dash diet)

WEEK 5
Topic: Heart healthy food/Know your fats
Hand-outs: nutrition to go: Trans fat, heart friendly fats, counting down cholesterol Nasco Busting the Myth – MUFAs, PUFAS, SF, and TF handouts, Common Fats and Oils handouts, Fat Facts handouts, Nasco Fat and Cholesterol Content of Foods Brochure
Interactive component: AHA bad fats videos on overhead, fat myths (review Nasco poster)
Food: Dark chocolate/nuts /avocado
Props/Models: TAG model, (2) Artery Death Models, Fat lipo visual model (tubes), fat model (Deb Riebe)

WEEK 6
Topic: Fruits and Vegetables (emphasis on DASH) *{Potassium,vitamin C}
Hand-outs: Nutrition on the go: The power of produce and Fantastic fruits, SNAP recipes ADA vegetable and potassium fact sheet.? Nasco Busting the Myth – Vitamins, Minerals, and Antioxidants handouts
Interactive component: Busting F&V Myths poster
Foods: variety of fruits and vegetables – raisins, craisins (portioned out), any other dried fruit, carrots, celery, some sort of DIP.
Props/models: Fruit and vegetable food models
Free Item: Sunkist Orange Peeler, "SNAP-ed squeeze fruit"
Participant Assignment: Bring in labels from grain products from home they believe may be whole grain.
Guest Speaker: Nivindra or BPS Grad student

WEEK 7
Topic: Grains/Carbohydrate *{fiber, folate}
Hand-outs: Whole grains made easy, whole grain handouts, strategies for increasing dietary fiber intake, SNAP recipes, CHO and Fiber content of foods brochure, COMPLEX VS SIMPLE CARBS myths HANDOUTS
Interactive component: Identifying whole grains based on food labels they bring in, provide examples, categorizing food items as either whole grain or refined, food myths poster.
Foods: variety of whole grain crackers, breads, white bread with whole grains.
Props/models: food models, Nasco fiber lipo visuals

WEEK 8
Topic: Protein *{B12}
Hand-outs: ADA fact sheets, SNAP recipes, Nutrition to go: Eggs, Nasco Busting the Myth – Protein and Veg Protein handouts, Nasco Protein Content of Foods Brochure (ordered)
Interactive component: Nasco myth poster: Veggie vs. Animal protein
Foods: Hummus, low fat string cheese
Props/Models: food models

WEEK 9
Topic: Dairy and dairy alternatives (osteoporosis and calcium)*{vitamin D}
Hand-outs: Nutrition to go: Got Calcium? Lactose intolerance, SNAP recipe

Interactive component: match food items with proper calcium content or a game in which ppts guess which food model contains the most amount of calcium. (I have a list of calcium rich foods I can match up with our food models).
Also, a true and false fact sheet about Vitamin D (Noereem)
Foods: alternative calcium sources: fortified soy and rice milks,
Props/Models: food models with calcium contents

WEEK 10
Topic: Healthy dining out and eating during social gatherings
Hand outs: Nutrition on the go: Dining out healthy, Eat out eat healthy, eating out healthy tip sheet, Sensible eating during the holidays.
Interactive component: analyzing local restaurant menus for healthy choices (Newport Creamery, Chellos, Chillis, Friendlys, Applebees, Dennys, McDs, etc.)
Foods:
Props/models: local restaurant menus

WEEK 11
Topic: Cutting calories and healthy substitutions
Hand-outs: Tip sheets: lowering calories on the DASH plan, healthy food substitutions
Interactive components:
Foods:
Props/Models: healthy alternative products used in cooking. (applesauce, prune puree, beans, yogurt etc.)
FREE ITEM: Pure Via samples

WEEK 12
Topic: healthy beverage choices/alcohol
Handouts: ADA fact sheet alcoholic beverages, Think Your Drink Handouts, Sizing up your beverages.
Interactive component:
Foods: assorted beverages (fruit juices)
Props/models: "giant soda" model (Linda), food props

WEEK 13
Topic: Food Safety and high risk foods
Hand-outs: High risk food fact sheet
Interactive component: Indentifying food risk in kitchen, Food Safety Toss Up Ball
Foods:
Props/models: examples of high germ conduits.
Free Item: SNAP-ed Fridge thermometer

WEEK 14
Topic: Healthy home cooking and the tools that make it easier.
Hand-outs: UR-IDEAL recipe book
Interactive component: Cooking demonstration/easy recipe
Foods: SNAP recipe: "Brocolli Bean and Pasta Salad"

Props models: Portion size gadgets for home cooking.

WEEK 15
Topic: Eating on a budget/healthy supermarket shopping /eating in season
Hand-outs:
Interactive component
Foods: SNAP recipe
Props/Models: cost comparisons of prepared food vs. ingredients.

WEEK 16
Topic: Common food beliefs feed-back and overall review of topics
Hand-outs: Redistribute common food beliefs questionnaire
Interactive component: food beliefs feedback
Foods:
Props models:

APPENDIX J: DATA COLLECTION SHEET

Name: Baseline Checklist Date:

Test	Checklist	Completed By:	Date Completed
Blood Pressure 1			
Blood pressure 2			
Height			
Weight			
Waist Circumference			
Hip Circumference			
Body Composition			
SPPB			
TUG			
Grip Strength			
Chair Sit and Reach			
Leg Strength			
DST			
DSST			
PSQI (Sleep Quality)			
YPAS			
NCI			
Body Satisfaction			
Life Satisfaction			
Resiliency			
Education			
Blood Markers			

Pacemaker/Internal Defibrillator? Yes_____ No _____