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IMPACT ON NUTRITION RISK IN COMMUNITY
DWELLING OBESE WOMEN WITH NUTRITION AND
PHYSICAL ACTIVITY INTERVENTION

BY

AMY TAETZSCH

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
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UNIVERSITY OF RHODE ISLAND

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OF

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ABSTRACT

Statement of the problem: There have been no studies examining a combination of behaviorally-based dietary education, resistance training, and Tai Chi on dietary quality and resilience.

Objectives: To examine the effect of a behaviorally-based diet education, resistance training, and Tai Chi intervention on dietary quality as well as physical resilience in obese older women.

Design: Community health outreach with a non-randomized quasi-experimental design. Setting: Urban senior center in Providence, Rhode Island.

Participants: There were 33 women with mean age of 65 ± 8.2 years and BMI of $37.3 \pm 4.6 \text{ kg/m}^2$ who were enrolled in the study at baseline however only 17 women in the intervention group and 9 women in the control group completed the study.

Intervention: Participants engaged in 12 weeks of 45 minutes of Tai Chi 3 times per week, resistance training 2 times per week, and behaviorally-based dietary education once per week. The dietary education was based off of the modified Dietary Approaches to Stop Hypertension (DASH) diet and led by a registered dietitian.

Measurements: Testing occurred at baseline and post-intervention. Dietary quality and nutrition risk were measured using the Dietary Screening Tool (DST), resilience was measured by the Resilience Scale, and physical resilience was examined using the Physical Resilience Scale.

Results: Although there was no significant effect for dietary quality in terms of group and time ($p=0.078$), the proportion of variance that dietary quality is explained by the intervention was considered a large effect (partial $\eta^2 = 0.147$). There was no change

seen in resilience, however the intervention improved physical resilience ($p=0.048$, partial $\eta^2 = 0.17$).

Conclusion: A community health outreach that involved behaviorally-based dietary education, resistance training, and Tai Chi may promote higher dietary quality as well as improve physical resilience in obese older women.

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PREFACE

This thesis was written to comply with the University of Rhode Island graduate school Manuscript Thesis Format. This thesis contains one manuscript: *Impact on Nutritional Risk in Community Dwelling Obese Women with Nutrition and Physical Activity Intervention*. This manuscript has been written in a form suitable for publication in the *Journal of Nutrition, Health, and Aging*.

TABLE OF CONTENTS

ABSTRACT	ii
ACKNOWLEDGMENTS	iv
PREFACE	v
TABLE OF CONTENTS	vi
LIST OF TABLES	vii
LIST OF FIGURES	viii
CHAPTER 1: Impact on Nutritional Risk in Community Dwelling Obese Women with Nutrition and Physical Activity Intervention	1
Abstract	2
Introduction.....	3
Materials and Methods	5
Results	10
Discussion	12
Conclusions	16
References.....	17
Figures and Tables	23
APPENDICES	31
Appendix A: Review of Literature	32
Appendix B: Extended Materials and Methods.....	85
Appendix C: Study Informed Consent	97
Appendix D: Assessment Materials	103
Appendix E: Intervention Information.....	125

LIST OF TABLES

TABLE	PAGE
Table 1. Eligibility Criteria.	24
Table 2. Participant Characteristics	25
Table 3. Intervention vs. Control Group at Baseline and Post-Intervention	30

LIST OF FIGURES

FIGURE	PAGE
Figure 1. Study Flow Chart.....	23
Figure 2. Dietary Quality	26
Figure 3. Nutrition Risk in Control Group.....	27
Figure 4. Nutrition Risk in Intervention Group.....	28
Figure 5: Physical Resilience	29

CHAPTER 1

Impact on Nutritional Risk in Community Dwelling Obese Women with Nutrition and Physical Activity Intervention

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ABSTRACT

Objectives: To examine the effect of a behaviorally-based diet education, resistance training, and Tai Chi intervention on dietary quality as well as resilience and physical resilience in obese older women. *Design:* Community health outreach with a non-randomized quasi-experimental design. *Setting:* Urban senior center in Providence, Rhode Island. *Participants:* There were 33 women with mean age of 65 ± 8.2 years and BMI of 37.3 ± 4.6 kg/m² who were enrolled in the study at baseline however only 17 women in the intervention group and 9 women in the control group completed the study. *Intervention:* Participants partook in 12 weeks of 45 minutes of Tai Chi 3 times per week, resistance training 2 times per week, and behaviorally-based dietary education once per week. The dietary education was based off of the modified Dietary Approaches to Stop Hypertension (DASH) diet and led by a Registered Dietitian. *Measurements:* Testing occurred at baseline and post-intervention. Dietary quality and nutrition risk were measured using the Dietary Screening Tool (DST), resilience was measured by the Resilience Scale, and physical resilience was examined using the Physical Resilience Scale. *Results:* The intervention group had significantly higher dietary quality (66.5 ± 10.2) compared to the control group (54.4 ± 12.8 , $p=0.025$) at post intervention, however there was no difference in nutrition risk category. There was no change seen in resilience, however the intervention improved physical resilience ($p=0.048$, partial $\eta^2 = 0.166$). *Conclusion:* A community health outreach that involved behaviorally-based dietary education, resistance training, and Tai Chi may promote higher dietary quality as well as improve physical residence in obese older women.

INTRODUCTION

Approximately, 80% of older Americans have at least one and 50% have at least two chronic health conditions [1]. Women are more likely to be obese, have chronic conditions [2] and have a greater rate of functional decline due to aging compared to men [3-5]. Additionally, about 1 in every 5 Americans are over the age of 65 years [1]. Successful, healthy aging is important as the aging U.S. population will significantly increase the burden on the health care system making preventative health care imperative [6-8]. Older women have more health care visits and emergency room visits compared with their younger and male counterparts [1]. It is important that health interventions target older obese women in order to reduce their risk of chronic disease and thus the burden to the U.S. health care system as nutrition is a critical component of therapeutic plans for chronic diseases as is physical activity [9-12].

The United States Department of Agriculture (USDA) and American Academy of Nutrition and Dietetics (AND) recommends that adults focus on overall healthy food patterns as the key to a healthy way of life [13]. However, up to 48% of older adults are not at optimal nutrition status [14,15]. The Dietary Approach to Stop Hypertension (DASH) diet, which was developed originally to manage hypertension, supports the overall diet approach USDA and AND advocates [16] and has been shown to help individuals prevent or control high blood pressure, lower cholesterol and help facilitate weight loss [17,16]. The DASH diet is a well accepted and effective diet for older adults [18,19].

Furthermore, less than half of older adults met the federal physical activity recommendations for aerobic and muscle strengthening exercise [20,21]. It is

recommended that older adults participate in physical activity that includes flexibility, balance, strength training, and aerobic training which is accomplished by participating in multiple modalities of physical activity [22,23]. Physical resilience, the ability to recover or optimize function in the face of age related losses or diseases, facilitates recovery and coping with the daily physical challenges associated with aging and chronic illness [24]. It is speculated that physical resilience could be modified following a health promotion intervention. Research has demonstrated that resistance training and Tai Chi are effective in improving anthropometrics as well as the symptoms of CVD, and diabetes [25-31]. Studies have also shown that Tai Chi and resistance training are well tolerated exercise modalities in older adults [32-34]. However to our knowledge, there have been no interventions that have combined dietary education, Tai Chi and resistance training.

Studies that combine Tai Chi or resistance training along with behaviorally-based dietary education have been shown to improve dietary quality along with anthropometrics and symptoms of CVD and diabetes in obese older women [35-43]. However, to date, there is limited research examining nutrition education combined with multiple modalities of physical activity intervention on health related outcomes in obese women, especially in minority populations. The primary aim of this study is to examine dietary quality and nutrition risk in older obese women in response to Tai Chi, resistance training, and dietary education intervention in obese older women compared to a non-treatment control group. The exploratory aim was to study the effect of a Tai Chi, resistance training, and dietary education intervention in older obese women on physical resilience.

MATERIALS AND METHODS

Study Design

This study was a quasi-experimental 1week community health outreach intervention at an urban Providence, Rhode Island Senior center. The intervention consisted of behaviorally-based diet education, Tai Chi, and resistance training and was approved by the University of Rhode Island (URI) Institutional Review Board (#HU1213-08). The intervention and all measures performed in this study were taken at baseline and post-intervention.

Subjects

Ninety-two women responded to recruitment efforts; however 59 women were ineligible due to variables that include inability to obtain medical clearance, BMI too small and too large, time constraints, and inability to communicate in English, see figure 1 for study flow chart and table 1 for eligibility criteria. Prior to starting the study, all participants completed the informed consent process. This resulted in 33 eligible participants of which 23 were first assigned to the intervention group and then 10 women werenon-randomly assigned to the control group. There were 6 participants in the intervention group who did not complete the study as well as 1 participant in the control group was lost to follow-up. Thus 17 individuals completed the intervention group and 9 completed the wait-list control group.

Questionnaires

Participants completed the Dietary Screening Tool (DST) in order to identify dietary patterns and nutritional risk [15,44]. The total score of the DST ranges from 0-

100 with 5 ‘bonus’ points for dietary supplement use; the higher the score indicating healthier dietary patterns. Furthermore, the composite score of the DST is associated with three different nutritional risk levels; (<60) at risk, (60-75) possible risk, and (>75) not at risk [15]. Physical resilience was measured via the Physical Resilience Scale, which was developed and validated by Resnick et al. [24,45]. This questionnaire is 15 validated questions and has the participant use a physical challenge they have experienced to base their answers ; higher scores indicates greater physical resilience. Resilience was measured using the Resilience Scale developed by Wagnild and Young, which is a series of 25 questions that are answered on a Likert scale from 1 to 7; higher scores indicate greater resilience [46]. The Yale Physical Activity Scale (YPAS) was also administered which measured activity index as well as weekly calorie expenditure[47].

Anthropometrics

Following an overnight fast and voiding of the bladder, weight was measured to the nearest 0.25 pound via a medical beam scale (Webb City, MO, USA) and height was measured with a stadiometer (Webb City, MO, USA) to the nearest 0.25cm; both were measured in duplicate and averaged. Body mass index (BMI; kg/m^2) was calculated from the average height and weight after appropriate conversions. Body composition was measured in all participants via foot-to-foot bioelectrical impedance analysis device (Tanita BF-556, Arlington Heights, IL, United States). The waist to hip ratio (W:H) was calculated from the waist circumference measurement using a standard tape measure with a tensometer (Creative Health Products, Ann Arbor, MI)

at the point of the iliac crest and hip circumference measurement at the broadest circumference of the hips above the gluteal fold.

Biochemical

A lipid and glucose panel was obtained via a finger stick (Cholestech[®] LDX system) after participants fasted for 12 hours and abstained from caffeine or nicotine. Researchers measured serum total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triacylglycerols, and glucose. Forty microliters of blood was collected using a lancet and analyzed using a portable Cholestech machine.

Clinical

Manual blood pressure (BP) was taken twice one minute apart after the participant had been seated for 5 minutes with arm at heart level using a standard sphygmomanometer (752 Mobile Aneroid, American Diagnostic Corp)[48].

Repeatable Battery for the Assessment of Neurological Status

The Repeatable Battery for the Assessment of Neurological Status (RBANS) test measures attention, language, visuospatial/constructional abilities, and immediate and delayed memory in individuals aged 20-89 years; the higher the score signifies better cognitive function [49].

Intervention

The intervention group participated in three 90-minute sessions a week over a 12-week period (36 sessions total). All sessions contained approximately 45 minutes of Yang-style Tai Chi [50]. Two sessions per week included 30-45 minutes resistance training sessions [51] and once per week there was 45 minutes of behaviorally-based dietary education. During the behaviorally-based dietary education sessions,

participants were encouraged to adopt a modified DASH diet throughout the study which includes low intake of saturated fat (<7% of caloric intake), moderate intake of total fat (<35% of caloric intake, modified from the original DASH diet recommendation of 27% [52]), high intake of fruits, vegetable, and whole grains; consumption of low-fat dairy and meat products, and a moderate intake of sodium (3,000 mg or less/day) [16,53]. The wait-list control group did not receive any intervention during the 12 week intervention period and were asked to maintain their normal lifestyle.

Statistical Analysis

It was determined that a sample size of 24 total participants would be adequate in detecting a difference in DST score resulting in an effect size of 0.77 with an alpha of 0.05 and this number was consistent with past interventions [37-41]. Data were analyzed using SPSS for Windows (version 22.0, IBM Corp. Summers, NY). Significance was set at a p value > 0.05. Variables were assessed for normality: skewness between -1 to 1 and kurtosis between -1.5 to 2. The following variables were log transformed: YPAS weekly calorie expenditure change score, resilience change score, total cholesterol, LDL-C, and triglycerides. Resilience at baseline and post-intervention were square root transformed. Lastly, physical resilience at baseline and post-intervention were reflect square root transformed. However the following variables were not able to be transformed and thus non-parametric tests were used: systolic blood pressure, diastolic blood pressure, body fat percent, YPAS weekly calorie expenditure at baseline and post-intervention as well as in waist to hip ratio change. Data was assessed for differences between groups and completer status. All

further tests were performed on completers only. Categorical variables were expressed as number and percentages. Continuous variables were expressed as mean \pm standard deviation.

The independent variable was group (intervention and control) while dependent variables included nutrition risk, diet quality, and physical resilience. At baseline and post-intervention, between subject tests conducted included Independent t-tests for normally distributed continuous variables, Mann-Whitney U Test for non-normally distributed continuous variables, and Fishers exact analysis for categorical variables. For normally distributed variables, a one-way repeated measures analysis of variance (ANOVA) for normally distributed or transformed continuous dependent variables was used to compare baseline to post-intervention by group. Paired t-tests for normally distributed variables, Wilcoxon Signed Rank test for non-normally distributed continuous variables, and McNemar's test for categorical values were used to determine changes between baseline and post-intervention within each group.

RESULTS

Table 2 presents participant characteristics. Participants in this study were primarily non-white women with a mean age of 65 ± 8.2 years, BMI of 37.3 ± 4.6 kg/m² and the majority with a high school degree or less. More than half of the women had heart disease and 42% had diabetes. Attendance was 67.5% for the overall intervention and 69.4% specifically for the dietary sessions. There was no difference in baseline variables between groups as well as was no difference in baseline variables in those who completed the study compared to those who did not. Therefore further statistical tests were run on completers only.

There was no significant effect for dietary quality in terms of group and time ($p=0.078$), although the proportion of variance that dietary quality is explained by the intervention was considered a large effect (partial $\eta^2 = 0.147$). At post-intervention, the intervention group had significantly higher dietary quality (66.5 ± 10.2) compared to the control group (54.4 ± 12.8 , $p=0.025$); see Figure 2.

There were 87.5% of women at baseline and 86.4% of women at post-intervention who were at or possibly at nutrition risk at baseline. There was no significant difference in nutrition risk between groups at either baseline or post-intervention or with-in groups from baseline to post-intervention; see Figure 3 and 4. However, 5 participants (33.3%) in the intervention group improved their nutrition risk category, while no one in the control group improved their nutrition risk category.

There was a significant group by time effect for physical resilience; with participants in the intervention group increasing their physical resilience from baseline to post intervention while those in the control group decreased their physical resilience

($p=0.048$). A large part of the variance of that physical resilience is explained by the intervention given a large effect size (partial $\eta^2 = 0.166$), see Figure 5. At post intervention. participants in the intervention group had significantly higher physical resilience (13.8 ± 1.0) compared to those in the control group (12.1 ± 2.5 , $p=0.032$). A greater change in physical resilience was measured for participants in the intervention group who increased their physical resilience score (0.2 ± 1.1) while participants in the control group's physical resilience score decreased (-1.0 ± 1.5 , $p=0.025$). There was no change in overall resilience either between or within groups and overall resilience was not impacted by the intervention ($p=0.835$, partial $\eta^2 = 0.002$).

There was a significant decrease in systolic and diastolic BP from baseline to post intervention in both groups as shown in Table 3. The control group significantly increased their triglycerides from 128.8 ± 61.9 mg/dl at baseline to 168.6 ± 85.9 mg/dl post-intervention ($p=0.033$). There was a significant effect for time in regards to an increase in waist to hip ratio ($p=0.002$, partial $\eta^2=0.345$). In the control group, waist to hip ratio from 0.89 ± 0.08 at baseline to 0.94 ± 0.09 at post intervention ($p=0.018$).

DISCUSSION

The novel aspect of this research is that this intervention combines Tai Chi, resistance training, and nutrition education in urban community-dwelling obese, older, primarily minority women. There was a non-significant trend indicating that 12-weeks of diet education combined with multiple modalities of physical activity may improve dietary quality along with other health outcomes. Furthermore, results from this study show that physical resilience can change following a community health intervention.

There was no significant effect of time and group in diet quality, there was a large effect size (partial $\eta^2 = 0.147$), suggesting that with a larger sample size, the intervention could significantly improve dietary quality. Another study with 16 weeks of behaviorally-based diet and Tai Chi education found that the intervention group significantly improved their dietary quality from baseline to post intervention in obese older women [40]. Similarly, an 8-week community intervention in overweight and obese older adults resulted in a significant improvement in dietary quality from baseline to post-intervention,[36]. Although there were improvements over time and at post intervention in dietary quality, overall dietary quality needs to improve in order for older adults to be classified as not at nutrition risk.

Although there was no difference in proportion of participants in nutrition risk categories between groups nor was there a change in nutrition risk over time in either group,, 87.5% of completers were at nutrition risk as classified by DST score and only 5 participants increased their nutrition risk category at post intervention; all in the intervention group. This is of particular concern as individuals with good nutrition status have better overall health, decreased chronic disease, improved quality of life,

increased life expectancy, better functional ability, and decreased disability [10,9,54,55].

Resilience is crucial for successful aging as it involves an individual's ability to adjust and adapt, which is particularly important as older adults often experience a loss of a spouse, other family members or close friend, an event that negatively impacts independence, or a general decline in physical health [7,56]. However, there is controversy as to whether resilience is static (a trait) or dynamic (a state) [57]. This debate partially hinges on whether personality can change. Most research agrees that personality characteristics influence how a person acutely and chronically deals with adverse life events and stresses and thus contributes to resiliency [57]. Research indicates that personality changes more drastically in younger years and becomes more stable with advancing age [58,59]. Nonetheless, research also indicates that personality traits can change in adulthood, although the change is less pronounced compared to the change that occurs during younger years [58,60]. This study found an effect on physical resilience, which is a specific type of resilience that addresses more the physical side of resiliency, may be more of a state as results from the one-way repeated measures ANOVA suggest that the behaviorally-based diet, Tai Chi, and resistance training has a beneficial effect in improving physical resilience. However, there was no change in overall resilience following the intervention suggesting that either this intervention did not effectively target a change in overall resilience or that overall resilience may be a more of a trait.

Behaviorally-based diet and resistance or Tai Chi interventions have been shown to improve health including physical function, body composition, and

cardiovascular health [38,37,36,35,42,39-41,43]. This study identified a decrease in blood pressure from baseline to post-intervention in both groups. There were no significant improvements in body composition or biochemical data in the intervention group. The control group increased their waist to hip ratio and triglycerides. In both groups the mean waist to hip ratio indicates visceral adiposity in women [61]. Although it is expected that the waist to hip ratio would be high in these women as an inclusion criteria was obesity, it is alarming that the control group increased their waist to hip ratio given the increased risk of morbidity and mortality associated with increased visceral fat [62]. Furthermore, the increase in triglycerides in the control group resulted in a mean level that is classified as borderline high according to National Cholesterol Education Program [63], which affects almost 30% of American women [64].

There were several strengths of this study. The first being that that the intervention examined multiple modalities of physical activity along with diet education; the combination of resistance training, Tai Chi, and diet education has not been studied before to our knowledge. Secondly, this study also had a large proportion of minority women which is a strength as more research is needed on dietary education and physical activity interventions in older minority women [65]. Thirdly, this study also used validated questionnaires and the intervention followed guidelines that have been shown to be effective in measuring targeted outcomes [51,16,18,19,66,67,36,35,68,37,42,39-41,43]. The fourth strength is that no studies, to our knowledge, have examined the impact of a lifestyle intervention on physical resilience. This study provided some evidence to the debate as to whether resilience is

a state or trait, however further research is needed. Lastly, a systematic review found that the mean attendance rate for African Americans participating in nutrition and physical activity interventions was 58% [69]. This study's attendance rate of 69.4% for behaviorally-based diet sessions and overall rate of 67.5% is high given our high proportion of non-Caucasian women even though the attendance rate was lower than previous studies [38,37,70].

There remain some limitations that should be addressed. Firstly, assignment to the groups was non-randomized as it was a community health intervention. Second, the sample size was small, however the sample size is similar to previous studies and did show large effect sizes [37-41]. Third, Individual intervention effects were not able to be tested, however interventions that include dietary education paired with resistance training or Tai Chi has been shown to significantly improve health outcomes [68,37,36,35,42,39-41,43].

CONCLUSION

The results from this study indicated that there is a non-significant trend that behaviorally-based diet education combined with resistance training and Tai Chi impacts dietary quality. Furthermore, 12 weeks of behaviorally-based diet education, resistance training, and Tai Chi beneficially improves physical resilience in obese older women; thus suggests that physical resilience is dynamic and thus a state. These results provide preliminary evidence that physical resilience is a state and therefore, amenable to change.. Future research is needed to explore the effects of behaviorally-based dietary education, resistance training, and Tai Chi with a larger sample of older women on dietary quality and resilience to determine if overall resilience can change as well as physical resilience.

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FIGURES AND TABLES

Figure 1: Study Flow Chart

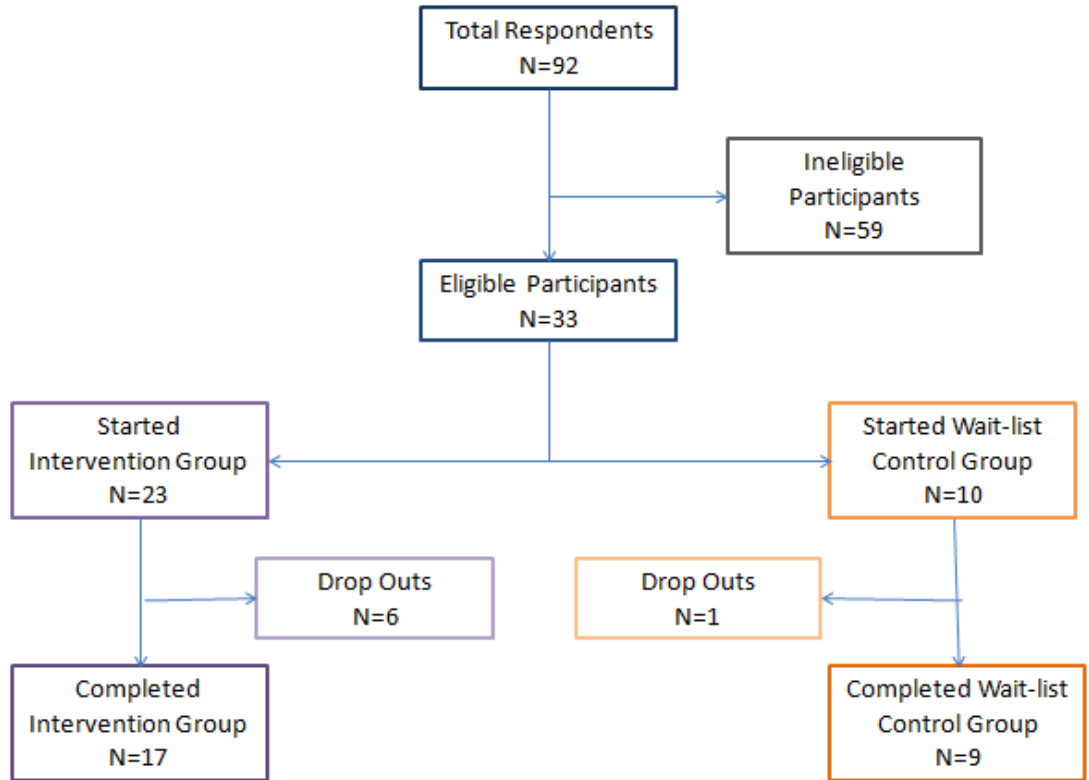


Table 1: Eligibility Criteria

<p><i>Inclusion Criteria</i></p> <ul style="list-style-type: none">a. Women, aged 50–80 years;b. BMI of 30.0 to 50.0 kg/m²;c. Not engaged in regular exercise program within the past 6 monthsd. Post-menopausal by self-report.
<p><i>Exclusion Criteria</i></p> <ul style="list-style-type: none">a. Failure to provide informed consent;b. Significant or suspected cognitive impairment;c. Severe hearing loss, speech disorder, language barrier or visual impairment;d. Progressive, degenerative neurologic disease;e. Terminal illness with life expectancy of < 12 months, as determined by a physician;f. Severe pulmonary disease, uncontrolled diabetes, blood pressure, or anemia;g. Medications not taken for >3 weeks, lipid lowering medications for >6 monthsh. Major joint, vascular, abdominal, or thoracic surgery within 6 monthsi. Significant cardiovascular disease;j. Inability to safely engage in mild to moderate exercise with muscular exertion

Table 2: Participant Characteristics

	All (n=26)	Intervention (n=17)	Control (n=9)
Age (years)	65±8.1	65±8.1	66±8.6
Height (cm)	158.8 ± 6.3	158.3 ± 6.6	159.7 ± 5.9
BMI (kg/m²)	38.1 ± 4.6	38.8 ± 5.1	36.6 ± 3.4
Race % (n)	15 (4)	24 (4)	0 (0)
Caucasian (non-Hispanic)	85 (22)	76 (13)	100 (9)
Not Caucasian			
Education % (n)	58 (15)	59 (10)	56 (5)
≤ High School degree	34 (9)	35 (6)	33 (3)
Some or college degree	8 (2)	6 (1)	11 (1)
> College degree			
CVD % (n)	69 (18)	65 (11)	78 (7)
Diabetes % (n)	42 (11)	35 (6)	56 (5)
Resilience	154.9 ± 19.8	155.5 ± 16.2	153.7 ± 26.0
Activity Index	26.6 ± 15.1 [¥]	24.6 ± 10.8	30.1 ± 22.1 [¥]
Cognitive Function	88.1 ± 19.9	86.7 ± 18.6	90.7±23.2 [¥]

Figure 2: Dietary Quality

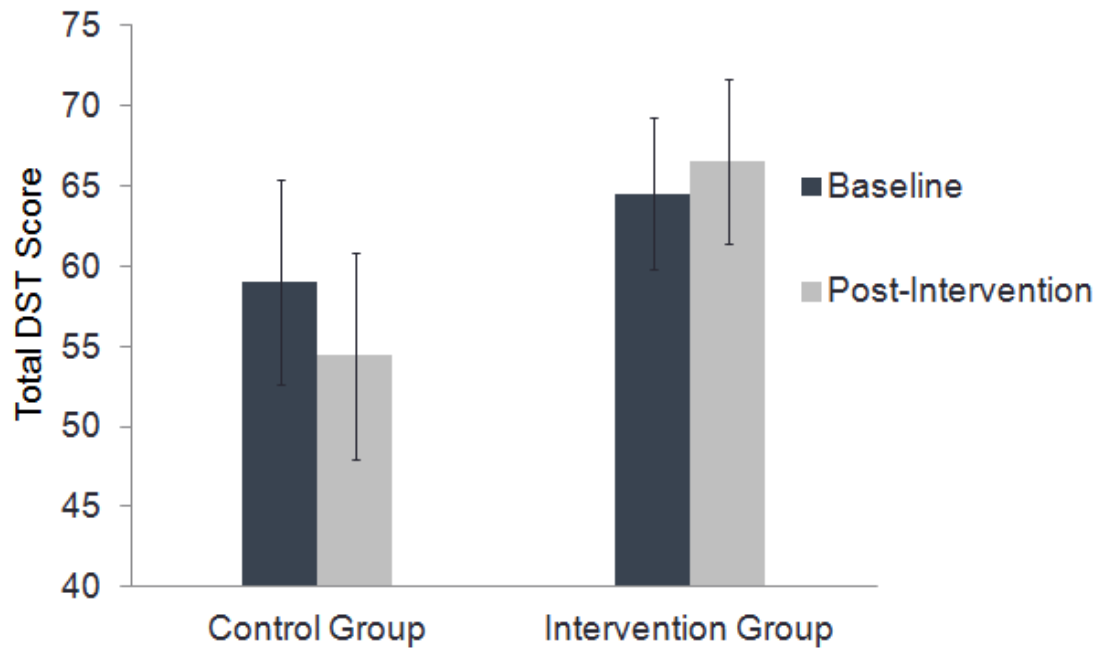


Figure 3: Nutrition Risk in Control Group

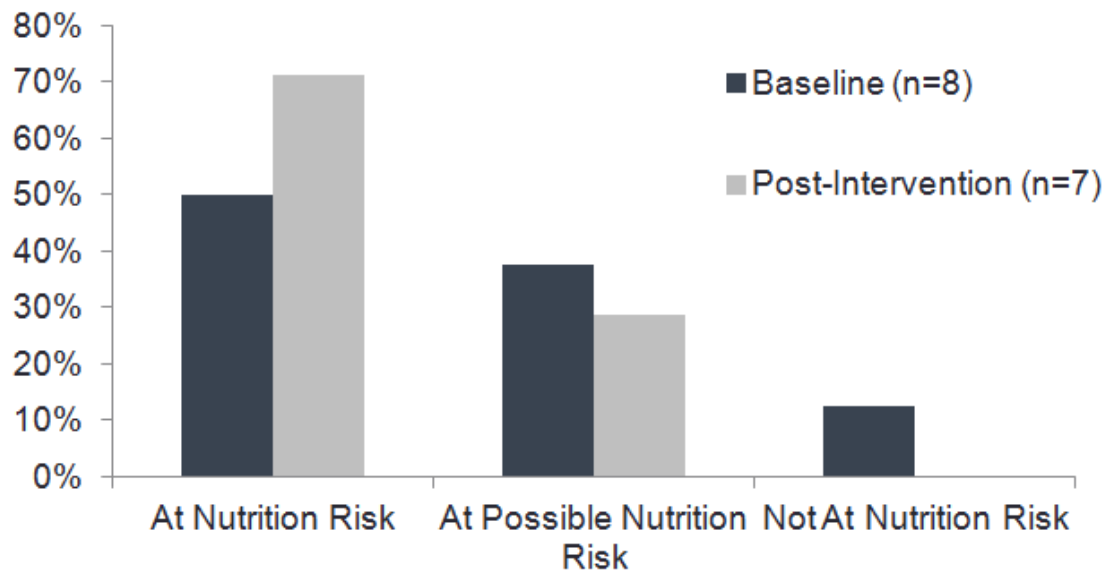


Figure 4: Nutrition Risk in Intervention Group

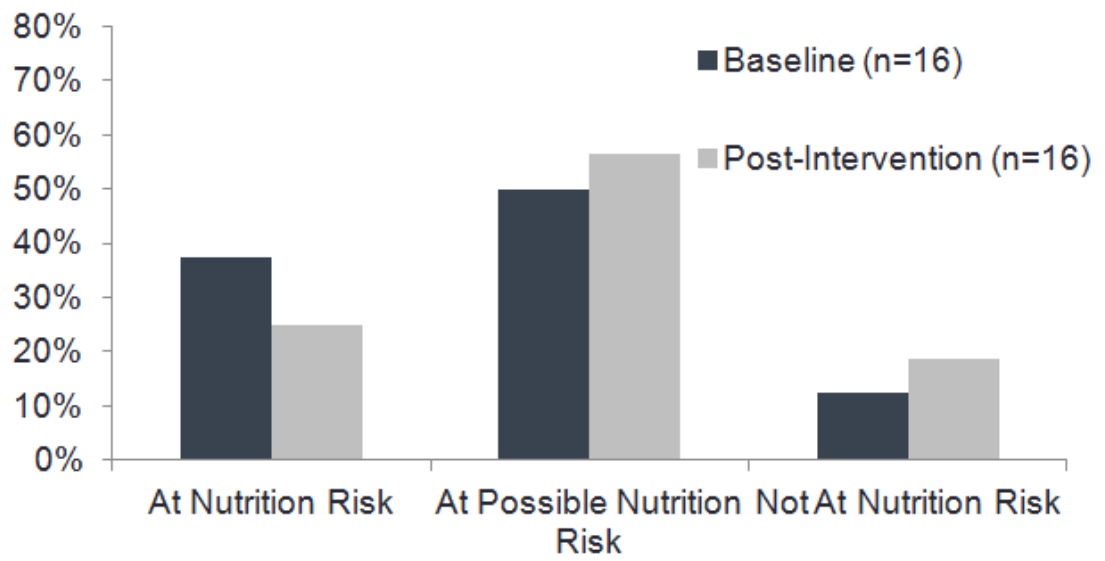


Figure 5: Physical Resilience

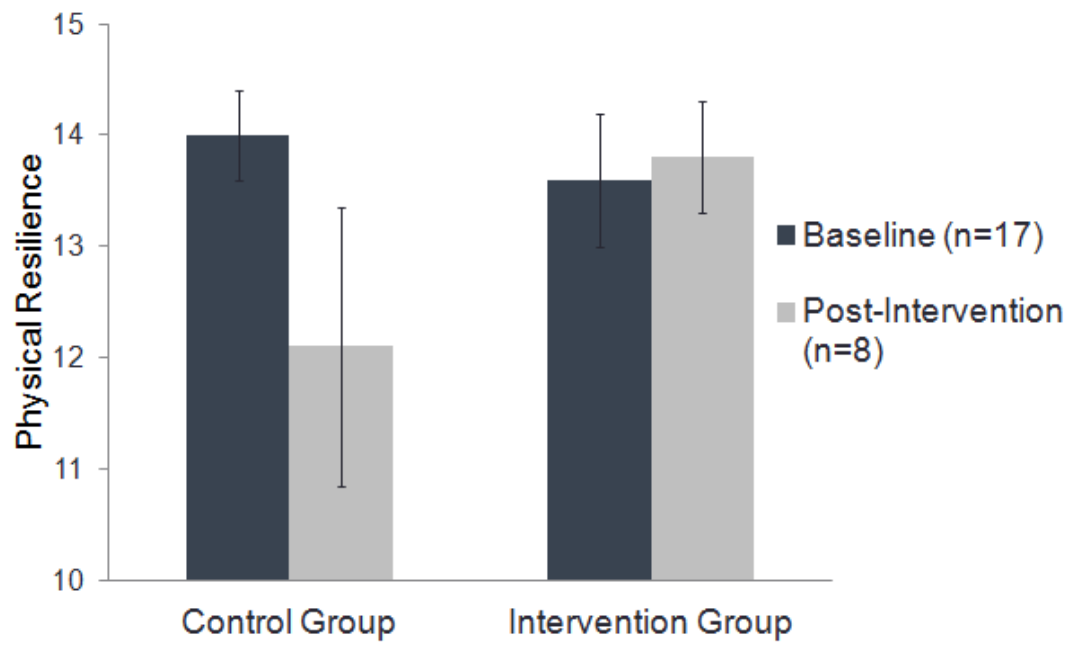


Table 3: Intervention vs. Control Group at Baseline and Post-Intervention

	Intervention: Pre (n=17)	Intervention: Post (n=17)	Intervention Change	Control: Pre (n=9)	Control: Post (n=9)	Control Change
Weight (kg)	97.9±16.1	98.0±15.5	.02±3.2	94.5 ± 12.0	94.9±12.0	0.5±2.0
BMI (kg/m²)	38.8± 5.1	38.9±5.0	0.1±1.1	36.6 ± 3.8	36.5 ± 3.8	-0.1 ± 1.1
Body Fat (%)	49.9±3.3 [¥]	48.0±5.3 [¥]	-1.4±4.6 [¥]	49.7 ± 2.9 [¥]	50.1 ± 3.5	0.3±3.2
Waist:Hip	0.93±0.05	0.95±0.06	0.11±0.35 [¥]	0.89±0.08 ^{*.b}	0.94±0.09 ^{*.b}	0.05±0.05
Systolic BP (mmHg)	143.4 ± 15.6 ^{**.b}	123.8 ± 9.1 ^{**.b}	-19.5±16.1	135.2 ± 14.3 ^{*.b}	118.7 ± 20.0 ^{*.b}	-11.8 ± 10.5
Diastolic BP (mmHg)	80.8 ± 7.8 ^{*.b}	75.7±8.6 ^{*.b}	-5.1±7.5	82.4 ±15.9 ^{*.b}	69.9 ± 8.3 ^{*.b}	-8.1±8.3
Total Cholesterol (mg/dl)	171.3±44.9	171.8 ± 41.9 [¥]	-1.5 ± 21.1 [¥]	169.7 ± 27.8	173.7 ± 26.1	4.0 ± 14.8
HDL-C (mg/dl)	51.1±17.1	49.4±17.7	-1.7±5.8	52.7 ± 12.5	50.6 ± 12.7	-2.1 ± 5.9
LDL-C (mg/dl)	94.6 ± 40.5 [¥]	96.6±34.0 [¥]	0.2±17.8 [¥]	91.2 ± 27.2	90.9 ± 25.2 [¥]	-0.3 ± 12.0
Triglycerides (mg/dl)	128.6 ± 66.2	117.7±56.5	-10.9±61.3	128.8 ± 61.9 ^{*.b}	168.6 ± 85.9 ^{*.b,¥}	26.1 ± 41.0
Glucose (mg/dl)	113.8 ± 36.0	110.7 ± 33.6	-3.1 ± 14.3	122.2 ± 30.9	114.8 ± 26.5	-7.4 ±1 7.6

* p < 0.05; ** p < 0.01; a. Between group test; b. Within group test; [¥] Missing data

LIST OF APPENDICES

Appendix A: Review of Literature.....31

Appendix B: Extended Materials and Methodsg

Appendix C: Study Informed Consent Form.....g

Appendix D: Assessment Materialsg

Appendix E: Diet Education, Resistance Training, and Tai Chi Intervnetiong

APPENDIX A: REVIEW OF THE LITERATURE

INTRODUCTION

The number of Americans over the age of 65 years is projected to grow from 35 million in 2000 to 72 million in 2030, roughly 20% of the U.S. population [1]. Older adults who maintain a good nutrition status and are physically active have better overall health, increased life expectancy, and decreased disability [10,9,71,72,11,73]. However, up to 48% of older adults do not have optimal nutrition status [14,15] and less than half met the federal physical activity recommendations for aerobic and muscle strengthening exercise [20,21]. A healthy diet and regular physical activity contribute to successful aging as does an individual's resiliency [74], the ability to positively adapt to significant stress, trauma or other challenge [24,75,57]. Successful, healthy aging is important due to of the rising number of older adults and the high cost of medical care. This is particularly challenging because 80% of older Americans have at least one and 50% have at least two chronic health conditions [1].

The aging U.S. population will significantly increase the burden on the health care system making managing current conditions and preventative healthcare imperative. Women are more likely to be obese, have chronic disease conditions [2] and have a greater rate of functional decline due to aging compared to men [3-5]. Older women have more health care visits and emergency room visits compared with their younger and male counterparts [1]. Nutrition and physical activity are critical components of therapeutic plans for chronic diseases[9-12,37,36,42,35,38]. It is essential that health interventions target older obese women in order to reduce their risk of chronic disease and decrease the burden to the U.S. health care system.

Research has shown that behaviorally-based diet education and physical activity interventions in older adults promote improvements in body composition, blood pressure,

lipid-related measures, diet quality, and physical functioning [35-38]. It is recommended that older adults participate in physical activity that includes flexibility, balance, and strength training, as well as aerobic training which is accomplished by participating in multiple modalities of physical activity [22,23]. However, to date, there is limited research examining nutrition education combined with multiple modalities of physical activity on health related outcomes in obese women, especially in minority populations.

OLDER ADULTS

The life expectancy of Americans has increased over 60% in the past century [76,77]; from 47 in 1900 to almost 77 in 2000 [78]. In 2005, more than half of the population over the age of 65 years were women; see figure 1 [79,80]. Between 2000 and 2030, the number of Americans over the age of 65 is projected to grow from 35 million to 72 million [78]. In 2030, nearly 1 out of 5 Americans will be over the age of 65 years (Figure 2) [81] and older adults are project to become more racially and ethnically diverse [78].

Figure 1. Number of people aged 65 years and over 1950-2005 [79,80]

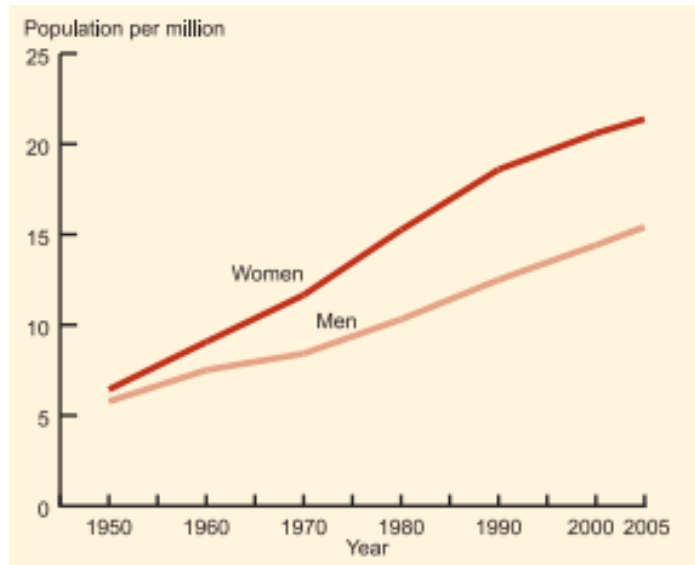
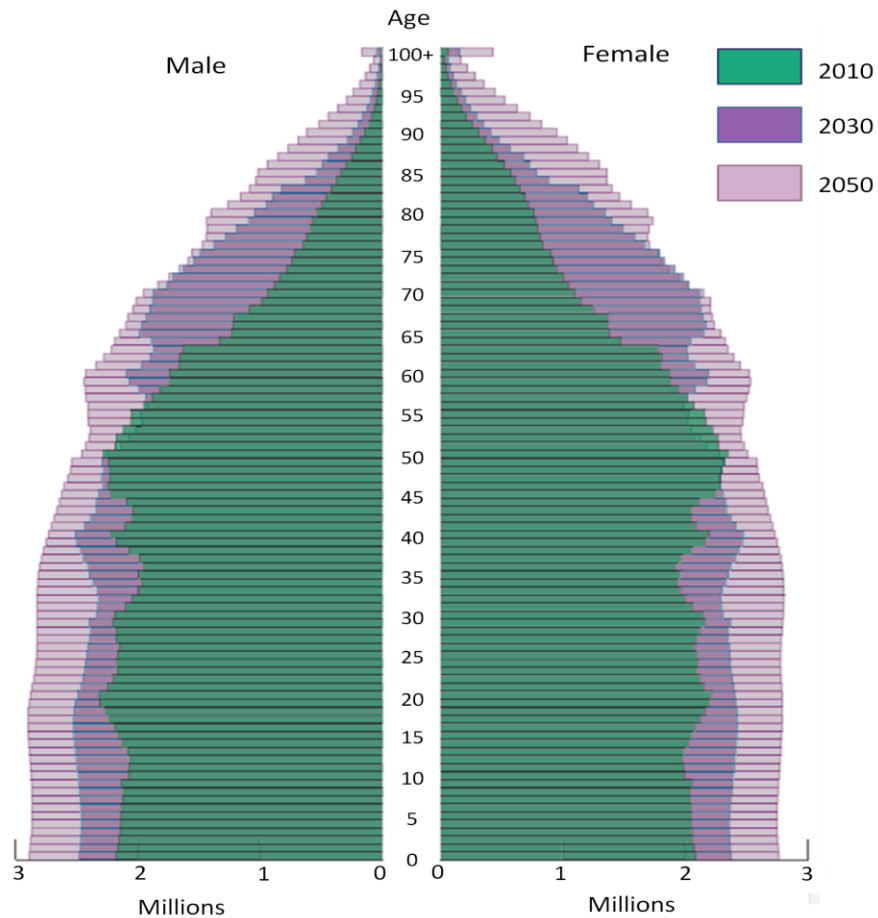


Figure 2: Age and Sex Structure of the Population for the United States: 2010, 2030, and 2050 [81]



This shift to an aging population shift will impact the health care system as more people live longer. The average age of chronic disease onset has not changed as life expectancy has, resulting in a greater increase in years of disability due to disease versus active health years [76]. Healthy life expectancy (HLE), defined by the World Health Organization, estimates the number of years a person can expect to live in full health [82]. In the U.S., the average life expectancy for persons 65 years of age is 19.1 years, although the HLE is only 13.9 years. However, the HLE for all women and black women 65 years of age and older are 15.6 and 14.9 years, indicating they will have 5 to 7.3 years of disability, respectively [82]. In Rhode Island, all women and specifically black women 65 years of age and older have a life expectancy of 20.7 and 21.9 years respectively [82].

The U.S. spent \$2.7 trillion on direct and indirect health care costs in 2011 [83]; it is estimated that the medical costs of preventable diseases (such as diabetes, heart disease, stroke and cancer) will increase by \$48-66 billion/year [84]. The average cost of health care is 5 times greater in adults with one or more chronic health conditions compared to those without any conditions [85]. Approximately 80% of older adults in the U.S. have at least one chronic health condition, and 50% have at least two chronic health conditions [78]; the most common health conditions include hypertension, arthritis, diabetes, and heart disease [78]. Older adults with five or more chronic health conditions have an average of 37 doctor visits and 50 different prescriptions annually [86]. Women are more likely than men to have multiple chronic health conditions (See Figure 3) and older adults are more likely to have multiple chronic conditions compared to their younger counterparts (Figure 4) [87,77,78,3]. Subsequently, older women have more health care visits and emergency room visits compared with their younger and male counterparts [78]. It is these additional visits that consumes much of the public health dollars and many of these issues are preventable [88]. Since several of

these issues are preventable, it is imperative that health interventions target older women in order to reduce their risk of chronic disease and thus reduce health care costs in America.

Figure 3: Percentage of People with Chronic Conditions: Men vs. Women [87]

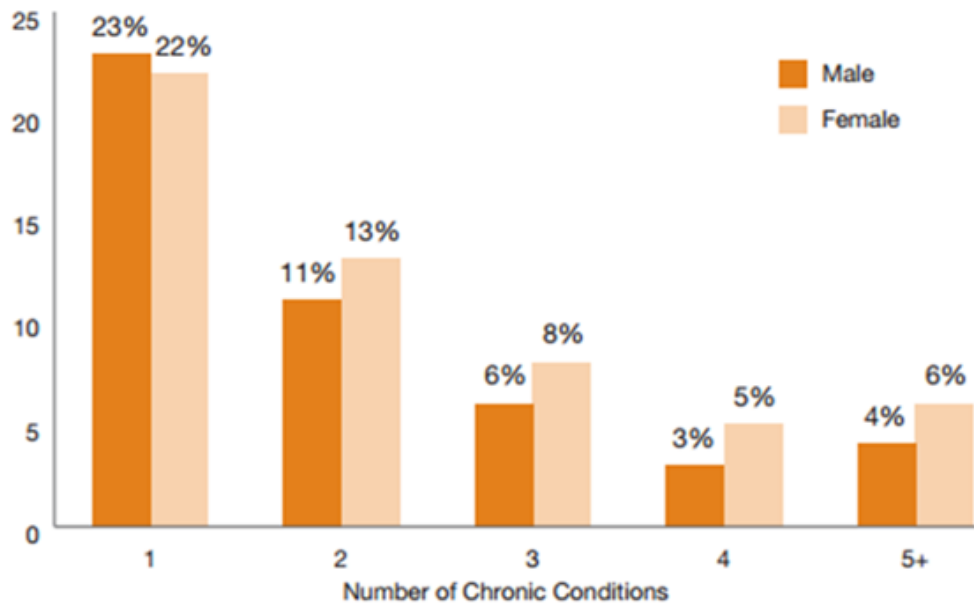
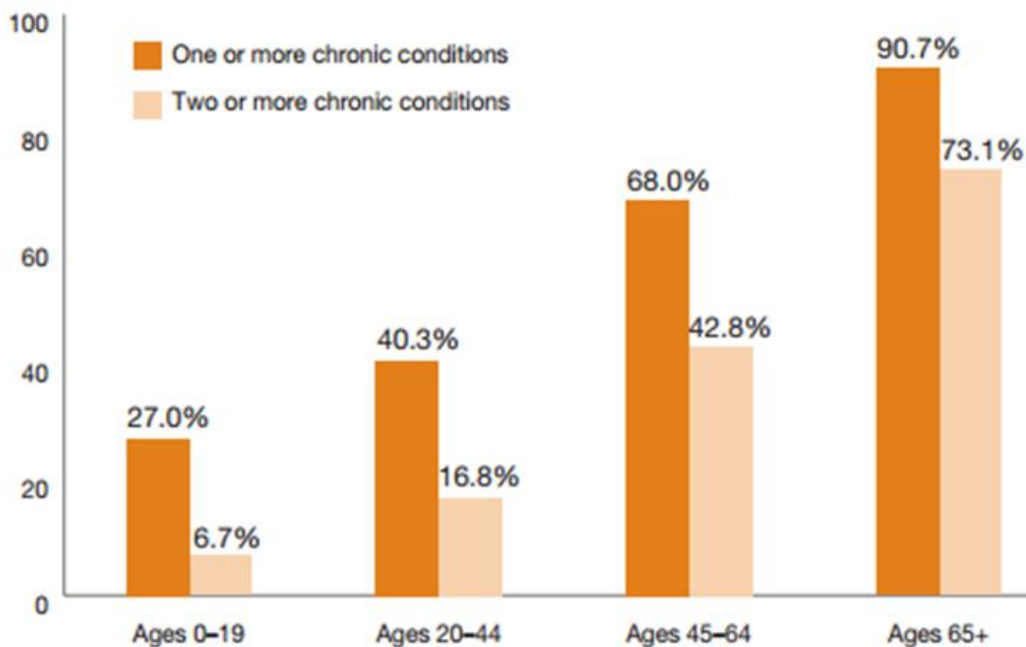


Figure 4: Percentage of People with Chronic Conditions: Young vs. Older Adults [87]



Successful aging is more important than ever as it is a combination of engagement with life, lack of disease and disability, as well as high physical and cognitive function [89]. The American population is aging and women outnumber men at every age category over the age of 55 years [79,80].

RESILIENCY

Individuals who age more successfully tend to be resilient [7,8]. Resiliency is when a person positively adapts and adjusts to a significant source of stress, trauma or challenge that can be emotional, financial, social and/or physical [24,75,57]. Positive adaptation, a component of resilience, is reinforced through a person's individual attributes (such as personality traits), relationships, and external support system [57]. Furthermore, resiliency has been positively associated with morale, self-esteem, and life satisfaction and negatively associated with depression and perceived stress [6]. Resilience is crucial for successful aging as it involves an individual's ability to adjust and adapt, which is particularly important as older adults often experience a loss of a spouse, other family members or close friend, an event that negatively impacts independence, or a general decline in physical health. However, not all individuals are able to successfully adapt to life changes and stressors [56]. Research indicates that resilient individuals are motivated to age successfully [7]. Therefore, it may be beneficial to screen adults for resiliency levels in order to determine who might need more support and services in order to promote successful aging in at risk older adults. It would also be beneficial to examine if and which types of resilience are dynamic and thus can be influenced.

Resilience: Trait or State

There is controversy as to whether resilience is static (a trait) or dynamic (a state) [57]. This debate partially hinges on whether personality traits can change. Most research agrees

that personality characteristics influence how a person acutely and chronically deals with adverse life events and stresses and thus contributes to resiliency [57]. Research indicates that personality traits changes more drastically in younger years and becomes more stable with advancing age [58,59]. However, research also indicates that personality traits can change in adulthood, although the change is less pronounced compared to the change that occurs during younger years [58,60].

The characteristics of trait resilience are being able to control one's life events, commitment in the activities of one's life, and facing challenges as exciting possibilities [90]. It is hypothesized that trait resilience contributes to positive adaptation of older adults allowing them to experience daily positive emotions, which subsequently leads to adaptive recovery from stress [57]. Future research would benefit from including resilience measures to examine whether resilience, or aspects of resilience, is a trait, state, or both.

Conversely, some researchers believe that resiliency is a dynamic process that is bidirectional between a person and their environment thus making an argument that resilience is a state [91,92]. Dynamic resilience can be influenced which suggests that dynamic or state resilience could be effected by a diet and physical activity interventions to promote successful aging. Researchers that argue resilience is a state because it is unrealistic for an individual to be resilient to all things, at all times [93]. Currently, there is no consensus in the scientific literature on whether resilience is a trait or state.

Physical resiliency

Successful aging can be facilitated through the personality traits of physical resilience including humor, adaptability, capitalizing on one's strengths, and social support [7].

Physical resiliency is a novel subcategory of resiliency that has yet to be fully explored.

Physical resiliency is defined as the capacity to recover or optimize function in the face of age-related losses or disease and can result in the determination and perseverance to overcome physical challenges [24]. Resilience was a protective characteristic for physical well-being in older adults (mean age 69.6 years) [94]. Individuals with better self-reported physical health had greater resilience [95,6].

Physical resilience is a combination of psychological, physiological, social and other types of resilience and facilitates recovery and coping with the daily physical challenges associated with aging and chronic illness [24]. There is no other research examining physical resilience to the author's knowledge. Although, given the definition of physical resilience, it is likely a dynamic resilience and thus can change. Research studies are needed to determine if physical resilience is dynamic and thus can be affected by a nutrition and physical activity intervention. There is currently no research examining change in physical resilience following an intervention.

Resilience and Diet

An individual with dietary resilience has developed strategies to adapt and enable him/herself to maintain dietary quality even when facing dietary challenges [96]. Vesnaver et al. [96] studied dietary resilience by examining nutritional vulnerabilities such as not prioritizing eating well, not having the ability to prepare grocery shop and not being able to prepare food. In this study, dietary resiliency was defined as maintaining or improving diet quality over the 3-year study. Thirty older participants (80% female) from the five year "NuAge" study reported that key themes of dietary resilience are "prioritizing eating well, doing whatever it takes to keep eating well, being able to do it yourself and getting help when

you need it” [96]. An individual’s daily diet is a dynamic and thus dietary resilience is a type of dynamic resilience, thus it is plausible that dietary resilience can be changed.

A study of 1,091 people with mean age of 69.9 ± 0.8 years found associations between dietary patterns and personality traits [97]. Dietary patterns were assessed using a food frequency questionnaire and were classified as Mediterranean-style, health-aware, convenience, and sweet foods diet. People who follow the Mediterranean-style diet had higher extraversion, openness, and lower neuroticism than those with other patterns. The health-aware diet was significantly associated with higher agreeableness and conscientiousness than those following other patterns. Conversely, following the convenience diet was significantly associated with high neuroticism and low openness. Preference for sweet foods was correlated with less openness. BMI was negatively associated with conscientiousness [97]. Although this study had a large sample size, a major limitation is that this was a cross-sectional study and thus dietary habits and personality were only measured once even though they likely change over the course of a life. However, this study suggests that personality, a component of resilience, may be associated with diet.

Cross-sectional studies have shown that resilience was positively associated with appetite [98], a more healthful diet, education, and personality traits [26]. Resiliency may impact diet in a similar fashion as emotional and psychological health affects appetite [98]. Furthermore, healthful dietary patterns, particularly in women from socioeconomically disadvantaged neighborhoods, may contribute to an individual’s resilience to obesity [99,100]. Dietary resiliency may have an advantageous effect on chronic diseases such as obesity.

OBESITY IN OLDER WOMEN

By 2035, more than one in five Americans are predicted to be obese [5]; obesity is defined as having a body mass index (BMI) ≥ 30 kg/m² [101]. The prevalence of obesity is greater in women compared to men [2]. Body weight typically increases throughout adulthood and reaches its peak during the 5th decade of life [101]; due to the lower resting energy expenditure, thermic effect of food, and physical activity [102]/ However most adults do not decrease their energy consumption as total energy expenditure decreases [103]. In most people, after the age of 30 years, lean body mass decreases as fat mass increases; by 70, up to 40% of lean body mass can be lost. The increased fat mass is typically increased visceral fat, intramuscular fat, and intra-hepatic fat, all of which increase risk for metabolic dysfunction such as insulin resistance, metabolic syndrome, and cardiovascular disease (CVD) [101]. A study by Ogden et al., found a 6.6% (31.5% vs. 38.1%, p=0.006) increase in the prevalence of obesity in women 60 years and older from 2003-4 to 2011-2 [104]. According to NHANES 1999-2000, obesity is 33% more prevalent in older women 60-79 years (42.3%) vs. women 20-39 years (31.9%) [2]. The rate of obesity is higher in women aged 65-74 compared to those 75 years and over except in non-Hispanic black women, where about one in two were obese in both age groups [105].

Obesity and excess fat mass is associated with adverse health outcomes. Clinically, BMI is associated with mortality until the age of 75 years [106]. The Framingham Heart Study reported that life expectancy decreased by 6-7 years if one is obese at 40 years of age [107]. Obesity in older women is associated with many serious co-morbidities including diabetes, hypertension, dyslipidemia, CVD and osteoarthritis [108]. Furthermore, in older adults, obesity has been associated with a decrease in quality of life [109] and disability [110]. While

obesity is a major problem with older women, it is also to consider sarcopenia as is a related condition that benefits from physical activity and diet interventions [111,112].

Sarcopenic Obesity

Sarcopenia is the age-related loss of lean body mass and muscle function and often leads to a decreased quality of life [113,114,38,115]. Sarcopenia currently costs the U.S. \$20 billion in annual health care dollars [116]. It can affect up to 50% of 70-80 year olds [86,117,113,118,119]. Although, the mechanism for sarcopenia is not completely understood, it is believed to be a combination of poor nutrition [113], physical inactivity [119], inflammation and oxidative stress [120,121], insulin resistance [122], abnormal protein and hormone kinetics [123,124], and adverse change in muscle morphology [125]. Sarcopenic obesity is an additional risk for disability and adverse health related outcomes compared to obesity or sarcopenia alone [111,112]. Although weight loss is warranted in sarcopenic obesity, weight loss is also associated with loss of lean body mass, thus it is important to treat sarcopenic obesity with a weight loss program that retains lean body mass.

One hundred seven obese adults ≥ 65 years of age were randomized to 1 of 4 groups to determine the most efficient treatment to treat sarcopenic obesity: control, behavioral weight management diet, exercise, and behavioral weight management diet exercise group. The diet component diet involved 1g/kg high quality protein and 500-750 kcal/deficit plus weekly meetings with the dietitian. The exercise portion was 90-minute sessions 3 times per week involving aerobic exercises, resistance training, flexibility, and balance exercises. The behavioral weight management diet and exercise group and the behavioral weight management diet group lost significant weight ($-8.6 \pm 3.8\text{kg}$, -9.7 ± 5.4 respectively), those in the behavioral weight management diet exercise group lost significantly less lean body mass ($-1.8 \pm 1.7\text{kg}$) compared to the behavioral weight management diet participants ($-3.2 \pm 2.0 \text{ kg}$) [126].

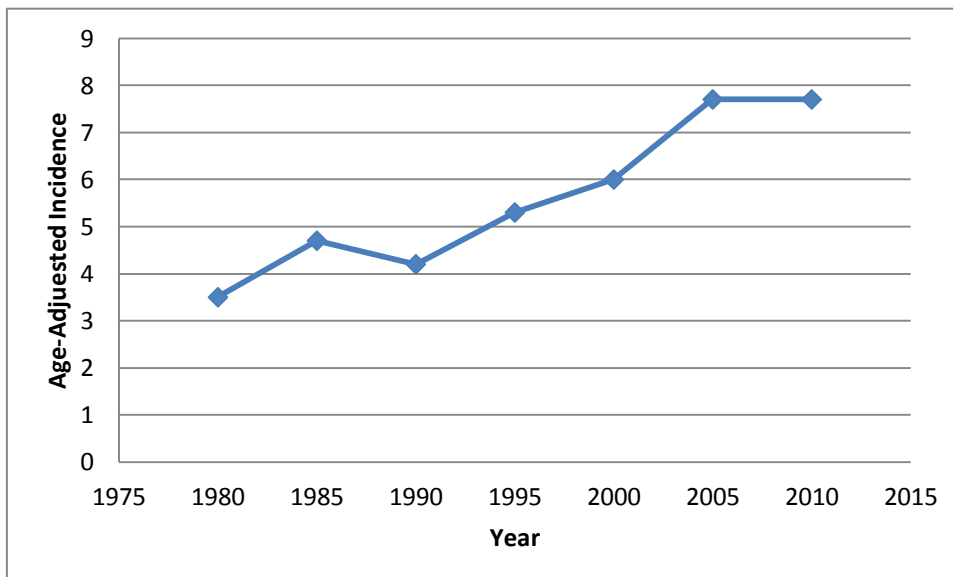
Frimel et al. [127] conducted a study in 30 frail older obese adults; half were assigned to 6 months of diet and behavioral therapy while half were randomized to a diet and behavioral therapy plus exercise group. The exercise component included 15 minutes of flexibility exercises, 30 minutes of high-intensity progressive resistance training, 30 minutes of low-impact aerobic exercise, as well as 15 minutes of balance activities. Both groups lost a significant amount of weight and fat mass. However, the 15 participants randomized to the diet and behavioral therapy plus exercise group lost less fat-free mass (-1.8 ± 1.5 vs -3.5 ± 2.1 kg, $p < 0.05$), lower extremity lean body mass (-0.9 ± 0.8 vs -2.0 ± 0.9 kg, $p < 0.05$), and upper extremity lean body mass (-0.1 ± 0.2 vs -0.2 ± 0.2 kg, $p < 0.05$) compared to the diet and behavioral therapy group. Although, this study did not have a control group that did not participate in exercise or weight loss only nor did they examine sex differences, it did show that an exercise regime that includes resistance training, balance training, flexibility exercises, as well as low impact aerobics would be beneficial for older adults with sarcopenic obesity [127].

Research demonstrate the importance of sarcopenic obese adults losing weight via diet and exercise while maintaining lean body mass through diet and physical activity [113,128,127]. More specifically, the research suggests that interventions which include multiple modalities of exercise along with a dietary component, are more successful in treating sarcopenic obesity [127,126]. Individuals with sarcopenic obesity tend to be older [86,117,113,118,119] and thus are more likely to have other chronic health conditions including diabetes and heart disease.

DIABETES IN OBESITY

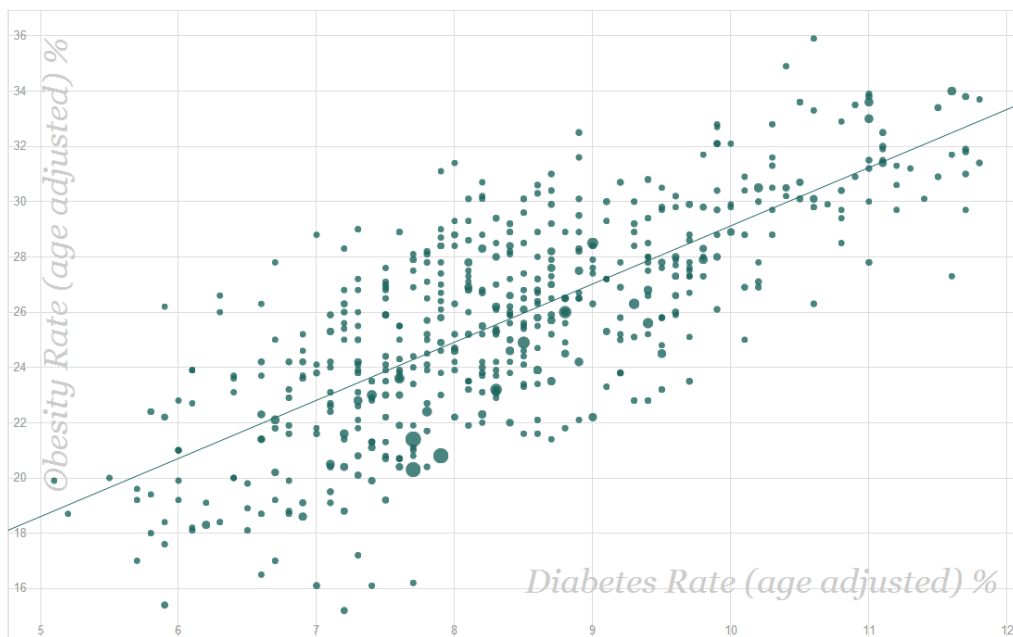
In the United States, 25.8 million people have diabetes [129]. In 2011, the age-adjusted incidence of diabetes for women was 7.5 per 1,000 compared to 3.5 per 1,000 in 1980 [130] and this rate is expected to continue to rise [131]. Furthermore, the age-adjusted incidence of diagnosed diabetes was more than 2 times higher in 2010 compared to 1980 [130]; see figure 5. It is estimated that diabetes costs \$245 billion in the U.S. [129]. Individuals with diabetes have 2.3 times greater health-care expenditures compared to those without diabetes [129]. The average age of diabetes onset has remained stable from 1997 to 2011 in adults 18-79 years of age although the median age of onset for women has increased by 1.6 years; from 53.6 to 55.2 years [132]. Due to the increasing older population, the number of individuals 65 years or older diagnosed with diabetes is projected to increase by 4.5 fold between 2005 and 2050 [133].

Figure 5: Age-Adjusted Incidence of Diagnosed Diabetes per 1,000 Women Aged 18–79 Years, United States, 1980–2010 [130]



Type 2 diabetes is caused when the body is unable to use insulin effectively [134,135]. Conversely, type 1 diabetes is an autoimmune disorder that damages the pancreas' beta cells that results in decreased insulin synthesis and concentrations and is typically diagnosed early in life [134,135]. Of all the diagnosed cases of diabetes; 90-95% have type 2 diabetes [135]. There is a link between the large proportion of the population with type II diabetes and the obesity epidemic, see Figure 6 [136], as well as other chronic diseases [137].

Figure 6: Diabetes and Obesity Rates by County [136]



Individuals with type 2 diabetes have increased risk of mortality and morbidity compared to those without diabetes [138-140]. Most notably, individuals with uncontrolled diabetes are at greater risk of co-morbidities from microvascular disease (affecting the kidneys, eyes, and limbs) and macrovascular disease (involving the coronary, peripheral, and cerebrovascular systems) compared to those without complications [137]. There is a causal relationship between obesity and the development of type 2 diabetes as well as CVD [141,142].

Additionally, approximately 75% of those with diabetes will die from CVD [143] and there is a 50% higher relative risk for fatal CHD in diabetic women compared to diabetic men [144,145] .

CARDIOVASCULAR DISEASE IN OBESITY

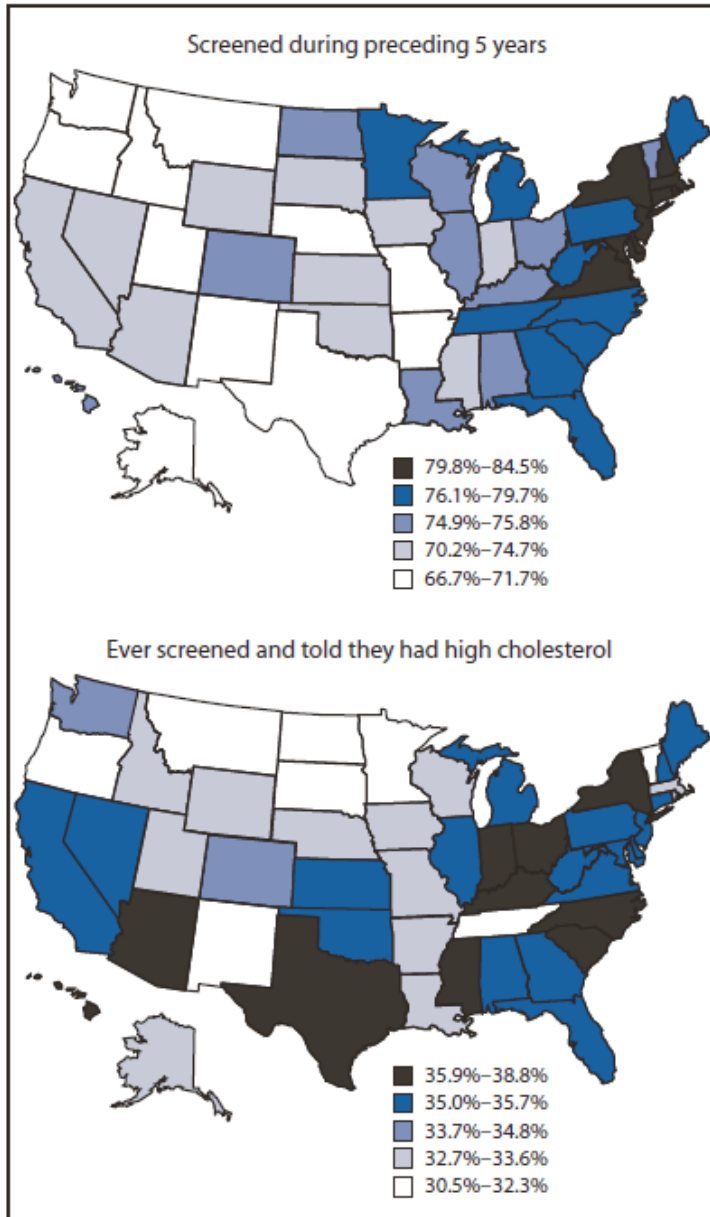
Cardiovascular disease contributes to 17% of America's national health expenditures [146]. The total direct medical costs of CVD are projected to triple between 2010 and 2030; from \$273 billion to \$818 billion [146]. One death every 40 seconds is attributed to CVD [147]. In the U.S., individuals over the age of 65 years account for more than 80% of CVD-related deaths and 85% of CVD hospitalizations [148,149]. In the elderly, CVD was the main cause of mortality, morbidity and health care costs [150]. The leading cause of death in American women is CVD; 236.1 deaths per 100,000 [147]. In 2009, the age-adjusted prevalence of CHD in American women 65-74 years and 75 years and older with their age-adjusted CHD prevalence of 25.8% and 36.9% respectively which is significantly lower to the 10.2% prevalence in all women [151].

Cardiovascular disease involves the heart and/or blood vessels and includes diseases such as CHD, hypertension, atherosclerosis, arrhythmia, and heart failure and is exacerbated by excess weight [152]. Excess adipose tissue results in an adverse change in body weight homeostasis, lipids, blood pressure, and insulin resistance which leads to atherosclerosis and endothelial dysfunction [153]. Longitudinal studies have shown that there is a direct relationship between obesity and CHD in both men and women [154,155]. Results from 16 years of follow-up in the prospective Nurses' Health Study of middle-aged women found that the CVD death rate was four times higher in women with a BMI >29 kg/m² compared with those women with a lower BMI [154]. A prospective cohort study with a 12-year follow-up

of 800 adults aged 65-80 years, found that there was a higher risk of a cardiovascular event in individuals who had diabetes (HR: 2.67; CI 95%: 1.98–3.61; $P < 0.001$), hypertension (HR: 1.69; CI 95%: 1.28–2.24; $P < 0.001$), increased waist to hip ratio (HR: 1.36; CI 95%: 1.03–1.79; $P < 0.05$), hypertriglyceridemia (HR: 1.67; CI 95%: 1.22–2.30; $P < 0.01$), and high triglyceride/HDL-C ratio (HR: 1.73; CI 95%: 1.31–2.84; $P < 0.001$) [150]. Furthermore, the adjusted population attributable fractions for mortality due to CVD is 40.6% for high blood pressure, 13.7% for smoking, 13.2% for poor diet, 11.9% for inadequate physical activity, and 8.8% for abnormal glucose levels [147,149]. Cardiovascular disease is exacerbated by excess weight, however there are modifiable risk factors, including hypertension, diabetes, dyslipidemia, obesity, sedentary lifestyle as well as smoking, which decrease the health outcomes normally associated with CVD.

Obesity is also positively related to dyslipidemia [156], a risk factor for the development for atherosclerosis and CHD [157]. In 2005, 74.6% of women were screened for dyslipidemia compared to 77.6% who were screened in 2009, see figure 7 [158]. More specifically, 12.3% more Rhode Island adults were screened in 2003 compared to 1991 [158]. Although screening for CVD has increased, it is still below the Healthy People 2020 recommendation of 82.1% of adults screened for dyslipidemia [159]. Due to the prevalence of dyslipidemia and the inadequate screening, it is important to promote the prevention of CVD.

FIGURE 7: Age-adjusted percentage of adults aged ≥ 18 years who had been screened for high blood cholesterol during the preceding 5 years and percentage who had ever been screened for cholesterol and were told by a health-care provider that they had high blood cholesterol — Behavioral Risk Factor Surveillance System, United States, 2009 [158]



CVD can be prevented or treated through lifestyle changes involving healthy eating and physical activity, which are also key treatments of obesity and sarcopenic obesity [160]. A study Stampfer et al., found that 82% of the coronary events could have been prevented if the women in the study maintained a healthy body weight, participated in moderate to vigorous

exercise for half an hour a day, moderate consumption of alcohol if it all, did not smoke and followed a healthy diet [161]. A heart-healthy lifestyle which includes an emphasis on nutrition has been beneficial in preventing or treating CVD [160], including populations of older adults [162,163].

NUTRITION IN OLDER ADULTS

Individuals with good nutrition status, defined as meeting physiological needs for nutrients [164,165], have better overall health, decreased chronic disease, improved quality of life, increased life expectancy, better functional ability, and decreased disability [10,9,54,55]. However, almost half of the older adult population is at increased nutrition risk [14,166]. Ford et al. [167] found that 86% of 4,009 adults with a mean age of 81.5 years and the majority being women were at nutrition risk or possible nutrition risk as assessed using the Dietary Screening Tool (DST) to measure dietary quality and nutrition risk. Furthermore, participants with lower dietary quality tended to be underweight, skipped breakfast, decreased their food consumption over the past 3 months, concerned about having enough food as well as difficulty chewing and swallowing [167].

Diet quality is determined by the composition of an individual's diet; foods that are more nutrient dense, have greater diet quality. Diet composition, which was composed of 14 components of diet including low fruits, low vegetables, low nuts and seeds, high sodium, high processed meats, and high trans-fat intake, was predictive of 26% of deaths and 14% of disability-adjusted years in a systematic analysis of descriptive epidemiology study of diseases, injuries, and leading risk factors in the U.S. from 1990-2010 [168]. However, considering that 5 of the top 10 risk factors for health were diet related, the number of deaths associated with diet increases to 74.5% [168]. Dietary patterns and their relation to dietary

recommendations comprise an individual's dietary quality [169,170,54]. Poor dietary quality is a major contributing factor to obesity, diabetes, and CVD [108,171,76,168,11].

Dietary Quality

Diet quality is the measure of how closely an individual's diet complies with the USDA's dietary recommendations [172]. Murray et al. [168] identified the most prominent dietary risks in Americans adults as diets low in fruits, vegetables, nuts and seeds, as well as high in sodium, processed meats, and trans fats. One widely used measure of dietary quality has been the Healthy Eating Index-2005 (HEI-2005) scores; scores range from 0-100 with higher scores indicating better diet quality with a score below 80 indicating poor dietary quality [173,172]. Higher HEI-2005 scores are associated with a significant reduction in chronic disease risk in women [174]. Data from NHANES 2003-2004 found that women, 55 years and older, had a mean HEI-2005 score that was below 80 [175]. Furthermore, women (20 years and older) only received a perfect score on two categories (total grains, meats and beans) and older adults only received a perfect score on three categories (whole fruit, total grains, and meats and beans) [175]. Additionally, data examining HEI-2010 scores from 2001-2002 indicate dietary quality remains poor and that there have been no improvements through 2007-2008 in Americans [173]. This is a concern because higher diet quality is associated with quality of life and functional ability [54] and inversely associated with all cause-mortality [169]. High diet quality and overall good nutrition is the cornerstone of therapeutic plans for many chronic diseases; including heart disease, diabetes, and obesity [10,9]. The United States Department of Agriculture (USDA) and American Academy of Nutrition and Dietetics (AND) recommends a focus on overall healthy food patterns as the key to healthy eating and is the basis of many therapeutic dietary interventions [13].

Dietary Approaches to Stop Hypertension

The Dietary Approach to Stop Hypertension (DASH) diet supports the overall diet approach of the USDA and AND advocates [16]; see Table 1. The DASH Diet is a healthy eating plan that has been shown to help individuals prevent or control high blood pressure, lower cholesterol and help facilitate weight loss [17,16].

Table 1 : Daily DASH Nutrient Goals [17]

Daily Nutrient Goals Used in the DASH Studies (for a 2,100 Calorie Eating Plan)	
<i>Nutrient:</i>	<i>Recommendation:</i>
Total Fat	27% of calories
Saturated Fat	6% of calories
Protein	18% of calories
Carbohydrate	55% of calories
Cholesterol	150 mg
Sodium	2,300 mg*
Potassium	24,700 mg
Calcium	1,250 mg
Magnesium	500 mg
Fiber	30 g
<i>*1,500 mg sodium was a lower goal tested and found to be even better for lowering blood pressure. It was particularly effective for middle-aged and older individuals, African Americans, and those who already had high blood pressure.</i>	

The DASH diet recommends 6-8 servings of grain per day with at least 50% of them being whole grains; see Table 2. Also recommended are four to five servings of vegetables and fruits per day with a focus on choosing whole versus juices. The DASH diet recommends individuals consume 6 servings or less of lean meat, poultry, or fish per day and limiting consumption of red meat. Furthermore, the DASH diet recommends 4-5 servings of nuts, seeds, and legumes per week. According to the DASH diet, low-fat dairy intake should be 2-3 servings per day as well as 2-3 servings of fat per day. Furthermore, DASH recommends limiting sweets or added sugars to 5 servings per week and sodium to less than 2300 mg per

day or 1500 mg per day for those who are at risk [17]. Though the DASH diet has been promoted since 1997, most Americans are not meeting all of the DASH recommendations.

Table 2: The DASH Eating Plan [17]

Food Group	Daily Servings	Serving Sizes
<i>Grains</i>	6-8	1 slice of bread 1 oz dry cereal ½ cup cooked rice, pasta, or cereal
<i>Vegetables</i>	4-5	1 cup of raw leafy vegetable ½ cup cut-up raw or cooked vegetable ½ cup vegetable juice
<i>Fruits</i>	4-5	1 medium fruit ¼ cup dried fruit ½ cup fresh, frozen, or canned fruit ½ cup fruit juice
<i>Fat-free or low-fat milk and milk products</i>	2-3	1 cup milk or yogurt 1 ½ oz cheese
<i>Lean meats, poultry, and fish</i>	6 or less	1 oz cooked meats, poultry, or fish 1 egg
<i>Nuts, seeds, and legumes</i>	4-5 per week	1/3 cup or 1 ½ oz nuts 2 Tbsp peanut butter ½ cup cooked legumes
<i>Fats and oils</i>	2-3	1 tsp soft margarine 1 tsp canola oil 1 Tbsp mayonnaise 2 Tbsp salad dressing
<i>Sweets and added sugars</i>	5 or less per week	1 Tbsp sugar 1 Tbsp jelly or jam ½ cup sorbet or gelatin 1 cup lemonade

The DASH diet adheres to the federal dietary guidelines which can be measured through HEI scores [172]. The total HEI-2010 score for NHANES 2001-2 and 2007-8 indicates the diet of Americans is suboptimal; total score of 51.9 and 53.5 respectively [172].

The HEI-2005 found that only 18% of older adults meet the dietary recommendations for grains [176] and merely 4% of older women consume at least 6 servings of grains with at least half whole grain per day [170]. On average, Americans consume 1.8 cups of milk or milk products which is below the DASH serving recommendations [177]. Older adults are also only meeting 27% of their dietary recommendations for fruit and 32% of their vegetable recommendation [176]. More specifically, women 65 years of age or older consumed only 1.3 cups and 1.5 cups of fruits and vegetables respectively, which is below the DASH and federal guidelines [178]. Adults increased their fruit consumption from 2001-2002 to 2007-2008 however this beneficial change was negated by an increase in sodium and empty calories, resulting in no change in the total HEI-2010 score [172].

Conversely, Americans exceed the DASH guidelines for fat, sugar, and sodium. Women consumed 33.2% of their total calories from total fat with 10.9% of calories coming from saturated fat in 2007-2010 which is 70% more saturated fat than the DASH diet recommends [179,17]. Adults consumed 20 teaspoons of sugar per day on average according to NHANES data from 2005-6 [180] which is more than is recommended per week, let alone one day; is 9 times greater than the DASH recommends [17]. According to NHANES III, older women are exceeding the sodium recommendations by consuming an average of 2,532mg of sodium per day which exceeds the sodium recommendation by 10% and the more stringent recommendation for individuals who have or are at greater risk of hypertension by 69% [181,17].

However, DASH diet interventions have been successful in improving health outcomes. Racine et al. [19] found that older adults improved dietary knowledge of the DASH diet from baseline to one year. Twenty-seven subjects who participated in 30 minutes of weekly DASH diet education for 10 weeks, had significant improvements in their DASH diet

scores, BMI, blood pressure, and lipids [38,37]. Furthermore, the Exercise and Nutrition Intervention for Cardiovascular Health (ENCORE) randomized clinical trial utilized the DASH diet for a 16 week intervention in 144 overweight and obese, hypertensive sedentary individuals [182,70]. Participants with better DASH adherence at post-intervention had significantly greater improvements in blood pressure compared to those who did not adhere to DASH guidelines [182]. The DASH diet not only improves nutrition knowledge, it also improves overall diet and cardiovascular health [182,70,19,16]

PHYSICAL ACTIVITY IN OLDER ADULTS

Regular physical activity results in many physiological, psychological, and social benefits for older adults [183,184] and can contribute to successful aging [183,185,186]. There is strong evidence that physical activity reduces the rate of all-cause mortality, heart disease, stroke, and type 2 diabetes as well promotes healthier body composition, increased functional health, improved cognition, and increased cardiorespiratory and muscular fitness [12,23,187-189]. According to a burden of disease analysis by Lee et al. [12], physical inactivity alone results in 6% of the burden of CHD and 7% of type 2 diabetes. Approximately 9% of the deaths in 2008 worldwide were due to physical inactivity [12]. By decreasing the amount of physical inactivity by 25%, 1.3 million deaths could be prevented annually [12]. According to a systematic review of physical activity in the elderly, older women tend to be more physically inactive when compared to older men [22]. Thus it is important to promote physical activity in older women and provide appropriate education and training to facilitate sustainable physical activity.

Physical Activity Recommendations

The Physical Activity Guidelines for Americans, published by the USDHHS, recommends adults participate in 150 minutes of moderate intensity aerobic activity or 75 minutes of vigorous intensity or an equivalent combination each week [23]. In addition, adults should complete in two days of muscle strengthening activities [23]. In 2008, just over 18% of adults met the physical activity recommendations [20] and only 10% of adults aged 64-74 years and 7% of adults ≥ 75 years participate in enough physical activity to maintain or enhance endurance and strength [190]. The Office of Disease Prevention and Health Promotion recommends that older adults be as physically active as they are able, given their health conditions and physical limitations, and suggests a variety of physical activities in order to reduce the risk of overuse injury and be more pleasant so there will be a greater chance of long-term compliance [23].

Physical Activity and Obesity

Research indicates that physical activity can prevent obesity [191,101]. Research from the Women's Health Study followed 34,000 middle-aged women for 13 years and found that women at a normal weight range at baseline needed the equivalent of an hour per day of moderate-to-vigorous activity to maintain their weight [192]. Additionally, the Nurses' Health Study II prospectively followed 46,754 premenopausal women in 1989 found women were less likely to gain weight if they sustained or in 1997 increased to ≥ 30 minutes of physical activity per day [193]. Although, 62% of the population gained greater than 5% of their baseline weight by 1997, women who sustained 30 minutes or more per day of running or jogging experienced less weight gain than those who did brisk walking or other activities [193]. These studies indicate that physical activity, particularly moderate to high intensity aerobic exercise is beneficial in preventing obesity. However other studies examining different

modes of physical activity have also shown positive health outcomes including favorable changes in anthropometrics [27,26,30,194].

Resistance Training

Research has shown that resistance training (RT) reduces the symptoms of chronic diseases including type 2 diabetes, heart disease, osteoporosis, and arthritis [113,195].

Resistance training is beneficial to older adults as it allows muscles to move dynamically against resistance leading to health benefits [195] and thus can increase muscle strength, muscle mass, bone mass, flexibility, dynamic balance, self-esteem, and self-confidence [195-203]. Resistance training can also help treat sarcopenia which is associated with aging [34,114,120] along with cardiovascular benefits [25] and favorable changes in anthropometrics [27].

A study of 12 weeks of RT resulted in a reduction in lipids and lipoprotein-cholesterol concentrations [25]. This study included 9 women with mean age of 64.4 ± 0.7 years and BMI of $31.0 \pm 0.5 \text{ kg/m}^2$ who were randomly assigned by BMI and age to the intervention group compared to the 12 women with mean age of 67.0 ± 0.6 years and BMI of $34.0 \pm 1.3 \text{ kg/m}^2$ to the control group. The intervention group participants underwent 12 weeks of RT 3 times per week which involved 10 whole body exercises using RT machines with 3 sets at their 8 repetition maximum. There was no change in body weight, BMI, or body composition in either group. However there was a significant decrease of 23.6% in total cholesterol concentrations, 28.5% in LDL-C, 27.0% in non-HDL-C, and 24.1% in HDL₃-C concentrations in the intervention group compared to the control group ($p < 0.05$). Furthermore, the women in the intervention experienced a 16% decrease in total cholesterol, 23% decrease in LDL-C, and 20.2% decrease in non-HDL-C ($p < 0.05$) following the 12 week intervention compared to

baseline measures. Despite a small sample size, the results of this study suggests that RT may have advantageous cardiovascular effects [25,26].

Hornbuckle et al. [26] conducted a physical activity intervention which included RT in minority women and found significant improvements in body composition and glucose. The study was comprised African-American women between the ages of 39-61 years; 25 were randomly assigned and completed a walking group while 19 women were assigned to a walking plus RT group. Throughout the 12 week intervention, participants in both groups were encouraged to increase their daily steps to $\geq 10,000$ per day. Participants in the walking plus RT group participated in RT 2 days per week of RT that included 3 sets of 8-12 repetition of 10 exercises. Throughout the interventions, participants did not change average energy intake nor percentage of intake of fat or carbohydrates, however there was a significant increase in the percentage of protein intake in the walking plus RT group. Compared to the baseline, the walking plus RT group had significantly lower blood glucose, hemoglobin A1c, waist circumference, hip circumference, and total fat mass. Furthermore there was a significant interaction effect in waist circumference and total fat mass with individuals in the walking plus RT reducing their amount of body fat and waist circumference over time and more than the walking group. Limitations of the study include lack of no exercise control group, did not report dietary quality, and the intensity of the walking was not measured [26]. Although Hornbuckle et al. [26] found that RT plus walking resulted in favorable changes in anthropometrics and serum glucose, future research should be done to examine the effects of RT on health outcomes when combined with a dietary intervention.

RT and Dietary Interventions:

A meta-analysis of studies with adult pre-diabetics or individuals at risk for diabetes, found that interventions that contained RT, aerobic exercise, and dietary education resulted in

improvement in dietary and physical activity outcomes [204]. The analysis included 8 studies with a median intervention length of 12 months. Of the 8 studies, 7 reported significant weight loss at post intervention in the intervention group compared to the controls. Fasting plasma glucose decreased more in the participants assigned to the intervention group compared to the control group. However, only one study in this meta-analysis, examined older adults, thus indicating a gap in the literature [204].

Bourchard et al. [205], randomized 48 obese women between the ages of 55 and 75 years to one of four groups: RT, calorie restriction (CR), CR + RT, or a control group. Participants in the CR and CR + RT groups attended weekly nutrition sessions and participants in the RT and CR + RT performed 3 sets of 8 repetitions for 9 exercises focusing on the whole body at 80% of participant's one repetition maximum 3 times per week for 3 months. There was no change in body composition from baseline to post intervention in the RT and control group. Individuals in the CR and CR + RT groups significantly decreased weight, BMI and fat mass compared to baseline. However, individuals in the CR group also lost a significant amount of lean body mass compared to baseline. Although the study had a small sample size, the study found that CR + RT may help treat sarcopenic obesity by promoting weight loss without losing lean body mass.

Furthermore, another study examining one year of resistance training, dietary intervention, and cognitive behavioral training resulted in weight and body composition changes in the 54 women, with mean BMI of 30.7 ± 5.4 kg/m², who were randomly assigned to the intervention group compared to the 44 women, with mean BMI of 30.4 ± 4.9 kg/m², who were randomized to the reference group [27]. The strength training component of the study was comprised of a 15 minute weekly session, with encouragement to repeat 2 more times per week, for the first 6 months followed by participant access to a fitness center from 6-9 months, and lastly

participants were encouraged to participate in sports at least twice per week during the last 3 months of the intervention. The dietary intervention targeted calorie controlled weight loss for a goal of 1-2 pounds lost per week. The women in the intervention group significantly reduced their BMI by 2.2 kg/m², weight by 12.8 pounds, and body fat percentage by 2.8% compared to the reference group. This study found that the intervention facilitated beneficial changes in weight and body composition, however there was no quantitative registration of the amount of physical training that the participants did outside of the study facility and this study did not focus on a specific age group of women [27].

Another study examining a combination of diet and physical activity intervention also found improvements in health outcomes. Researchers randomly assigned 27 overweight or obese older adults to a 10 week behaviorally-based diet and physical activity intervention (DERT) or the behavioral-based diet intervention alone (DE). The behaviorally-based dietary education classes were based on a modified DASH diet. Instead of the original goal of $\leq 27\%$, the total fat goal was modified to $\leq 35\%$ in order to encourage unsaturated fatty acids given their cardiovascular benefit [206]. The behaviorally-based dietary education classes were 30 minutes and participants were given an individualized DASH-based diet plans utilizing the Harris-Benedict equation [207] to estimate a 500 calorie reduction per day to promote weight loss [37]. The 15 individuals assigned to the DERT group underwent 40 minutes of moderate intensity RT on 3 non-consecutive days per week. The RT involved 6 lower and upper body exercises on machines. Participants were monitored by study staff and resistance was increased in order for participants to have a repetition range of 8-12 repetitions with near-maximal effort. Both groups had significant improvements in body composition, although compared to the DE group, the DERT group lost significantly less lean mass than the DE only group. The DERT group also had a beneficial change in strength which was significantly

higher than the DE group [68]. Furthermore, compared to the DE group, participants in the DERT group had significantly better DASH diet scores (4.5, 6.3 respectively $p < 0.01$) indicating better compliance as well as improvements in triacylglycerol ($+4.3 \pm 2.9$ mg/dl, -8.5 ± 0.8 mg/dl respectively $p < 0.05$) and apoB concentrations (-1.9 ± 3.1 mg/dl, -4.9 ± 7.7 mg/dl respectively $p < 0.05$)[37].

Consequently the same group of researchers conducted an 8 week DASH behaviorally-based dietary education and light RT community health intervention in 95 older adults [36,35]. The diet component consisted of 30 minutes per week of DASH diet education with a registered dietitian. The light RT occurred for a total of 50 minutes over 2 non-consecutive days. Post-intervention, participants had significant improvements in DST score (73.4 ± 0.3 vs. 66.7 ± 12.0 at baseline, $p < 0.001$), proportion at nutrition risk ($\chi^2 (2) = 20.43$, $p < 0.01$), and triacylglycerol (145.9 ± 79.4 mg/dl vs. 157.8 ± 79.5 mg/dl at baseline, $p = 0.028$). In addition, participants had favorable changes in anthropometric measures at post intervention, including: weight, BMI, waist circumference, hip circumference, and percent body. Furthermore, at post-intervention, there was a significant improvement in both systolic (129.9 ± 12.0 mmHg vs. 139.3 ± 16.8 mmHg at baseline, $p < 0.001$) and diastolic (77.1 ± 6.5 mmHg vs. 78.9 ± 6.9 mmHg at baseline, $p = 0.034$) blood pressure[163]. Following the intervention, participants in the RT and behavioral based diet group had diet, cardiovascular and body composition improvements. RT and behavioral based diet intervention was successful in improving cardiovascular health, body composition, and diet quality in both the clinical setting and community setting [36,35].

Research has shown that RT can result in improvements in cardiovascular health, body composition, and dietary quality in obese older women including minority populations [37,68,26,163,36,35]. However, given the U.S. Department of Health and Human Services

(USDHHS) recommendation for seniors to engage in multiple modalities of exercise, it would be beneficial to combine dietary education with RT along with another type of aerobic exercise such as Tai Chi.

Tai Chi

Tai Chi is a Chinese low impact mind-body exercise [208] that is a slow and gentle form of exercise that is appropriate for adults with chronic health conditions as it can improve health without aggravating an individual's current impairments [209]. Tai Chi is an effective exercise to improve the health of older adults [209] including reducing cardiovascular risk factors [29]. Tai Chi has been shown to advantageously affect blood lipids and body weight in hypertensive adults [28], diabetics [30], and older adults [29] particularly older women [31] and minorities [210].

A study examining 74 hypertensive men and women with mean age 58.5 ± 7.5 years found a decrease in blood pressure in the individuals who were assigned to the Tai Chi intervention. Participants in the Tai Chi group practiced 1 hour of Yang-style Tai Chi three times a week for 8 weeks. Individuals in the Tai Chi group, significantly decreased both diastolic (2.0 ± 5.4 mm Hg) and systolic (-9.7 ± 11 mm Hg) blood pressure which was a significantly greater decrease compared to the control group ($p < 0.001$) who only received routine care. However the fact that this was a convenience sample and the researchers did not stratify analyses by gender, were major limitations to this study. Despite these limitations, this study gives evidence that Tai Chi may reduce blood pressure in hypertensive adults [28].

Park et al. [29], also found cardiovascular benefits in adults following a Tai Chi intervention. Of the 88 adults in the study with mean age of 66 years, those who were assigned to the Tai Chi and nutrition education had significant cardiovascular improvements compared to the Tai Chi or control groups. The Tai Chi intervention was a combination of Yang and Sun

styles which participants practiced for 1 hour once a week as well as 30 minutes of home exercises three times a week. The individuals who were in the Tai Chi and nutrition education group also participated in weekly one hour classes led by a dietitian and nurse educator.

Participants who engaged in Tai Chi exercises had lower systolic blood pressure compared to the control group ($F=5.16$, $p=0.008$). Additionally, fasting blood glucose levels were lower in the Tai Chi and nutrition education group compared to the control group ($F=6.94$, $p=0.002$) and mean performance of health behaviors was higher in those who participated in the Tai Chi and nutrition education (mean = 50.26) compared to the control group (mean = 44.79).

Participants in the Tai Chi and nutrition education group had significantly fewer modifiable cardiovascular risk factors (mean=13.45) compared to those assigned to Tai Chi (mean=15.89) or control group (mean= 15.98) at 6 months; the modifiable cardiovascular risk factors included age, family history, cholesterol, glucose, systolic blood pressure, obesity, exercise behaviors, stress, and smoking habits. Although limitations of this study include lack of group randomization and gender differences in dropouts, the study did demonstrate that Tai Chi may improve cardiovascular health [29].

A randomized control trial in 40-70 year old adults with type 2 diabetes with BMIs of 30-35 kg/m^2 found cardiovascular and anthropometric changes in those assigned to the intervention group [30]. The individuals in the Tai Chi group participated in 1 hour of Chen style Tai Chi 3 times a week which consisted of 20 minutes of warm-up, 30 minutes of Tai Chi gymnastics, and 10 minutes of breathing and cool down. Participants in the Tai Chi group were also encouraged to practice at home. Participants in the control group also received 12 weeks of basic exercise techniques. Both groups also partook in 12 weeks of diabetes education. The intervention significantly decreased BMI (-2.2 kg/m^2) and triglycerides (-43 mg/dL), as well as increased HDL-C ($+7 \text{ mg/dL}$) compared to baseline [30]. Limitations of

this study were that there was no non-exercising control group and the lipids were taken after the 6 week dietary stabilization period and not before. Additionally this study did not differentiate between gender and the results are not generalizable to the general population nor minorities as the study was conducted in type 2 diabetics [30].

Barbat-Argitgas et al. [31] examined cardiovascular health following Tai Chi intervention of 12 weeks in older women. Thirty-three nondynapenic and 15 dynapenic post-menopausal women between the ages of 50 and 75 years with mean age of 61 ± 6 years completed 12 weeks of Tai Chi intervention. The intervention included 3 non-consecutive days of Yang-style Tai Chi. Participants were classified as dynapenic, defined as the loss of muscle strength common with aging [211], if their muscle strength index value was less than 1.53 kg/SM. Following the intervention, dynapenic individuals significantly decreased their body weight, BMI, systolic blood pressure, and diastolic blood pressure, as well as increased their general health perception. Nondynapenic individuals also had significant reductions in blood pressure as well as a decrease in waist circumference ($p=0.04$), however there was no improvements in BMI, weight, or general health perception. Compared to nondynapenic participants, dynapenic participants had significantly better general health perception at post-intervention ($p=0.03$). Although this study was conducted in non-obese individuals and did not measure dietary quality, results from this study indicate that women, particularly those with decreased muscle strength, may have positive health outcomes, including anthropometric and cardiovascular, following a Tai Chi intervention.

A 16 week Tai Chi intervention in which 56 adults who were 55 years and older with a majority being females, minorities, had low education levels, and most had incomes less than \$14,000 a year completed this study which found that participants with higher attendance had better health outcomes. The participants had the option to attend 7 Tai Chi classes that

involved 15 minutes of Qigong followed by 45 minutes of Yang-style Tai Chi; participants were encouraged to attend 2 classes per week for 16 consecutive weeks. Although attendance did not affect cardiovascular measures or anthropometrics, participants who were mid to high attendees (attended 9 or more sessions) had musculoskeletal improvements. However, this study lacked a control group and did not measure dietary quality, it did demonstrate that low income minorities can experience improvements following a Tai Chi intervention [210]. Although it is important to consider interventions that include Tai Chi and diet education.

Tai Chi and Dietary Interventions:

Dechamps et al. [212] looked at anthropometrics, cardiovascular, and dietary measures in 21 women with mean age of 44 ± 12 years and BMI of 38 ± 6 kg/m². All participants attended 10 weeks of a weight management program which included an individualized hypocaloric diet which was monitored by a dietitian. Participants were randomized into 2 hour weekly conventional structured exercise or Yang-style Tai Chi. At post-intervention, participants in the Tai Chi group had significantly lower percent of fat mass ($-3.6 \pm 4.8\%$), compared to the conventional structured exercise group (-1.4 ± 6.5) as well as reduced dietary restraint, or self-control relating to food (1.9 ± 4.3 vs. 3.4 ± 3.6 respectively). Limitation of the study includes small sample size and lack of a control group that participated in no exercise [212]. However this study indicates that Tai Chi may impact dietary behaviors although it would be advantageous for research to examine dietary composition or quality.

A 16-week randomized trial in which 14 obese older women were assigned to the diet and Tai Chi (DE+TC) group while 13 older women were assigned to the diet (DE) group resulted in biochemical and dietary quality improvements [42,43]. All subjects attended weekly 45 minute dietary sessions focused on the DASH diet. The 14 subjects in the diet and Tai Chi group participated in 45 minute Yang style Tai Chi sessions per week. All subjects had

significant amount of weight loss (DE+TC: 88.6±13.95 kg at baseline vs. 86.3±14.5 kg at post-intervention & DE: 90.3±9.0 kg at baseline vs. 86.6±9.8 kg at post intervention, effect size = 0.475), decrease in waist circumference loss (DE+TC: 105.6±9.1 cm at baseline vs. 102.0±10.4 cm at post-intervention & DE: 107.1±9.0 cm at baseline vs. 101.9±10.6 at post intervention, effect size = 0.536), and improvements in DST score (DE+TC: 59.6±9.7 at baseline vs. 70.7±8.4 & DE: 66.9±11.5 at baseline and 74.8±9.3 at post intervention, effect size = 0.533) in all subjects (P<0.05) [42]. Furthermore, the DE+TC group significantly improved their mean DASH score (4.1±1.4 at baseline vs. 5.2±1.3, p<0.05). Tai chi and behavioral based diet intervention showed beneficial body composition changes, heart health, and diet quality, however this study did not examine a minority population [42,43].

The same group of researchers then implemented a 16 week intervention of Tai Chi and DASH diet education in 29 women plus 9 controls with mean age of 68.2±7.7 years and BMI of 35.4±4.3 kg/m² [40]. Participants in the intervention group completed in three sessions weekly of Yang-style Tai-Chi as well as once weekly 45 minute behavioral based DASH diet education. There was no significant difference in anthropometric measures between groups at post intervention. However the Tai Chi and diet intervention group lost a significant amount of weight from baseline to post intervention (-1.6 ± 0.5, p<0.01). Subjects in the Tai Chi and diet intervention group also had improved physical function (0.59±1.28, p =0.023 vs. 0.56±1.81, p =0.38 in the control group [39,41]. In terms of dietary quality, as measured by DST score, there was no significant effect of the intervention (time x group) difference between groups at baseline or post intervention, however there was a significant, within group, improvement in DST score in the intervention group (baseline 68.5±11.013, post-intervention 74.93±11.21, p<0.001) [40]. This study demonstrates that a behaviorally-based diet intervention combined

with Tai Chi can improve dietary quality but not more than diet alone; however this future research should examine a similar intervention in minority populations.

Lack of Tai Chi, RT, and Dietary Interventions

The USDA recommends that older adults participate in multiple modalities of physical activity [23]. Although both Tai Chi and RT meet parts of the USDHHS's recommendations and are acceptable exercises in older adults, there is limited research on the combination of RT and Tai Chi interventions and there have been no published studies to our knowledge looking at health outcomes in a nutrition, Tai Chi, and RT intervention in older obese adults particularly in minorities.

CONCLUSION

The prevalence of adult obesity is 35.9% in the U.S [213] with 20.9 million obese adults 60 years or older in 2010 [5]. The number of Americans over the age of 65 years is projected to double by 2030 [1]. These population shifts will result in an increase in the number of individuals with chronic health conditions and therefore an increase in the number of health care visits and ultimately effect health care costs. Eighty percent of older adult Americans have at least one and 50% have at least two chronic health conditions; including diabetes and CVD [1]. This is of particular concern as both CVD and diabetes, which are exacerbated by aging and obesity, are in the top 10 leading causes of death in American women [138,147]. Thus it is important to promote successful aging in women.

Resilience, defined as the ability to “bounce back” or adapt to significant sources of stress, trauma, or a challenge [24,214], and promotes healthful aging. Resilience may be associated with obtaining and maintaining a balanced diet [13], physical activity routine [23] and ultimately successful aging [7]. This is important as 24-48% of older adults may be at

increased nutrition risk [14,15]. Nutrition is a key part of therapeutic plans for many chronic diseases; including heart disease, diabetes, and obesity [9,10]. Older adults with a good nutrition status have better overall health, increased life expectancy, and decreased disability [10,9]. Research indicates that the DASH diet results in beneficial outcomes including cardiovascular and weight improvements [16,53,17]. Furthermore, regular physical activity can facilitate successful aging [183,185,186]. It is recommended that older adults should incorporate aerobic exercises, muscle strengthening activities, and balance training [23] for optimal health benefits. Although

The USDHHS recommends that older adults participate in multiple modalities of physical activity [23] as well as follow a healthy diet [170]. Nutrition and physical activity interventions have been shown to be successful in improving health related outcomes in obese older adults [37,38,36,35] particularly in dietary quality. However, to date, there is no research examining behavioral based dietary education combined with multiple modality physical activity interventions in obese older women. The novel aspect of this research is that this intervention combines Tai Chi, resistance training, and nutrition education in urban community-dwelling, obese, older, primarily minority, women.

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APPENDIX B: EXTENDED MATERIALS AND METHODS

Study Design

This study is phase VI of the University of Rhode Island Dietary Education and Active Lifestyle (UR-IDEAL) Study. It is a non-randomized quasi-experimental design with a 12-week intervention (See the University of Rhode Island’s Institutional Review Board application HU01213-028). Measurements were taken at baseline and post intervention, see Table 1. Phase VI of UR-IDEAL took place at the St. Martin de Porres Senior Center in Providence, Rhode Island. Principal investigators of the study are Matthew Delmonico, PhD, MPH; Ingrid E. Lofgren, PhD, MPH, RD; Leslie Mahler PhD, CCC-SLP, and Furong Xu, PhD.

Table 1. Timeline

Activity	Fall 2012	Spring 2013	Summer 2013	Fall 2013	Spring 2014
IRB Approval	X				
Intervention Development	X				
Staff Training	X	X			
Recruitment	X	X			
Baseline Testing		X			
Intervention Delivery		X			
Post-testing		X			
Data Analysis			x	X	X
Manuscript Preparation, Thesis Writing			X	X	X

Participants

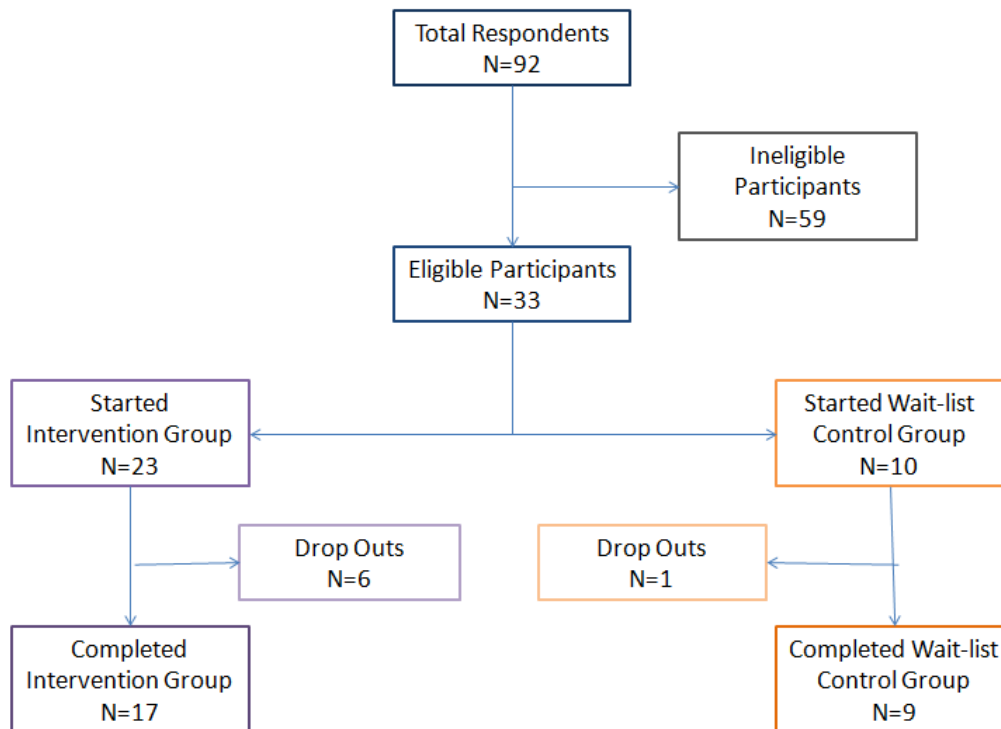
Potential participants were women recruited from the Providence area. Participants were recruited via flyers which were mailed to women ≥ 50 years in a 1.5 mile radius of the St. Martin de Porres Senior Center, flyers posted in local senior living communities, and from announcements at the St. Martin de Porres Senior Center. Women were screened to meet eligibility requirements initially through a phone interview at which time, study staff asked the prospective participant about her height, weight, medications, and past medical history, see Table 2. If a woman appeared to meet eligibility requirements, she was invited to an orientation session. The orientation sessions consisted of a discussion the purpose, the activities and risks and benefits of the study, signing the informed consent for those women who were eligible and interested, and a more in-depth past medical history after the consent had been signed in a one-on-one interview with study staff. Participants were placed in the intervention group until it was at capacity (n=25). Additional individuals who qualified for the study and wanted to participate had the opportunity to participate in the wait-list control group. When a principle investigator deemed a participant's medical history may indicate that the exercise intervention could be unsafe or contraindicated, participants were given a medical clearance form for their primary care provider to complete and return to the staff.

Table 2: Eligibility Criteria

<p><i>Inclusion Criteria</i></p> <ul style="list-style-type: none">a. Women, aged 50–80 years;b. BMI of 30.0 to 50.0 kg/m²;c. Not engaged in regular exercise program within the past six monthsd. Post-menopausal by self-report.
<p><i>Exclusion Criteria</i></p> <ul style="list-style-type: none">a. Failure to provide informed consent;b. Significant or suspected cognitive impairment;c. Severe hearing loss, speech disorder, language barrier or visual impairment;d. Progressive, degenerative neurologic disease;e. Terminal illness with life expectancy of < 12 months, as determined by a physician;f. Severe pulmonary disease, uncontrolled diabetes, blood pressure, or anemia;g. Medications not taken for >3 weeks, lipid lowering medications for >6 months;h. Major joint, vascular, abdominal, or thoracic surgery within six months;i. Significant cardiovascular disease;j. Inability to safely engage in mild to moderate exercise with muscular exertion.

There were a total of 92 respondents to recruitment efforts. Of those 92 women, 59 were ineligible due to inability to obtain medical clearance, BMI too low or too high, time constraints, and inability to communicate in English. This resulted in 33 eligible participants of which 23 started the intervention group and 10 started in the control group. Throughout the study, 4 participants dropped-out of the study due to the sessions being too early, inability to obtain travel to the sessions, gallstones, and the program being “too easy.” There was 1 person who was lost to follow-up from the wait-list control group. Thus 19 individuals completed the intervention group and 9 completed the wait-list control group, see Figure 1.

Figure 1: Flow Chart of URIDEAL VI Intervention



Methods for Hypothesis

The primary hypothesis of this project is that nutrition risk will decrease following dietary education, Tai Chi, and resistance training intervention in obese older women compared to a non-treatment control group. Participants completed the Dietary Screening Tool (DST) in order to identify dietary quality and nutrition risk. The total score of the DST ranges from 0-100 with 5 ‘bonus’ points for dietary supplement use; the higher the score indicating healthier dietary patterns. Furthermore, the composite score of the DST is associated with three different nutritional risk levels; at risk (<60), possible risk (60-75), and not at risk (>75) [15].

Anthropometrics

During anthropometric testing, all participants wore scrubs, had fasted overnight and voided their bladder. Weight was measured in pounds in duplicate to the nearest 0.25 pounds; the average was taken. Then, weight was converted to kilograms. Height was measured with a stadiometer in duplicate to the nearest 0.25cm and averaged. Body Mass Index (kg/m^2) was calculated from the height, converted to meters, and weight. Body composition was measured in all participants except those who have a pacemaker via foot-to-foot bioelectrical impedance analysis device (Tanita BF-556). Waist circumference was measured at the point of the iliac crest. Hip circumference was measured at the broadest circumference of the hips above the gluteal fold. Measurements were taken using a standard non-stretch tape measure with tensometer. Waist to hip ratio was calculated.

Methods for Exploratory Hypothesis

The exploratory hypothesis is that there will be a positive relationship nutrition risk and resiliency. Resiliency was measured using two questionnaires. Participants were given the questionnaires either orally or written depending on participant's preference. The Physical Resilience Scale as developed and validated by Resnick et al. [24,45]. This questionnaire has the participant use a specific, discreet physical challenge they have experienced to answer the questions. The Physical Resilience questionnaire contains 15 validated questions; therefore the scoring is a sum of 0-15 in which the higher score indicates greater resilience. The second resilience questionnaire was the Resilience Scale developed by Wagnild and Young, which is a series of 26 questions that are answered on a likert scale from 1 to 7 [46]. However the last question, "I'm resilient," is not included in the score, thus the scoring is a sum of 25-175; with the higher number indicating greater resilience.

Intervention

Intervention group

The intervention group met three times per week for 90 minutes each session and consisted of Tai Chi and resistance training and behaviorally-based dietary education sessions. The intervention group participated in 36 sessions over a 12-week period on Mondays, Wednesdays, and Fridays, see Figure 3. Throughout the study, participant received incentives in order to compensate them for their time and to maintain their interest; incentives included study t-shirt, measuring spoons, food samples, and study pens. Each session contained approximately 45 minutes of Tai Chi which was developed by Dr. Furong Xu and led by Kinesiology graduate students and supervised by Dr. Xu. A modified 24 form Yang style Tai Chi emphasizing slow and progressive movements was taught [50]. The movements were introduced gradually. An instructional DVD was provided to participants to allow them to practice outside of the sessions if they so desire. In addition, participants in the intervention group partook in 30-45 minutes resistance training sessions twice a week for a total of 24 sessions. Resistance training was led by a kinesiology graduate student and supervised by Dr. Matthew Delmonico. Resistance training was comprised of 6 exercises; the leg press, knee extension, leg curl, overhead press, chess press, and back row. Participants were supervised while performing the exercise to make sure they were doing it safely and effectively. Blood pressure was taken before and after exercise sessions.

A total of 12 sessions of behaviorally-based dietary education was provided to participants for roughly 45 minutes once a week. A nutrition graduate student conducted the nutrition education sessions that had been develop by Dr. Ingrid Lofgren's lab. Participants learned about healthy eating and lifestyle changes with each session focusing on a different

topic related to the modified DASH diet; which includes low intake of saturated fat (<7% of caloric intake), moderate intake of total fat (<35% of caloric intake, modified from the original DASH diet recommendation of 27%), high intake of fruits, vegetable, and whole grains; consumption of low-fat dairy and meat products, and a moderate intake of sodium (3,000 mg or less/day)[16]. Participants filled out food logs three days per week and were given constructive, motivating feedback by the nutrition undergraduates and graduate student from Dr. Lofgren’s lab on their dietary choices.

Figure 3: Intervention Sessions

	Tai Chi	Resistance Training	Dietary Education
Number of days per week	3	2	1
Number of minutes per session	45	45	45
Total number of minutes per week	135	90	45
Total number of minutes in intervention	1620	1080	540

Wait-list control group

The wait-list control group did not receive any intervention during the 12-week intervention period. Participants in the wait-list control group were asked to maintain their normal lifestyle. Following post-intervention testing, participants in the wait-list control group were given two weeks of Tai Chi, resistance training, and nutrition education along with the other incentives provided to the intervention group.

Other Measures

Repeatable Battery for the Assessment of Neurological Status

The Repeatable Battery for the Assessment of Neurological Status (RBANS) test measures attention, language, visuospatial/constructional abilities, and immediate and delayed memory in individuals aged 20-89 years. The RBANS includes 12 subtests: list learning, story

memory, figure copy, line orientation, picture naming, semantic fluency, digit span, coding, delayed list recall, list recognition, story recall, and figure recall. It took approximately thirty minutes to administer; a communicative disorder graduate student and Dr. Mahler, PHD, CCC-SLP administered the test during baseline and post-intervention testing [49].

Chronic Diseases

The presence or absence of diabetes and cardiovascular disease was determined from the participant's answers to questions on the phone screener and medical history questionnaire.

Blood Pressure

Manual blood pressure (BP) was taken twice within one minute of each other while the participant is seated with arm at heart level using a standard sphygmomanometer after the participant was seated for 5 minutes [48]. Blood pressure was also measured prior to each exercise session; however these were not included in the analysis.

Biochemical

A lipid and glucose panel was obtained via a finger stick (Cholestech[®] LDX system) after participants fasted for 12 hours and abstained from caffeine or nicotine. Researchers measured serum total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triacylglycerols, and glucose. Forty microliters of blood was collected using a lancet and analyzed using a portable Cholestech machine.

Questionnaires

The following 9 questionnaires were completed by participants involved in the study at baseline and post intervention. The additional questionnaires given to participants include Yale Physical Activity Scale (YPAS) measured activity index and weekly calorie expenditure [47] as well as Sleep Quality Questionnaire [215], Social Support and Exercise Survey [216],

REACT II Life satisfaction questionnaire[217,218], Body Satisfaction Measure [219], and the Activities-specific Balance Confidence (ABC) Scale [220].

Physical Function

Beyond the scope of this proposal, the Kinesiology research assistants conducted several physical functioning tests, including: the short physical performance battery (SPPB), which is comprised of three tests: balance assessment, gait speed assessment, and timed chair stands, 8-foot up and go (UG) test, grip strength, as well as the chair-sit and reach [221].

Statistical Analysis

It was determined that a sample size of 24 total participants would be adequate in detecting a difference in DST score resulting in an effect size of 0.77 with an alpha of 0.05 and this number was consistent with past interventions [37-41]. Data was analyzed using SPSS, version 22.0 for Windows (IBM Corp. Summers, NY). Significance was set at a p value > 0.05. A completers analysis was performed. Variables were assessed for normality: skewness between -1 to 1 and kurtosis between -1.5 to 2. Total cholesterol, LDL-C, TAG, change in resilience, and change in YPAS calorie expenditure were log transformed. Resilience and YPAS activity index was square root transformed while physical resilience was reflect square root transformed.. However the following variables were not able to be transformed and thus non-parametric tests were used: systolic blood pressure, diastolic blood pressure, body fat percent, YPAS weekly calorie expenditure at baseline and post-intervention as well as in waist to hip ratio calculated by subtracting the baseline from post-intervention. Categorical variables were expressed as number and percentages. Continuous variables were expressed as mean \pm standard deviation.

The independent variable was group while dependent variables included nutrition risk, diet quality, and physical resilience. At baseline and post-intervention, Independent t-tests for normally distributed continuous variables, Mann-Whitney U Test for non-normally distributed continuous variables, and chi square analysis for categorical variables were completed. Paired t-tests for normally distributed variables, Wilcoxon Signed Rank test for non-normally distributed continuous variables, and McNemar's test for categorical values were used to determine changes between baseline and post-intervention within each group. For normally distributed variables, a one-way repeated measures analysis of variance (ANOVA) for normally distributed continuous dependent variables was used to compare baseline to post-intervention [81].

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APPENDIX C: STUDY INFORMED CONSENT

Title of Project: A community-based exercise and dietary intervention program in obese women at an urban Rhode Island senior center

Purpose of the Consent:

You are invited to take part in the 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 (401-874-5440), Ingrid Lofgren (401-874-5706), Furong Xu (401-874-2412), and Leslie Mahler (401-874-2490) from the Departments of Kinesiology, Nutrition and Food Sciences, and Communicative Disorders at the University of Rhode Island, the persons mainly responsible for this study, will discuss them with you. Individuals may be able to participate if they have/are 1) female, 2) age 50-80 years, 3) a body mass index (BMI) of 30-50 kg/m², 4) no recent medication changes, 5) post-menopausal, and 6) free of diseases or conditions that would prevent safe changes in diet and/or participation in an exercise program.

Description of the project:

This is a research project designed to assess the role that a 12-week Tai Chi and resistance exercise training program plays in improving physical functioning, muscle mass, fat mass, and improving heart disease risk factors when combined with a dietary intervention to improve dietary intakes. Tai Chi, a form of martial arts that is a slow and low-impact exercise, and resistance training (RT) have 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 dietary changes with Tai Chi and resistance exercise training on changes in cognitive function, sleep quality, blood pressure, blood fats and sugar metabolism, muscle function, and other important health-related measures. Your participation will vary depending on which group you are assigned to. However, the study may require your participation of about 4 hours per week. All of the testing and intervention sessions will take place at the St. Martin de Porres Center. 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 (two visits, 1-2 hours per visit). At the first testing 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 that will take only 30-40 minutes. These include a dietary screening tool, a physical activity survey, a social support survey, a sleep quality questionnaire, balance questionnaires, life and body satisfaction surveys, and resiliency surveys. You will also complete one finger stick that will be used to analyze blood sugar, fats, and cholesterol. 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 8:00 am on a Wednesday, you are asked to not eat and/or drink anything besides plain water after 8:00 pm 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.

At testing visit 2, a brief cognitive screening test will be administered that will take 30 minutes. The screening tasks include list learning, naming, short-term recall, figure drawing, and coding.

You understand that trained personnel, using universal precautions and established methods, will conduct these finger sticks. You understand that the finger stick requires 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 trained 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 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 device.

At the end of the first phase (testing), you will be assigned to either the exercise (Tai Chi and resistance training) plus dietary group or to a waitlist control group based on group availability.

PHASE 2: INTERVENTION

Dietary Sessions (Exercise plus Healthy Diet Group)

For those assigned to this intervention, you will be asked to participate in a dietary intervention designed to improve your diet. You will be instructed on how to change your diet to increase fruit, vegetable, whole grain, and monounsaturated fat intakes

with reductions in saturated/trans fats, refined carbohydrates, and sodium by the end of 12-week protocol as measured by the dietary questionnaires. At the senior center, you will meet in a group (~15-25 other participants) with an expert in nutrition once per week (~ 45 minutes per session) for 12 weeks who will give you instructions and expert advice on food selection, preparation, and other dietary changes. Body weight will be monitored periodically, and you will be instructed to keep careful records of your food intake.

Exercise Sessions (Exercise plus Healthy Diet Group)

Tai Chi. If you are assigned to the diet plus exercise group, you will also be asked to participate in three (3) supervised exercise sessions per week (~ 40 minutes per visit) for the 12-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 an assigned room at the 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 the 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 and other 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 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 at an effort level that is judged to be appropriate to improve your fitness level. Your blood pressure will also be measured at the start of 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 5-10 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.

Resistance Training. On two of the days that you participate in Tai Chi, you will be asked to do some additional exercises using basic resistance exercise training equipment (for example, rubber bands), which offers resistance against extending and flexing your arms, legs, and trunk region for approximately 20 minutes. All sessions

will start with a brief warm-up that will be achieved by doing the Tai Chi exercise. The first several resistance training sessions will begin with lighter resistances to get you used to the resistance training program. Your overall progress will be monitored by an exercise specialist so that you are able to tolerate the exercise.

Control Group

If there is no space available in the exercise plus diet group, you understand that you may be assigned to the “waitlist control” group. If you are 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 12-week intervention (phase 2). 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 the dietary materials, six supervised Tai Chi exercise sessions, and four resistance training sessions at the St. Martin de Porres 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 healthy diet 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 from Phase 1 after the completion of the 12 week intervention. All data will be coded with a study number and stored only at the University of Rhode Island without any personal identifiers (including initials or birth dates) to ensure confidentiality. 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. The St. Martin de Porres 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, resistance training, 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 participant:

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 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, room 120). Study records are retained securely for ten years after the study ends.

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 a healthy diet and 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 at the end of the study.

Decision to quit at any time:

You understand that it 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. If you wish to quit, simply inform one of the principal investigators listed in the next section of this consent.

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, Furong Xu (401) 874-2412, or Leslie Mahler (401) 874-2490) (anonymously, if you choose). In addition, if this study causes you any injury or if you have questions about your rights as a research participant you may contact the office of the Vice President of Research, 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., another 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 healthy diet 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.

Approved by the University of Rhode Island IRB on October 2, 2012

APPENDIX D: ASSESSMENT MATERIALS

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)

Physical Resilience Scale

Please agree or disagree with each statement.

What has been your most difficult physical challenge _____ (e.g, vision changes, arthritis, hip fracture, pneumonia, stroke).

When faced with this challenge:

	Agree	Disagree
1. I was determined to recover.		
2. I adjusted to the new changes.		
3. I used humor to help me through.		
4. I believed I could recover.		
5. I focused on my remaining abilities, not on what I couldn't do.		
6. I accepted the new challenges.		
7. I accepted help from others.		
8. I figured out how to do my daily activities.		
9. The challenging event was so bad I gave up trying to recover.		
10. I found it difficult to ask for help from others when I needed it		
11. I found the energy to do what I had to do.		
12. I saw this challenge as an opportunity.		
13. I was determined to regain my prior functional ability.		
14. I became a stronger person.		
15. I continued to make plans for the future.		
16. I learned from it		
17. Since the challenging event I have not wanted to even do my usual activities		

The Resilience Scale™

Date: _____

Please read the following statements. To the right of each you will find seven numbers, ranging from "1" (Strongly Disagree) on the left to "7" (Strongly Agree) on the right. Circle the number which best indicates your feelings about that statement. For example, if you strongly disagree with a statement, circle "1". If you are neutral, circle "4", and if you strongly agree, circle "7", etc.

	Strongly Disagree			Strongly Agree			
1. When I make plans, I follow through with them.	1	2	3	4	5	6	7
2. I usually manage one way or another.	1	2	3	4	5	6	7
3. I am able to depend on myself more than anyone else.	1	2	3	4	5	6	7
4. Keeping interested in things is important to me.	1	2	3	4	5	6	7
5. I can be on my own if I have to.	1	2	3	4	5	6	7
6. I feel proud that I have accomplished things in life.	1	2	3	4	5	6	7
7. I usually take things in stride.	1	2	3	4	5	6	7
8. I am friends with myself.	1	2	3	4	5	6	7
9. I feel that I can handle many things at a time.	1	2	3	4	5	6	7
10. I am determined.	1	2	3	4	5	6	7
11. I seldom wonder what the point of it all is.	1	2	3	4	5	6	7
12. I take things one day at a time.	1	2	3	4	5	6	7
13. I can get through difficult times because I've experienced difficulty before.	1	2	3	4	5	6	7
14. I have self-discipline.	1	2	3	4	5	6	7
15. I keep interested in things.	1	2	3	4	5	6	7
16. I can usually find something to laugh about.	1	2	3	4	5	6	7
17. My belief in myself gets me through hard times.	1	2	3	4	5	6	7
18. In an emergency, I'm someone people can generally rely on.	1	2	3	4	5	6	7
19. I can usually look at a situation in a number of ways.	1	2	3	4	5	6	7
20. Sometimes I make myself do things whether I want to or not.	1	2	3	4	5	6	7
21. My life has meaning.	1	2	3	4	5	6	7
22. I do not dwell on things that I can't do anything about.	1	2	3	4	5	6	7
23. When I'm in a difficult situation, I can usually find my way out of it.	1	2	3	4	5	6	7
24. I have enough energy to do what I have to do.	1	2	3	4	5	6	7
25. It's okay if there are people who don't like me.	1	2	3	4	5	6	7
26. I am resilient.	1	2	3	4	5	6	7

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

Data Sheet for Detailed Subject Telephone Interview

**THE UNIVERSITY OF RHODE ISLAND DIETARY EDUCATION
AND ACTIVE LIFESTYLE (UR-IDEAL) STUDY – PHASE 6**

Data Sheet for Detailed Subject Telephone Interview

- Brief Explanation of Study**
- Permission to Conduct Interview?** ___Yes ___No

Comment: _____

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: _____

 - **Proximity to St. Martin de Porres Senior Center**
 Length of commute: _____ miles or _____ minutes
 Within reasonable commute ___ Willing to make unreasonable
 commute_____
 Too far to commute_____
 - **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

- **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) _____

- **Smoking**

Always Smoker _____ 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)

Describe other non-structure physical activity (e.g. leisure time, gardening, occupational, or other)

- **Cardiovascular (heart, blood, or blood vessel) conditions?**
 No Yes (Record on Medical History/Treatment Form)
Comments: _____

- **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**
Fractures (wrist, hip, spine) as adult? _____ Yes _____ No
If yes, describe: _____

- **Diabetes**
 No
 Yes – Type 2. If type 2, taking insulin now?

____ Yes – Type 1 (Insulin Dependent)

Comments: _____

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

____ No

____ Yes (Record on Medical History/Treatment Form)

Comments: _____

- **Major 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 _____ Needs 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?

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

Name: _____ **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

Musculoskeletal system:

Have you ever been told by your doctor that you have any of the following? **YES** **NO**

- | | | |
|---|-------|-------|
| a. Osteoarthritis or degenerative arthritis | _____ | _____ |
| b. Rheumatoid arthritis | _____ | _____ |
| c. Osteoporosis | _____ | _____ |
| d. Ankylosing 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 walking? _____

If yes, is it a current problem? _____

4. If yes, is this pain relieved by rest or by discontinuing walking? _____

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? _____

	YES	NO
10. Have you ever had any chest pain or discomfort other than breast pain 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-	_____	_____
g. Did you ever consult a doctor for this pain or discomfort?		
If yes,	_____	_____
What was the diagnosis?	_____	_____
Were you given any medications?	_____	_____

	YES	NO
11. Do you have any history of high cholesterol in your blood as evident by previous blood lipid tests?	_____	_____

Comments: _____

SECTION C

Respiratory System:

1. 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?	_____	_____
2. Has your doctor ever told you that you have any respiratory or lung disease?	_____	_____
a. If yes, please describe	_____	_____

Comments: _____

SECTION D

YES NO

Endocrine system:

Have you ever had any of the following symptoms?

a. Thyroid problems?	_____	_____
b. Adrenal problems?	_____	_____
c. Diabetes mellitus?	_____	_____

If yes, which type? Type 1 or Type 2

Date of onset- _____

Were you on any medication, diet controlled? _____

SECTION E

Reproductive system:

YES NO

Menstrual History

a. Have you attained menopause? _____

If so, move on to question b & c, then to section F. If no,
proceed to section F.

b. Are you on Hormone Replacement Therapy? _____

c. Approximate date of last menstrual period? _____

Comments: _____

SECTION F

YES NO

Neurological system:

1. Do you have any significant problems with your memory?

a. When answering the telephone, do you recall
what you were doing before it rang? _____

b. Can you give the directions to your house/apartment? _____

c. Can you keep appointments without a reminder? _____

d. Can you remember what clothes you wore yesterday? _____

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:

	YES	NO
3. Ringing in your ears?		
4. Faintness (other than feeling faint when changing posture)	_____	_____
5. Vertigo (a feeling of spinning, or unsteadiness)	_____	_____
6. Fainting Spells (black outs)?	_____	_____
7. Seizure or convulsions?	_____	_____
8. Migraine or severe headaches?	_____	_____
9. Paralysis of arm or leg?	_____	_____
10. A head injury with loss of consciousness?	_____	_____
11. Pain, numbness or tingling in your arm or hand?	_____	_____
12. Pain in your lower back?	_____	_____
13. Kidney stones?	_____	_____
14. Ruptured vertebral disc in neck or back?	_____	_____
15. Do you have pain in any part of 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?	_____	_____
	_____	_____
	_____	_____

- | | YES | NO |
|---|------------|-----------|
| 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

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

	YES	NO
Surgical History:		
1. Have you undergone any surgeries as an adult?	_____	_____
If yes,		
a. Where and for what purpose?	_____	_____
b. Date of Surgery?		
c. Length of stay in hospital	_____	_____
d. Any complications of Surgery?	_____	_____

Comments: _____

2. Have you ever been diagnosed with an abdominal aneurysm?	_____	_____
---	-------	-------

Do you have a:

3. History of severe pain in the abdomen?	_____	_____
---	-------	-------

 If yes, Please specify

4. Do you have a history of severe headache?	_____	_____
--	-------	-------

 a. If Yes, What was the date of onset? _____

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

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

d. Was it the worst ever experienced?	_____	_____
---------------------------------------	-------	-------

e. Did it occur after exertion, coughing or straining?	_____	_____
--	-------	-------

SECTION J

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

If yes, please do specify.

Comments: _____

Medical Clearance to Participate in a Healthy Diet and Exercise Research Project

_____ has volunteered to participate in a healthy diet plus exercise study entitled “A community-based Tai Chi and weight loss study in obese women at Rhode Island senior centers.” It is strongly recommended that volunteers have the clearance of her physician to participate in this study.

The aim of this study is to evaluate the impact of a 12-week Tai Chi and resistance training exercise program when combined with a healthy diet intervention (Dietary Approaches to Stop Hypertension-based diet) in obese (BMI: 30.0-50.0 kg/m²) older women aged 50-80 years.

Exclusionary criteria for eligibility (Please check any that apply):

- Significant or suspected cognitive impairment
- Significant cardiovascular disease
- Severe hearing loss, speech disorder, language barrier or visual impairment
- Progressive, degenerative neurologic disease
- Terminal illness with life expectancy of < 12 months, as determined by a physician
- Severe pulmonary disease, uncontrolled diabetes, blood pressure, or anemia
- Inability to safely engage in mild to moderate exercise with muscular exertion
- Not within age range for study (50-80 years)
- Medications not taken for > 3 weeks, lipid lowering medications for > 6 months
- Major joint, vascular, abdominal, or thoracic surgery within six months

Although we are unaware of any cardiac complications that have resulted from Tai Chi, resistance training, 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 will either participate (at the St. Martin de Porres Senior Center) in 1) a 12-week dietary program plus Tai Chi (a low-impact martial art) and resistance 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, PhD, MPH., Department of Kinesiology, University of Rhode Island, Ph: (401) 874-5440, Ingrid E. Lofgren, PhD, MPH, RD, Department of Nutrition and Food Sciences, University of Rhode Island, Ph: (401) 874-5706, Furong Xu, PhD, Department of Kinesiology, Room 215, University of Rhode Island, Ph: (401) 874-2412, and Leslie Mahler, PhD, CCC-SLP, Ph: (401) 874-2490.

Physician's name: _____

Physician's signature: _____

Date _____

APPENDIX E: INTERVENTION INFORMATION

UR-IDEAL VI Nutrition Session Outline

Session #1- Introduction

- Introduced study and DASH eating plan using food models and props.
- Discussed participant's common food beliefs.
- Educated participants on how to fill out a food log
- Handouts:
 - Common Food Beliefs Questionnaire
 - Sample Food Log
 - Food logs

Session #2- Food Label Reading

- Reviewed how to fill out a food log
- Educated participants on reading food labels and label terminology
- Handouts:
 - Nutrition label terminology
 - Healthy Habit: Read Food Labels
 - Food logs

Session #3 – Introduction to MyPlate and serving size

- Introduced food groups and MyPlate using food models and props
- Discussed serving sizes
- Handouts:
 - Choose MyPlate
 - Healthy Eating the MyPlate Way
 - Handy Portions
 - Portion Distortion
 - Food logs

Session #4- Introduction to DASH Diet

- Educated participants on the DASH diet
- Reviewed food groups and serving sizes using food models and props
- Handouts:
 - Healthy Eating the DASH Way
 - Following the DASH eating plan
 - Sodium Content of Food
 - Sugar Content of Food
 - Food logs

Session #5- Know Your Fats

- Educated participants on fats including saturated and unsaturated fats using food models and props
- Handouts:
 - Calorie Content of Fats
 - Fat Facts
 - Common Fats & Oils
 - Busting the Myths about Fats: Trans Fat, Saturated Fat, Monounsaturated & Polyunsaturated Fat
 - Food logs

Session #6- Fruits and Vegetables

- Educated participants on the benefits, recommendations, preparation, and serving sizes of fruits and vegetables using food models and props
- Discussed dietary supplements
- Handouts:
 - Fruits
 - Vegetables
 - Busting the Myths about: Vitamins, Minerals, Antioxidants, & Dietary Supplements
 - Food logs

Session #7- Grains

- Educated participants on grains including the benefits, sources, and serving sizes using food models and props
- Encouraged whole grain consumption
- Discussed the health benefits of fiber
- Handouts:
 - Whole Grains Energizing your Day
 - Fiber
 - Busting the Myths about Simple Carbohydrates & Complex Carbohydrates
 - Carbohydrates & Fiber
 - Food logs

Session #8- Protein

- Educated participants on the function and sources of protein using food models and props
- Discussed animal versus plant protein
- Handouts:
 - Busting the Myths about Protein & Vegetable Proteins
 - Protein Content of Foods
 - Alternative Sources of Protein
 - Protein Alternative Recipes
 - Food logs

Session #9- Dairy and Osteoporosis

- Educated participants about the benefits, sources, and serving sizes of dairy using food models and props
- Discussed the importance of calcium and vitamin D
- Handouts:
 - Non-Dairy food sources of calcium
 - Low-Fat Dairy Makes Mealtime Complete
 - Calcium
 - “Power of 3” Planner
 - Food logs

Session #10- Cutting Calories and Healthy Food Substitutions

- Educated participants on weight management and appropriate weight loss:
- Discussed nutrient-dense foods and healthy food substitutions using food models and props
- Handouts:
 - The UR-IDEAL cook book
 - Calorie Content of Foods
 - Be Substitution Savvy
 - Eat This Instead of That
 - Food logs

Session #11- Healthy Beverage Choice and Alcohol

- Discussed the importance of hydration as well as healthy beverage choices
- Discussed alcohol intake and encouraged moderation
- Handouts:
 - Think your Drink
 - Alcohol Consumption
 - Food logs

Resistance Training Exercises

Seated Low Row:

- Sit up straight in a chair. Pull belly button to spine
- Start with resistance tube wrapped underneath the arch of both feet
- Level 1: Feet close together
- Level 2: Feet shoulder width apart
- Hold one end of the band in each hand
- Extend legs out straight with heels on the floor
- Extend arms out straight in line with your legs, hands to your knees
- Pull arms straight back to your armpits, bending the elbows
- Squeeze shoulder blades together in the back (exhale) about 1 second
- Slowly return to the starting position (inhale) about 2 seconds
- Repeat 10-15 times for 2 sets



Lat Pull Down:

- Sit up straight in a chair. Pull belly button to spine
- Hold the band in each hand
- Extend the arms above your head, shoulder width apart
- When arms are above head, thumbs should be touching.
- Slowly pull the tubing down to the chest and separate the arms so they are shoulder width apart (exhale) about 1 second
- Squeeze shoulder blades together in the back
- Slowly push the tubing back up above your head to the starting position (inhale) about 2 seconds
- Repeat 10-15 times for 2 sets



Seated Leg Press:

- Sit up straight in a chair. Pull belly button to spine
- Hold one end of the band in each hand
- Loop tube underneath the arch of one foot
- Pull tube up with both arms so hands are at shoulder height. Press elbows back so tubing is now behind the arms
- Bend knee, lifting foot off the floor (bottom of your shoe should be facing the wall opposite you)
- Level 1: Extend leg straight down to the floor with toes to the ceiling, but keep a small bend in the knee.
- Level 2: Extend leg straight out in front with toes to the ceiling (exhale) about 1 second
- Slowly return to starting position where knee is bent and bottom of foot is facing the wall (inhale) about 2 seconds
- Switch sides
- Repeat 10-15 times for 2 sets



(Level 1)

Bicep Curls:

- Level 1: Step one foot on the middle of the resistance tube.
- Level 2: Place both feet on the middle of the resistance tube
- Hold one end of the band in each hand
- Stand up straight and tall.
- Relax arms to the side
- Palms facing each other
- Keep elbow in at side throughout exercise
- Curl arm up (exhale) while on the way up, rotate palms to face the ceiling. About 1 second
- Slowly return to starting position (inhale) about 2 seconds
- Repeat 10-15 times for 2 sets



(Level 1)

Seated/Standing Shoulder Press:

- Place both feet on the middle of the resistance tube
- Level 1: Sit nice and tall. Flat back no arching, keep breathing
- Level 2: Stand up straight. Flat back no arching, keep breathing
- Both levels: Hold one end of the band in each hand
- Both levels: Place arms in the "field goal" position
- Both levels: Extend arms straight up to the sky (exhale) about 1 second
- Both levels: Slowly lower arms to starting position (inhale) about 2 seconds
- Repeat 10-15 times for 2 sets



(Level 1)

Chest Press:

- Performed sitting in chair
- Loop exercise band around your back
- Grasp one end of band in each hand as shown
- Press forward until arms are straight. About 1 second
- Keeping wrists straight
- SLOWLY return arms to starting position. About 2 seconds
- Level 1: Arms make a diagonal
- Level 2: Arms are straight in front of body shoulder width apart.
- Level 3: Arms come forward and fists touch
- Repeat 10-15 times for 2 sets
- 30 second rest interval between sets



(Level 1)

Triceps Extensions:

- Do 10-15 repetitions times total on each arm, and 2 sets on each arm
 - Stand straight with feet shoulder width apart.
 - Grab one end of the resistance band with your right hand.
- Option 1:
- Hold the other end of the band in Left hand.
 - Raise right hand chest level with the back of your hand facing your chest.
 - Without rotating the hand,



(Option 1)

straighten your arm out to the side shoulder height. About 1 second

- When as straight as possible, pause at the end and then slowly return to starting position. About 2 seconds

Option 2:

- Raise your right hand above your head until your arm is vertical and elbow is by your ear. Bend your arm at the elbow until it is behind your neck or back.
- Make sure the resistance band is hanging behind your back.
- Grab the other end of the resistance band in the small of your back with your left hand. This is your starting position.
- Raise your arm up to the ceiling until it is completely straight. Focus on keeping your upper arm vertical and close to the side of your head. About 1 second
- Pause at the top and then slowly lower your forearm to the starting position. You have completed one repetition. About 2 seconds



(Option 2)