NC STATE UNIVERSITY The Forum for Family and Consumer Issues (FFCI)

The Forum for Family and Consumer Issues (FFCI)
Carolyn L. Bird, Ph.D., AFC - Editor In Chief
TheForumJournal.org | ISSN 1540-5273 | info@theforumjournal.org

Effectiveness of the six-week Strong Women Stay Young program

Marnie Spencer
Bingham County
University of Idaho

Laura Sant
Franklin County
University of Idaho

Carol Hampton
Boundary County
University of Idaho

Rhea Lanting
Twin Falls County
University of Idaho

Audrey Liddil
Bannock County
University of Idaho

Marsha Lockard
Owyhee County
University of Idaho

Joey Peutz
Payette County
University of Idaho

Grace Wittman
Cassia County
University of Idaho

Sharlene Woffinden
Bear Lake County
University of Idaho

Martha Raidl
School of Family and Consumer Sciences
University of Idaho

Abstract

Two hundred forty-four women, ages 29 to 89, participated twice a week in a Strong Women Stay Young Extension program for six weeks. Participants completed six strength-training exercises and received nutrition information at each class. Participants reported that they increased their arm and leg strength by 46 to 80 percent; increased their intake of fruits, vegetables, whole grains, and low-fat dairy products; and improved their ability to complete daily activities.

Keywords

strength training, women, Strong Women Stay Young, nutrition

Introduction

Strength training is defined as physical activity that increases muscle strength and mass(Kruger, Carlson, and Kohl 2006). The minimum recommendations for strength training are completing eight to ten exercises that work the major muscle groups at least twice a week (U.S. Department of Health and Human Services 2008; American College of Sports Medicine 2006). The most recent National Health Interview Survey (NHIS) data collected from 1998 to 2004 indicates that only 21.9 percent of men and 17.5 percent of women reported that they strength trained two or more times per week (U.S. Department of Health and Human Services and National Health Interview Survey 2006). This is lower than the 2020 Healthy People objective of 24 percent (U.S. Department of Health and Human Services 2010). Some of the most common barriers that prevent adults from participating in a strength-training program are lack of time, feeling intimidated by strength-training exercises, lack of self-motivation and confidence, and fear of injury (Sallis and Hovell 1990; Sallis, Hovell, and Hofstetter 1992).

Adults who strength train are less likely to experience loss of muscle mass (Seguin and Nelson 2003), functional decline (Chandler et al. 1998), and fall-related injuries (Butler et al. 1998), compared to adults who do not strength train. Other benefits of strength training include a decrease in the signs and symptoms of chronic diseases such as arthritis, diabetes, osteoporosis, obesity, back pain, and depression (Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion 2011). Most of the results from strength-training programs have been collected from participants in a research setting or gym over a four-to-six month period of time.

The purpose of the study is twofold: first, to offer the Strong Women Stay Young (SWSY) strength-training classes through an Extension program as a way to make strength training less intimidating for participants, and second, to determine if a short-term (six-week duration) program is effective in increasing participants' strength, ability to complete daily activities, and consumption of healthy foods.

Methodology

Development of an Extension strength-training program

Extension develops and delivers research-based programs based on the needs of its citizens. To develop a strength-training program, ten Family and Consumer Sciences (FCS) Extension educators became certified to conduct StrongWomen classes in their communities. StrongWomen is a national evidence-based resistance-activity program (Tufts University 2011) developed by Dr. Miriam E. Nelson at Tufts University. We collected data on the SWSY program for six weeks. University of Idaho Institutional Review Board (IRB) approval was obtained prior to beginning the study. All FCS Extension educators were trained on the research protocol.

Subjects

A convenience sample of 244 subjects was enrolled from six rural and five urban counties, based on U.S. Census Bureau data (U.S. Census Bureau 2010). The location of the classes was based on Extension faculty who had been certified to teach StrongWomen classes. Approximately 98 percent (238) were white, 1 percent (3) were Native American, and 1 percent (3) were Asian. Of those who responded (n = 241), 2 percent (4) were Hispanic. Participant mean age was 63, with the subjects ranging from 29 to 89 years old. The greatest percentage of participants was between 56 to 70 years old. Seventy-two percent of participants had six months or less of strength-training experience. Approximately 79 percent completed the twelve classes. Individuals who did not complete the classes did not markedly differ in age or strength-training experience.

One to two weeks before the SWSY classes began, subjects attended an orientation session during which they learned about the importance of strength training, the components of the StrongWomen program, and the forms that they would need to complete. All subjects were women 18 years and older; those who were >70 years old or answered yes to a Physical Activity Readiness Questionnaire (PAR-Q) question (PAR-Q Validation Report 1978) obtained their physician's approval. All participants signed a Subject Consent Form.

Description of the classes

During the six-week SWSY program, subjects attended classes at Extension offices twice a week for a total of twelve classes. Each class lasted one hour and had two components. In the first component, which lasted 45 minutes, participants completed a warm-up, six strength-training exercises, and a cool down. In the second component, which lasted 15 minutes, participants received nutrition information and a handout. The nutrition topics covered in the twelve classes were Staying Hydrated, Setting Strength-Training Goals, MyPyramid Overview, Meat and Beans Group, Milk Group, Grain Group, Vegetable Group, Fruit Group, Oils, Visualize Your Portions, Fiber, and Did You Meet Your Strength-Training Goals (HHS and USDA 2005; HHS 2008).

Data collection

Participants completed data forms at the Extension office under the supervision of Extension faculty and staff at specified times during the 2009-2011 study to obtain the following data:

- Characteristics of the participants: At Class 1, participants provided information on their age, race, ethnicity, county, and strength-training experience.

- Strength-training progress: At Classes 1-12, participants recorded what weights (0-10 pounds) they used for three arm exercises (biceps curl, bent forward fly, overhead press) and three leg exercises (standing leg curl, knee extension, side hip raise). These exercises are depicted at the StrongWomen website (Tufts University 2011).

- Ability to complete routine daily activities: At Class 1 and Class 12, participants recorded their ability to complete routine daily activities, their level of independence, energy, calmness, and how well they slept. This form was adapted from the United Kingdom Short Form 12 Health Survey Questionnaire (UK SF-12) (Ware, Kosinski, and Keller 1996).

- Eating habits: At Class 12, participants completed a retrospective post-pre nutrition survey to record their intake of fruit, vegetable, whole-grain, and low-fat dairy foods. The post-then-pre design accounts for changes in learners' behavior by allowing participants

to first report present behaviors (post) and then rate how they perceived these same behaviors just before taking the course (Rockwell and Kohn 1989).

Statistical analysis

Both the Analysis of Covariance (ANCOVA) and t-test statistical analyses were used to evaluate strength-training results. The Wilcoxon Signed Rank test for paired samples was used to test for differences in daily activity responses and a paired t-test was used to test for differences in nutrition behaviors before and after the program. Both tests included a Bonferoni correction based on the thirteen questions asked on the Daily Activities Survey and three questions asked on the Nutrition Survey. A more conservative $\alpha = 0.0038$ (i.e., $0.05/13 = 0.0038$) was derived for the Daily Activities Survey and $\alpha = 0.0167$ for the Nutrition Survey. The analysis included data from all subjects, not only those who completed all twelve classes.

Results

Strength training results

A simple one-tailed paired t-test was used to determine if there was a significant change in the amount of weight used from Class 1 to Class 12 for the six exercises. Table 1 shows that from Class 1 to Class 12 participants reported that they significantly ($p< 0.001$) increased their arm and leg strength for all six exercises. From Class 1 to Class 12, participants increased arm strength from 46 to 67 percent and leg strength from 73 to 80 percent. Figure 1 shows that the average amount of weight lifted by the participating women increased with the progression of the twelve-class program, irrespective of exercise. However, the amount of weight lifted appeared to depend on the exercise. For example, at both Class 1 and Class 12, the biceps curl was associated with the highest amount of weight lifted, whereas the bent forward fly was associated with the lowest amount of weight lifted.

Table 1. Mean strength training results, percent change, paired *t*-test results

Strength training exercises	**Class 1 Mean weight used (95 percent CI*)**	**Class 12 Mean weight used (95 percent CI*)**	**Percent increase from Class 1 to Class 12**	***t*- values**	**P values**

Arm exercises	Biceps curl	3.6 lb (0.26)	6.0 lb (0.4)	67	15.04	<0.0001
	Overhead press	3.4 lb (0.24)	5.3 lb (0.31)	56	13.59	<0.0001
	Bent forward fly	2.8 lb (0.18)	4.1 lb (0.23)	46	12.8	<0.0001
Leg exercises	Knee extension	3.0 lb (0.28)	5.4 lb (0.45)	80	12.05	<0.0001
	Standing leg curl	3.0 lb (0.26)	5.2 lb (0.41)	73	11.7	<0.0001
	Side hip raise	2.9 lb (0.27)	5.2 lb (0.41)	79	12.6	<0.0001

* CI=Confidence Interval

[Table 1 Summary: Participants increased the amount of weight they could lift from Class 1 to Class 12 in three arm and three leg exercises.]

Effect of age and strength-training experience

An ANCOVA was used to determine if age and strength-training experience affected the amount of weight women lifted during the six-week, twelve-class SWSY program.

Linear regressions showed that age and prior strength-training experience had a minimal effect on weight-lifting ability. The biceps curl was the only exercise where age had a negative effect. Age did not affect a woman's weight-lifting ability for the bent forward fly, overhead press, side hip raise, knee extension, and standing leg curl. Further analysis indicated that the women who improved the most were those who lifted the smallest amount of weight at Class 1 and had little or no strength-training experience. They had the greatest increase in the amount of weight they lifted by Class 12. Those who started Class 1 lifting heavier weights had a much smaller increase in the amount of weight they lifted by Class 12.

Ability to complete daily activities

There were 206 participants who completed the thirteen-question pre- and post-Ability to Complete Daily Activity survey. Table 2 shows that two activities that significantly improved

over the six-week period were having more energy and sleeping better. Five activities or perceptions that improved but were non-significant included their overall ability to complete daily activities, needing less assistance in completing activities or chores, feeling less pain, feeling calmer and more peaceful, and increasing their level of social activities. Six activities or perceptions did not improve or change. These included feeling physically limited, level of independence and self-reliance, sense of balance, climbing stairs, completing moderate activities, and getting up off a chair.

Table 2. Daily Activities Survey results

Daily Activity Survey questions	**P value (α = 0.0038)**
1.Overall ability to easily complete daily activities	0.0695
2. Able to complete moderate activities (carrying groceries, yard work, vacuuming, etc).	0.356
3. Able to climb several flights of stairs	0.453
4. Have a good sense of balance	1
5. Able to easily get up off a chair, sofa, commode, or bathtub	0.361
6. During the past six weeks, have you felt physically limited and did that affect your ability to be independent?	0.145
7. During the past six weeks, have you felt physically limited and did that affect your ability to be self-reliant?	0.145
8. During the past six weeks, have you felt physically limited and did you need assistance to complete activities or chores?	0.019
9. During the past six weeks, how much did pain interfere with your normal work (including work both outside the home and housework)?	0.024
10. How much time during the last six weeks have you felt calm and peaceful?	0.015
11. How much time during the last six weeks have you had a lot of energy?	0.001*
12. How much time during the last six weeks have you slept well?	<0.0001*
13. How much time during the last six weeks have you limited social activities?	0.089

* based on the Bonferoni correction, a p-value ≤ 0.0038 indicates significance

[Table 2 Summary: Participants significantly improved their ability to complete two of the thirteen daily activities measured.]

Nutrition Results

There were 186 participants who completed the three-question nutrition survey. A two-tailed t-test for paired samples was conducted. The results in Table 3 show that participants reported that they significantly ($p<0.0001$) increased their intake of fruits and vegetables by 0.58 cups, whole grains by 0.75 ounce equivalents, and low-fat dairy by 0.6 cups per day.

Table 3. Change in fruit and vegetable, whole grains, and low-fat dairy intake.

Food group	**Mean intake Pre**	**Mean intake Post**	**P (mean difference) α = 0.0167***
Fruits and vegetables	1.525 cups	2.105 cups	<0.0001 (increase of 0.58 cups)
Whole grains	2.71 ounce equivalents	3.46 ounce equivalents	<0.0001 (increase of 0.75 ounce equivalents)
Low-fat dairy	2.32 cups	2.92 cups	<0.0001 (increase of 0.60 cups)

*based on the Bonferoni correction a p value of ≤ 0.0167 indicates significance

[Table 3 Summary: Participants increased their consumption of fruits, vegetables, whole grains, and low-fat dairy product.]

Discussion

During the six-week strength training program approximately 79 percent of participants completed the twelve classes. This high completion rate could be related to having the class last approximately one hour (American College of Sports Medicine 2006), limiting our program to six weeks, conducting the program in an Extension setting that is seen as less threatening to some than a gym, and having the program in a group setting of mainly older women which provided the social network and support that many older adults enjoy (Seguin and Nelson 2003).

Strength-training results

Participants in our study reported increasing their arm and leg strength by 46 to 80 percent in six weeks. Nelson (Nelson et al. 1994) obtained similar strength increases, of 35 to 76 percent, in her subjects, but this occurred after one year. Some participants initially began by lifting lighter weights in order to ensure proper form and prevent injury. Some may have underestimated their ability to strength train at the beginning but were encouraged to progress to lifting more weight. Participants commented and provided specific examples of how they felt stronger and better. Examples included lifting 25 to 30 pound bags, an iron skillet, bales of hay, or grandchildren; starting a rock garden; and moving a large flower pot around the yard without assistance.

Participants reported numerous reasons that they preferred an Extension setting to a gym for a strength-training program. Only a minimal fee was charged for this program to cover basic expenses. Weights were provided. The classes were offered at times of day that were convenient for the subjects. Classes were small, which enabled instructors to give a lot of individual attention. It was observed that as class participants got to know each other, they formed their own social networks, such as sharing community resources. Some participants have reported that although they come to class to feel stronger, they really come for the social interaction that they feel from other class members and the instructors. Growth of this program has been mainly by word of mouth.

Our study found that age did not affect a woman's ability to strength train throughout the program. We expected older women to lift less weight than younger women based on physiological decrease in muscle mass and strength that occurs with age (Wilkes 2009). Other researchers have found that strength training is effective in older women (Seguin and Nelson 2003; Bird et al. 2009) and strength training may prevent muscle wasting that normally occurs as a person ages (Kumar 2009). These results suggest that strength training can be effective at any age.

Participants who had prior strength-training experience started with heavier weights and had the smallest increase in strength. Even though participants with prior strength-training experience did not increase their level of strength as much as participants without strength training experience, this program was a good way for them to maintain their level of strength.

Ability to complete daily activities

There were two activities that participants reported were significantly improved, having more energy and sleeping better. However participants' comments contradicted some of the daily activity survey results. They were able to get in and out of their chair or car easier, to complete

gardening activities, and, in the case of some, to try other physical activities because of their increased strength. These activities included golfing, kayaking, hiking up a mountain, snow shoeing, and walking more frequently.

Eating habits results

At the end of the SWSY program, participants significantly improved their fruit and vegetable, whole grain, and low-fat dairy intake and met the Dietary Guideline recommendations for whole grains and dairy. They did not meet the Dietary Guideline recommendations for consuming 2 cups of fruit and 2.5 cups of vegetables per day.
Participants commented that they ate healthier by reducing portion sizes, drinking more water, eating breakfast, reducing fat intake, and eating more whole grains. Researchershave hypothesized that individuals who are physically active may develop the cognitive resources to improve eating behaviors (Joseph et al. 2011).

Limitations

There were three limitations noted in this study. The first is that it was conducted over a short time period. Data is being collected on the long-term effectiveness of this program. The second is that this sample population is not representative of the U.S. general population and these results may not apply to the general population. The third is that this study was done only on women, and a similar study of men might not yield similar results.

Conclusions

The six-week Strong Women Stay Young program was an effective strength-training program for women regardless of age or previous strength-training experience. In addition to becoming stronger, participants also improved their eating behaviors. Based on these results, Extension proved an excellent setting for conducting this program.

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We would like to acknowledge Deanna Poulsen who contributed data to this project but who is no longer with the University of Idaho.

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