

The Impact of Resistance Exercise Training on the Mental Health of Older Puerto Rican Adults With Type 2 Diabetes

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Objective. To determine the impact of a 16 week high-intensity progressive resistance exercise training (PRT) program on the mental health of older Puerto Rican adults with type 2 diabetes.

Methods. Fifty-eight Puerto Rican adults were randomly assigned to supervised PRT ($n = 29$) or a control group ($n = 29$). A secondary analyses were conducted, and 2 mental health outcomes, the Geriatric Depression Scale and the SF-36 mental component summary score, were used to assess the impact of PRT on mental health status. At baseline, no differences were found on measures of self-reported mental health status.

Results. PRT participants had significantly improved mental health status at follow-up (16 weeks).

Discussion. The incorporation of exercise into treatment planning for older adults may have important benefits on their mental health status. More work is needed to understand the mechanisms by which this occurred as well as the applicability of these findings to sustainable community programs.

Key Words: Depression—Exercise—Type 2 diabetes.

APPROXIMATELY 23.6 million (8%) of the U.S. population have diabetes (National Diabetes Information Clearing House, 2007). Diabetic patients are twice as likely to have depression compared with matched controls without diabetes (Lin et al., 2004). Furthermore, depressive symptoms are more common in individuals with diabetes than in those without (Golden et al., 2008). The impact of exercise on diabetes (Morrato, Hill, Wyatt, Ghushchyan, & Sullivan, 2007), depression (Penninx et al., 2002), and resistance exercise training with depression (Singh, Clements, & Fatarone, 1997) has been documented.

Much of the research on Hispanics in the United States has failed to take into account important intragroup variation. However, the prevalence of type 2 diabetes among elderly participants in the United States, South America, and the Caribbean varies by Hispanic subgroups. Specifically, Puerto Ricans have significantly higher rates of diabetes (38%) than non-Hispanic Whites (23%; Tucker, Bermudez, & Castaneda, 2000). Depression and diabetes co-occur more frequently among older Hispanic/Latinos than in other populations; however, Hispanics are less likely than non-Hispanic Whites to be diagnosed and half as likely to receive treatment for depression (Cherrington, Ayala, Sleath, & Corbie-Smith, 2006).

Lack of exercise is an important risk factor for both depression (Barbour & Blumenthal, 2005) and diabetes (Golden et al., 2008; Lin et al., 2004; Morrato et al., 2007). Although a number of intervention studies have been conducted to examine the benefits of exercise in patients with

diabetes (Morrato et al., 2007), few have focused on older adults (Castaneda et al., 2002) and even fewer have targeted Hispanics (Castaneda et al., 2002). A randomized controlled trial of high-intensity progressive resistance exercise training (PRT) performed for 16 weeks with 58 Hispanic older adults with poorly controlled type 2 diabetes found that this exercise modality significantly improved glycemic control and diabetes management compared with a control group who did not undergo exercise training (Castaneda et al., 2002). The authors found that not only did PRT improved glycemic control and insulin sensitivity, but it also increased fat-free mass, reduced the requirement for diabetes medications, reduced abdominal adiposity and systolic blood pressure, and increased muscle strength and spontaneous physical activity.

Other research has examined the impact of exercise interventions in people with depression. Aerobic exercise training (Penninx et al., 2002) and resistance exercise training (Singh et al. 1997) are as effective as antidepressants thus are recommended as an alternative to antidepressants. Furthermore, a long-term follow-up found that these positive lifestyle changes were maintained by participants. Therefore, exercise proves not only physically but also psychologically beneficial and should be considered a part of routine treatment for depression.

We have found no studies examining the impact of resistance exercise training on depression among people with type 2 diabetes. Therefore, we examined the hypothesis that an intervention designed to improve glycemic/metabolic

control has the additional benefit of improving mental health among Puerto Rican elders with type 2 diabetes. We used data gathered in a randomized control trial (RCT) on resistance exercise training and type 2 diabetes to examine the impact on mental health outcomes.

METHOD

Study Population

Fifty-eight community-dwelling Puerto Rican men and women older than 60 years of age with type 2 diabetes participated in this study and enrolled as previously described (Castaneda et al., 2002). Participants reported living in the United States an average of 23 (± 13) years, and 94% of the participants' language used for speaking and reading in the United States among friends and family was Spanish. Eligible participants were given written informed consent approved by the Institutional Review Board at Tufts Medical Center. Upon enrollment, participants were randomly assigned to PRT or to the control group. Data used in these analyses were collected in interviews conducted at baseline and after 16 weeks postrandomization at the conclusion of the study period. All interviews were conducted in Spanish.

Intervention

Resistance exercise training group.—As previously described, training group participants exercised three times per week under supervision for 16 weeks. Each session lasted approximately 45 min and included warm-up, resistance training, and cool-down exercises (Castaneda et al., 2002).

Control group.—Control participants received phone calls every other week and came to the Human Nutrition Research Center on Aging for one-repetition maximum (1RM) testing during baseline and weeks 9 and 16. 1RM is the heaviest load that can be lifted once in good form through the full range of motion.

Outcome Measures

Two primary outcome measures were examined. The first is the Geriatric Depression Scale (GDS) to document depressive states in this elder adult population. GDS consists of 30 items. Scores range from 0 to 9 (considered as normal), 10 to 19 (as mild), and 20 to 30 (as severe) depressive symptomatology (Yesavage, Brink, & Rose, 1983).

The SF-36 was used to assess eight different domains: general and mental health, physical and social functioning, role physical and emotional, bodily pain, and vitality, each ranging from 0% to 100%, with higher scores reflecting better quality of life (Ware, Kosinski, & Keller, 1994). These domains represent multiple operational indicators of health, including behavioral function and dysfunction, distress and

well-being, objective reports and subjective ratings, and both favorable and unfavorable self-evaluations of general health status. The mental component summary score (MCS) was determined based on 14 items from mental health, role emotional, social functioning, and vitality. The SF-36 is reliable and valid in community-dwelling adult and patient populations.

Both the GDS and the SF-36 have been validated in Spanish and found to have strong psychometric properties. The Cronbach alpha coefficient for the GDS in Spanish is .82. Reliability estimates for the MCS exceed .90 (Ware et al., 1994). The trends in reliability coefficients for the SF-36 scales and summary measures have also been replicated across 24 patient groups differing in sociodemographic characteristics and diagnoses (Ware et al., 1994).

Independent Factors and Covariates

The following variables were examined in these analyses.

Sociodemographic variables.—Self-reported age, sex, marital status (single, married, and divorced), and level of formal education were obtained using a questionnaire administered at baseline.

Medication.—Medication used (dose and frequency) was ascertained by self-report. Diabetes medications were categorized in two groups including insulin and oral hypoglycemic agents (metformin, glyburide, glimeperide, glypizide, and/or sulfonylureas). Participant use of potentially mood-impacting medication was assessed in multiple ways. First, medications specifically prescribed for mood were examined. Second, a dichotomous variable was created for the use of any nonmental health condition medication (e.g., steroids, antihypertensives, antivirals, and anticonvulsants) known to affect mood, as determined by the study psychiatrist.

Statistical Analysis

Baseline comparisons were assessed by independent sample *t*-test or Chi-square. Repeated measures analysis of covariance was used to assess time-by-group interactions on each outcome measure (GDS and MCS) adjusting for insulin and oral hypoglycemic therapies, the only two variables found to be different between groups at baseline.

RESULTS

The study sample was 64% female with a mean age of 67.1 ± 7.8 years. The largest proportion of the sample was married (43%) with 21% widowed. Forty-eight percent had a history of smoking. There was a high prevalence of insulin treatment (33%) and use of oral glycemic medications (60%). In addition, participants were taking medications prescribed for mood problems (17%) or other medications known to affect mood (91%). There were no significant relationships between these types of medication measures and GDS

Table 1. Participant Characteristics per Group

Characteristic	PRT (n = 29)	Control (n = 29)	Test statistic ^a
Female	69.0 (20)	58.6 (17)	.67 (1)
Age (years)	66.0 ± 7.9	66.6 ± 7.4	-.31 (56)
Education (years)	6.8 ± 4.5	5.2 ± 3.8	1.42 (56)
BMI (kg/m ²)	30.9 ± 5.7	31.2 ± 5.9	-.23 (56)
Marital status			.63 (1)
Divorced	27.6 (8)	17.2 (5)	
Married	37.9 (11)	48.3 (14)	
Separated	13.8 (4)	6.9 (2)	
Single, never married	6.9 (2)	.0 (0)	
Widowed	13.8 (4)	27.6 (8)	
Insulin therapy	17.2 (5)	48.3 (14)	6.34 (1)*
Oral hypoglycemic therapy	72.4 (21)	48.3 (14)	3.53 (1)*
Medication for mood	13.8 (4)	20.7 (6)	.48 (1)
Medication impacts mood	89.7 (26)	93.1 (27)	.22 (1)
SF-36 mental component summary score	44.2 ± 10.6	47.9 ± 9.3	-1.43 (56)
Geriatric depression scale	11.5 ± 7.5	11.1 ± 7.4	.21 (56)

Notes: Data are mean ± SD or percentage (and number). PRT = progressive resistance exercise training.

^aBaseline comparisons were assessed by independent sample *t*-test for continuous variables or Chi-square for categorical variables. *T* or chi-square values (and degrees of freedom) are shown. **p* < .05.

and MCS outcomes. Table 1 describes the participant characteristics by randomized group. The PRT and control groups differed at baseline only on the prevalence of insulin and hypoglycemic therapy.

As seen in Table 2, GDS and MCS were not different between groups at baseline. However, following the 16-week intervention, there were strong statistically significant differences between PRT and Controls, showing mean improvements on both GDS (3.1 ± 3.5 vs. 12.4 ± 8) and MCS scores (54.4 ± 6.9 vs. 44.5 ± 10.1) among PRT participants.

DISCUSSION

The data suggest that older Puerto Rican adults with diabetes experience depressive symptoms and overall

Table 2. Main Study Outcomes

Outcome	PRT (n = 29)	Control (n = 29)	Test statistic ^a
Geriatric depression scale			
Week 0	11.5 ± 7.5	11.1 ± 7.4	.21 (56)
Range (min-max)	0-29	1-23	
Week 16	3.1 ± 3.5	12.4 ± 8.0	20.38 (1)***
Range (min-max)	0-18	1-25	
SF-36 mental component summary score			
Week 0	44.2 ± 10.6	47.9 ± 9.3	-1.43 (56)
Range (min-max)	20.4-61.3	21.3-63.4	
Week 16	54.4 ± 6.9	44.5 ± 10.1	14.49 (1)***
Range (min-max)	40.9-66.1	17.0-63.2	

Notes: Data are mean ± SD. PRT = progressive resistance exercise training.

^aWeek 0 group comparisons are based on independent *t*-test analysis (with *t* values [and degrees of freedom] shown), and postintervention time-by-group comparisons are based on repeated measures analysis of variance (with *F* values [and degrees of freedom] shown). Both analyses were adjusted for insulin treatment and oral hypoglycemic medication use, the only two variables found to be statistically different between groups at baseline. Time-by-group, ****p* < .0001.

poor mental health. At baseline, 51.7% of the sample reported levels of depressive symptoms that are likely to indicate clinically significant distress. Although this intervention was originally designed to improve glycemic control, we have demonstrated that participation in the PRT had the added benefit of significantly improving mental health.

This study has several important limitations. First, only two mental health measures were included (GDS and MCS), which do not capture anxiety or other mental health symptoms. Second, although the design did involve an attention control for glycemic management, it is likely that participants in the intervention group may have experienced a greater increase in social interactions due to the exercise program. The lack of social interaction with the control group participants may explain in part the significantly worse mental health outcomes observed among these participants.

As public health and medicine continue to focus on the development of population-based strategies for the management and reduction of chronic diseases such as diabetes, it becomes increasingly important to understand the impact of clinical interventions like the one we studied. This intervention targeted a particularly high-risk and underexamined group. Just as social theorists describe basic social conditions and contexts that influence multiple health outcomes (Link & Phelan, 1995), there are parallel behaviors for which behavioral changes promote positive health across multiple domains. Increasing physical activity, particularly among older adults, is one such behavioral change, which is likely to have a positive impact on many markers of health status. Most research examines the impact of behavioral change on one particular outcome and although these studies are important in documenting relationships, more work is needed to understand the multiple pathways and outcomes influenced by health interventions. Finally, although our results demonstrate the multiple benefits of weight bearing exercise in older Puerto Ricans, many other laboratory-based studies are needed to determine how to translate these positive findings into sustainable community settings, particularly those most appropriate for diverse populations of older adults.

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