

## Effects of a physical activity program on depressive symptoms and functional capacity of institutionalized Mexican older adults

MELINNA ORTIZ-ORTIZ<sup>1</sup>, LUIS M. GÓMEZ-MIRANDA<sup>2</sup>, YAMILETH CHACÓN-ARAYA<sup>3</sup>, JOSÉ MONCADA-JIMÉNEZ<sup>4</sup>

<sup>1,2</sup>Faculty of Sports, Autonomous University of Baja California, Tijuana, MÉXICO

<sup>3,4</sup>Human Movement Sciences Research Center (CIMOHU), University of Costa Rica, COSTA RICA

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### Abstract:

**Purpose:** The aim of the study was to determine the effects of a physical activity program on depressive symptoms and functional capacity of institutionalized older adults from Tijuana, Mexico. **Methods:** Fifty older adults (Mean age = 74.2 ± 6.1 yr., Min = 61, Max = 82) who recruited from a retirement home who were assigned to an experimental (EG, n = 25) and a control group (CG, n = 25). The EG performed a physical activity program consisting of chair exercises of moderate-intensity 5 days/week, 40-50 min/session, over 12-weeks. The CG performed low-intensity passive activities programmed by their retirement home personnel. Before and after the experiment, depressive symptoms and functional capacity were measured. General-linear model ANOVA were used to analyze data. **Results:** Following intervention, depressive symptoms were reduced in the EG compared to CG ( $p = 0.001$ ,  $\eta^2 = 20.3\%$ ). Reductions in depressive scores were found in men ( $\eta^2 = 12.4\%$ ) and women ( $p = 0.024$ ;  $\eta^2 = 10.6\%$ ) in the EG compared to older adults in the CG (Men = 10.2 ± 1.3, Women = 8.5 ± 1.0). Functional capacity increased in the EG compared to CG ( $p \leq 0.001$ ,  $\eta^2 = 74.4\%$ ). Gait performance increased in the EG ( $p \leq 0.001$ ,  $\eta^2 = 72.3\%$ ) and decreased in the CG ( $p \leq 0.001$ ,  $\eta^2 = 43.5\%$ ). **Conclusion:** Older adults from a retirement home in Tijuana, Mexico, reduced depressive symptoms and improved physical functioning following an intensive 12-week exercise program. Breaking sedentary-time in institutionalized older adults must be encouraged.

**Key Words:** Depression, elderly, Mexico, exercise, gait.

### Introduction

According to international estimations, there will be an increase in the aging population worldwide; with projections of a growth in the population older than 60 years from 900 million in 2015 to two billion in 2050 (World Health Organization, 2017). This means that the older population will move from 12% to 22% of the global population. In Mexico, the population older than 65 years will be 20.2% by 2050 (Angel, Vega, & López-Ortega, 2017).

Depressive symptoms are common in older adults (Fiske, Wetherell, & Gatz, 2009). In Mexico, depressive symptoms have been estimated as high as 43% in poor older adults; a figure dramatically higher than that found in non-institutionalized older adults from developed countries. Depressive symptoms might lead to suicide and clinically diagnosed depression has been explained by a myriad of factors, including low education level, insomnia, low socioeconomic status, and lack of social, religious or spiritual support (Fiske et al., 2009).

Older adults from developing countries such as Mexico continue working at older ages due to unfavorable social security benefits and lack of retirement plans (Angel et al., 2017). Sometimes, older adults are abandoned by their relatives in retirement homes (the Spanish word used is “Asilo” [Asylum]) due to cognitive and physical decline or extreme poverty, and become a burden for caregivers. It has been reported that even older adults from high-income countries require caregivers to carry out basic human needs and activities of daily life (ADL) such as eating, bathing and grooming (World Health Organization, 2017).

The decline in physical functioning impairs older adult's health and quality of life, with additional negative cognitive, social and emotional consequences. Mexican older adults aged 62 to 88 years consider that a successful aging should include at least remaining in good health, being able to cope with changes, having family and friends who are there for them, and being close to God (Reyes Uribe, 2015). Therefore, programs aimed at increasing or at least maintaining functional capacities and overall health status in non-working older adults and reduce sedentary behavior are needed (Aunger, Doody, & Greig, 2018; World Health Organization, 2017).

The antidepressant effects of exercise in older adults have been summarized in systematic reviews of literature and meta-analyses (Catalan-Matamoros, Gomez-Conesa, Stubbs, & Vancampfort, 2016; Rhyner & Watts, 2016; Schuch et al., 2016). In a meta-analysis of randomized controlled trials on adults older than 60 years comparing exercise vs. controls, showed a large influence of exercise (i.e., high effect size) in reducing depression (Schuch et al., 2016). Similar findings were reported in another meta-analysis by Rhyner and Watts (2016). The effective exercise programs were those using group-based exercises, supervised or unsupervised, using mixed aerobic and anaerobic exercises, performing moderate-intensity exercises, and including clinical or non-clinical populations (Schuch et al., 2016). According to Catalan-Matamoros et al. (2016), exercise programs for older adults are safe and efficacious in reducing depressive symptoms.

Exercise has been also included as part of multicomponent interventions targeting physical function in socioeconomically vulnerable older adults in rural communities (Jang et al., 2018). Korean older adults (n = 187) performed a 24-week program that included group exercise, nutritional supplementation and depression management, among other components. Physical function and depression were measured before and after the intervention, with significant improvements following the intervention (Jang et al., 2018). Thus, culturally appropriate exercise programs need to be implemented.

Based on the previous context, the purpose of the study was to determine the effects of a physical activity program on depressive symptoms and functional capacity of institutionalized older adults from Tijuana, Mexico.

## **Material & methods**

### *Participants*

Volunteers were 50 institutionalized older adults from the city of Tijuana, in northern Mexico. The participants were divided into an experimental group (EG, n = 25) and a control group (CG, n = 25). All the participants were over 60 years old and did not have any significant health conditions that prevented them for participating in the study.

### *Procedures*

Older adults from San Vicente de Paul Retirement Home located in the city of Tijuana, Mexico, were invited to participate in the study. Participants read and signed a voluntary consent letter in which they were informed about the characteristics of the study and that they were free to withdraw at any time. The study protocol followed the Helsinki Protocol for studies on human subjects (World Medical Association, 2013).

Once the participants enrolled the study, initial affective and physical measurements were obtained (i.e., pre-test). Subsequently, the physical activity program started for the EG. The program consisted of Monday to Friday chair exercises performed over 12-weeks. The approximate exercise duration was 40 to 50 min. Each exercise session had an initial or warm-up phase (~ 10-min), a main physical conditioning phase (~ 25-min), and a cool-down or relaxation phase (~ 10-min). The physical activities selected had a metabolic equivalent tasks (METs) considered as moderate, between 3.0 and 6.0 METs (Ainsworth et al., 2011; Ainsworth et al., 2000). Trained personnel assisted older adults to perform the activities, including articular flexibility using elastic bands, postural and proprioception exercises with materials such as rubber balls, wood sticks, and small sandbags. These activities were selected due to the deterioration and joint stiffness observed in the participants.

The CG continued with passive activities that the institution had programmed for them. These activities included watching television in the room, going out to the patio to sit down and talk, sleep and pray in the institution's chapel. These activities had an approximate energy expenditure of 0.9 to 1.5 METs (Ainsworth et al., 2011; Ainsworth et al., 2000). Dependent variable measurements were obtained following the 12-weeks in both, EG and CG.

The affective state was evaluated with the Yesavage Geriatric Assessment Scale (Yesavage et al., 1983). This scale measures emotional state related to depression in older adults. The original scale had 30-items, however, we used the 15-item Spanish scale developed by Gomez-Angulo and Campo-Arias (2011).

The functional capacity was evaluated with the Katz index (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963). This instrument is used to assess older adult independence to perform ADL. The scale allows older adults to be evaluated in six basic functions: bathing, toileting, dressing, eating, walking and bladder control (Trigás Ferrín, Ferreira González, & Mejjide-Míguez, 2011).

The fall risk was assessed with the Tinetti scale (Tinetti, Williams, & Mayewski, 1986). This scale uses gait and balance measures to assess fall risk, and is one of the most used scales in geriatric and primary care services for determining older adults at risk of constant falls (González Barón & Casado Sáenz, 2001).

### *Statistical analysis*

The statistical analyzes were performed with IBM SPSS Statistics for Windows, Version 20.0 (Armonk, NY). Summary statistics are presented as mean (M) and standard deviation ( $\pm$  SD). Three-way general linear model ANOVA tests (gender x groups x measurements) were performed on depression symptoms, functional capacity and gait variables. Effect size ( $\eta^2$ ) and the 95% confidence interval (CI<sub>95%</sub>) for the estimates are presented. Pearson correlation were obtained between change scores ( $\Delta = [\text{Post-test} - \text{Pre-test}]/\text{Pre-test} \times 100$ ) of

depression symptoms, functional capacity and gait performance (Vincent & Weir, 2012). Statistical significance was set a priori at  $p \leq 0.05$ .

## Results

The mean age of men in the EG ( $n = 10$ ) and CG ( $n=10$ ) was  $73.1 \pm 6.8$  and  $75.9 \pm 5.7$  yr., respectively. For women in the EG ( $n = 15$ ) and CG ( $n=15$ ), the mean age was  $75.2 \pm 5.8$  and  $72.7 \pm 6.2$  yr., respectively (Table 1).

**Table 1**

*Descriptive statistics for affective and physical variables in older adults from a Retirement Home.*

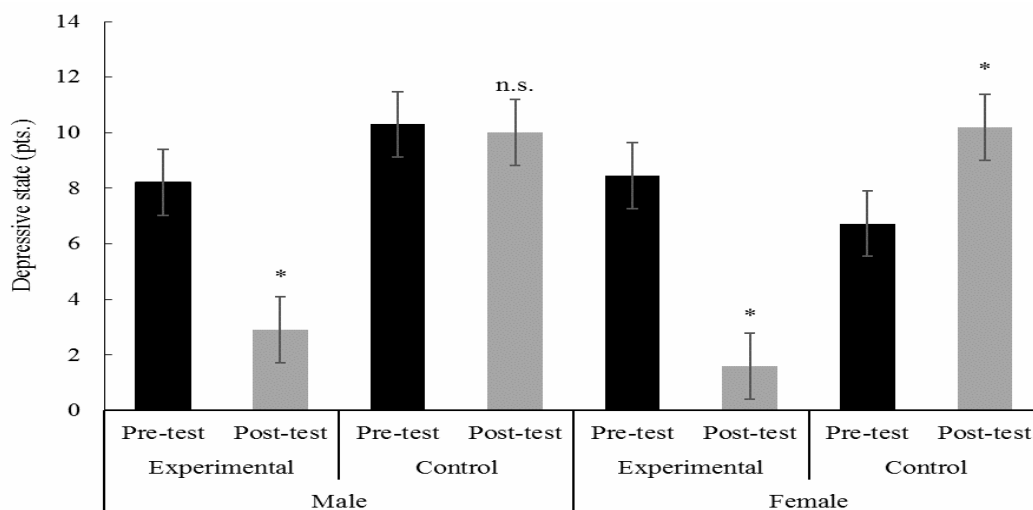
Variable	Males (n = 20)				Females (n = 30)			
	Experimental (n = 10)		Control (n = 10)		Experimental (n = 15)		Control (n = 15)	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Age (yr.)	$73.1 \pm 6.8$	-	$75.9 \pm 5.7$	-	$75.2 \pm 5.8$	-	$72.7 \pm 6.2$	-
DS (pts.)	$8.2 \pm 6.1$	$2.9 \pm 3.5$	$10.3 \pm 5.2$	$10.0 \pm 4.8$	$8.5 \pm 2.8$	$1.6 \pm 2.2$	$6.7 \pm 4.8$	$10.2 \pm 4.4$
FC (pts.)	$4.1 \pm 2.1$	$5.5 \pm 0.7$	$4.8 \pm 1.0$	$3.3 \pm 0.7$	$3.5 \pm 1.6$	$5.6 \pm 0.6$	$4.9 \pm 1.1$	$3.1 \pm 0.8$
Gait (pts.)	$12.5 \pm 7.6$	$19.7 \pm 8.2$	$16.8 \pm 5.2$	$13.1 \pm 5.4$	$10.4 \pm 6.8$	$19.0 \pm 6.9$	$20.7 \pm 4.4$	$15.9 \pm 4.8$

Note: DS: Depressive state; FC: Functional capacity.

A significant triple interaction was found ( $F_{1,46} = 11.7$ ,  $p = 0.001$ ,  $\eta^2 = 20.3\%$ ) between men and women of the control and experimental groups and the initial and final measurements on depressive state. In men of the EG, a reduction on the depressive state was found following the intervention; while no change was observed in men of the CG. Women in the EG showed a reduction in the depressive state following the intervention; while women in the CG showed an increase in the depressive state (Fig. 1).

**Figure 1**

*Mean values of initial and final depressive state of men and women of the experimental and control groups. \* $p \leq 0.001$  between pre-test and post-test; n.s. =  $p > 0.05$  between pre-test and post-test for the respective comparison.*



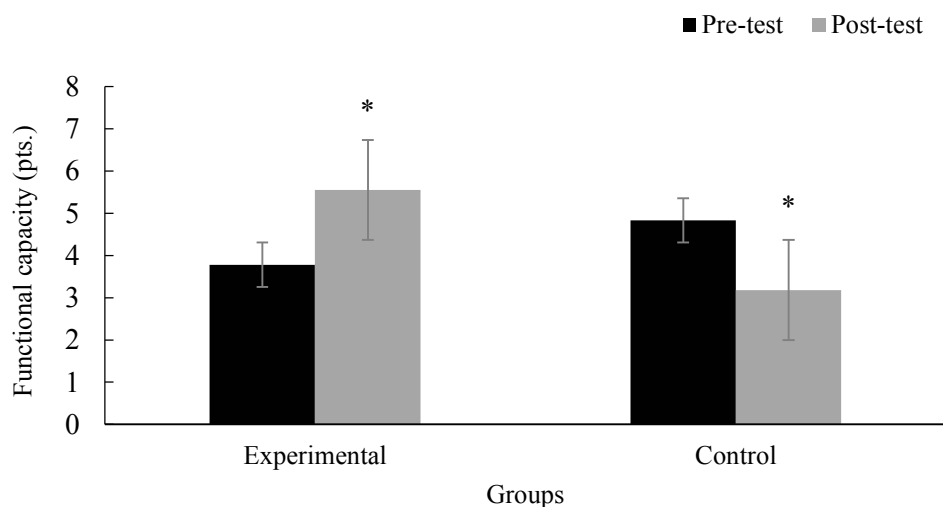
No significant triple interaction ( $F_{1,46} = 2.1$ ,  $p = 0.157$ ,  $\eta^2 = 4.3\%$ ) was found between men and women of the CG and EG and the initial and final measurements on functional capacity.

There was no significant gender ( $F_{1,46} = 0.4$ ,  $p = 0.537$ ,  $\eta^2 = 0.8\%$ ) and measurements ( $F_{1,46} = 0.1$ ,  $p = 0.746$ ,  $\eta^2 = 0.2\%$ ) main effects or a significant double interaction of gender by measurements ( $F_{1,46} = 0.4$ ,  $p = 0.549$ ,  $\eta^2 = 0.8\%$ ) on functional capacity.

No significant double interaction ( $F_{1,46} = 0.01$ ,  $p = 0.909$ ,  $\eta^2 = 0\%$ ) was found in the initial and final measurements between men and women on functional capacity. A significant double interaction was found ( $F_{1,46} = 90.7$ ,  $p \leq 0.001$ ,  $\eta^2 = 66.4\%$ ) in the initial and final measurements between the CG and EG participants on functional capacity (Fig. 2).

**Figure 2**

Mean initial and final functional capacity of the participants of the experimental and control groups. \* $p < 0.001$  between pre-test and post-test.



A significant group main effect was found ( $F_{1,46} = 5.5$ ,  $p = 0.024$ ,  $\eta^2 = 10.6\%$ ) on functional capacity. The mean functional capacity scores of the EG ( $M = 4.7 \pm 0.2$ ) were higher than the CG ( $M = 4.0 \pm 0.2$ ), regardless of gender and measurement time ( $CI_{95\%} = 0.1, 1.2$ ).

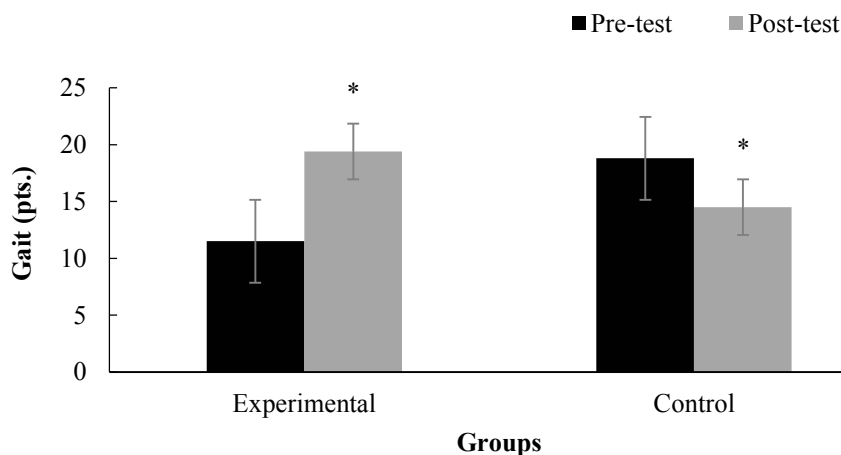
A non-significant triple interaction ( $F_{1,46} = 1.6$ ,  $p = 0.214$ ,  $\eta^2 = 3.3\%$ ) was found between men and women of the CG and EG and the initial and final measurements on gait performance.

There was also no significant gender main effect ( $F_{1,46} = 0.3$ ,  $p = 0.574$ ,  $\eta^2 = 0.7\%$ ), group ( $F_{1,46} = 0.5$ ,  $p = 0.481$ ,  $\eta^2 = 1.1\%$ ), or a significant double interaction of gender by groups ( $F_{1,46} = 1.9$ ,  $p = 0.175$ ,  $\eta^2 = 4.0\%$ ) on gait performance.

No significant double interaction ( $F_{1,46} = 0.01$ ,  $p = 0.909$ ,  $\eta^2 = 0\%$ ) was found in the initial and final measurements between men and women on gait performance. A significant double interaction was found ( $F_{1,46} = 143.0$ ,  $p \leq 0.001$ ,  $\eta^2 = 75.7\%$ ) in the initial and final measurements between the CG and EG participants on gait performance (Fig. 3).

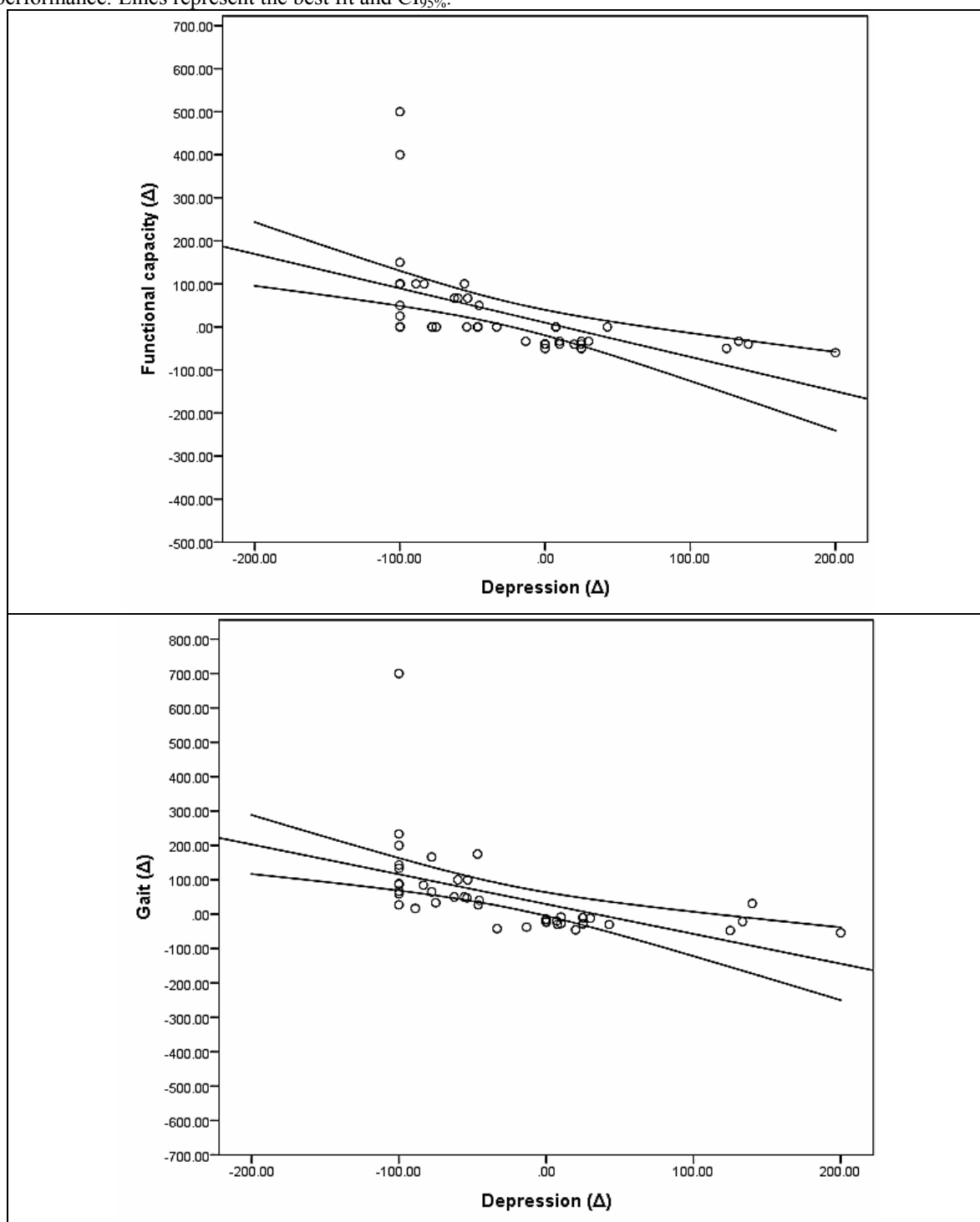
**Figure 3**

Mean initial and final gait of the participants of the experimental and control groups. \* $p < 0.001$  between pre-test and post-test.



Significant correlations were found between change scores of functional capacity and depression ( $r = -0.538$ ,  $p \leq 0.001$ ) and gait performance and depression ( $r = -0.514$ ,  $p \leq 0.001$ ) (Fig. 4).

**Figure 4.** Scatterplots between change scores ( $\Delta$ ) of depression symptoms, functional capacity and gait performance. Lines represent the best fit and CI<sub>95%</sub>.



### Discussion

We studied the effects of a physical activity program on depressive symptoms and functional capacity of institutionalized older adults from Tijuana, Mexico. The main findings of the study were significant reductions in depressive symptoms in the EG following the exercise program. In the CG, men maintained and women increased depressive symptom levels. In addition, participants in the EG increased their functional capacity and gait performance following the exercise intervention compared to participants in the CG.

In this study, women who performed regular activities in the retirement home increased their depressive symptoms compared to women engaging in an exercise program. The National Survey on Health and Nutrition (ENSANUT, for its acronym in Spanish) of Mexico, collected data on a nationally representative sample of 6525 adults 60 years and older (Picazzo-Palencia, 2016). Depressive symptoms were more related to limitations in older adult mobility rather age itself; which is important given that major depressive disorders are higher among

older adults than the general adult population. Comprehensive strategies are needed to reduce depressive symptoms in Mexican older adults. Exercise seems to positively affect depressive symptoms, and there is evidence suggesting that spirituality might also positively reduce depression in Mexican older adults (González-Celis & Gómez Benito, 2013).

Depressive symptoms in older adults might lead to physical deterioration, which in turn, might predispose to physical dependence. We found that positive changes in physical function and gait performance were significantly related to changes in depressive symptoms (Figure 4). It is known that Mexican women older than 65 years are at higher risk than men to become functionally dependent (Lozano Keymolen, Montoya Arce, Gaxiola Robles Linares, & Román Sánchez, 2018). It has been estimated that both, men and women, with severe functional dependence have higher mortality risk than non-dependent older adults (Lozano Keymolen et al., 2018). In addition, physical health has been shown to predict self-rated health in Mexican older adults (Reynolds & Altman, 2018).

The older adults of this study live in a retirement home in Tijuana, Mexico. It is known that older adults are among the most sedentary adults (Harvey, Chastin, & Skelton, 2013, 2015), and guidelines and recommendations to increase physical activity and reduce sedentary behavior have been advocated, including those living in long-term care facilities (de Souto Barreto et al., 2016; Taylor, 2014). Tse, Wong, and Lee (2015), found that low-intensity exercise quantified as activities between 1.5 to 3.0 METs can improve physical and cognitive health of older adults. This intensity is safe for older adults with low physical functioning since it prevents injuries and might promote adherence.

In this study, older adults in the EG performed physical activities with an energy expenditure between 3.0 and 6.0 METs, which complied with recommendations of moderate-intensity activities between 2.3 to 5.0 METs for older adults (Taylor, 2014). However, older adults in the CG performed activities of 0.9 to 1.5 METs, which resulted in inadequate stimuli to improve depression symptoms and functional capacity. In addition, the EG performed exercises 5 sessions/week, an exercise intervention that exceeded the recommended frequency of 2-3 times/week for older adults living in long-term care facilities (de Souto Barreto et al., 2016). Therefore, we provided strong enough stimuli to older adults in the EG that explained the positive changes observed in depression and functional capacity scores.

Other forms of low- to moderate-intensity exercise might be explored in older adults; for instance, exergames and Pilates (Chao, Scherer, & Montgomery, 2015; Skjæret et al., 2016). Exergames might be a considered a feasible option for older adults living in retirement homes since they are easy to learn and might promote social interactions and adherence (Skjæret et al., 2016). In addition, exergames have shown positive outcomes in older adults, for instance, improved physical function (e.g., static and dynamic balance), decreased depression, and increased attention, concentration, and quality of life (Chao et al., 2015).

## Conclusions

In conclusion, institutionalized older adults from Tijuana, Mexico, reduced depressive symptoms and improved physical functioning following an intensive 12-week exercise program. Breaking sedentary-time in institutionalized older adults must be a priority.

## Conflicts of interest

The authors declare no conflict of interest.

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