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The level of physical activity affects the health of older adults despite being active

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Health care in the ageing population is becoming a crucial issue, due to the quality of life. Physical activity, is of primary importance for older adults. This report compared the physical activity in two active older adults population with functionality, quality of life, and depression symptoms. A cross-sectional study was developed with 64 older adults. Physical activity was assessed through the Yale Physical Activity Survey for classification into a less activity (LA) group and a more activity (MA) group. Afterwards, the other health variables were measured through specific questionnaires: the quality of life with the EuroQol (EuroQol five dimensions questionnaire, EQ-5D), functionality with the Berg balance scale (BBS) and depression symptoms with the geriatric depression scale (GDS). There is a statistical significant difference between groups for the BBS (t=2.21; P=0.03, d=0.27). The Pearson correlation analysis shows in LA group a moderate correlation between the BBS and age (r=-0.539; P<0.01) and EQ-5D (r=0.480; P<0.01). Moreover, both groups had a moderate negative correlation between GDS and the the EQ-5D time trade-off (r=-0.543; P=0.02). Active older adults with different amounts of physical activity differ in the BBS. This functional score was higher in the MA group. When observing to quality of life, only the LA group was negatively associated with age while in both groups were associated with depression index.

Keywords: Age, Physical activity, Motor activity, Postural balance, Quality of life, Depression in the elderly

INTRODUCTION

Ageing represents a fundamental problem for society due to the demographics changes in the older population, which is increasing with the ages, and also to an increase in the dependency taxes. These facts suggest new perceptions around the older population, like the socioeconomic and sanitary environment (Abades Porcel and Rayón Valpuesta, 2012). Societies have to improve the robustness of health, long-term care, and welfare systems in Europe, and to help people to be healthy and active in their older ages (Rechel et al., 2013). The predictions for 2050 are that there will be 16 millions of older adults around the world, which correspond to 30% of the total population. Currently, older adults represent about 19% of the total population in Spain, though this population is increasing faster than the older population in other European countries. Life expectancy has increased markedly in older adults between 65 to 85 yr during this century, thus contributing to the global ageing community.

The physical, economic and social environments are changing the daily living patterns of humans and this includes the demands of physical activity (PA) (Owen et al., 2010). Among older populations the concept of healthy ageing has developed. This concept includes issues like the person's social life and economic security. Home surroundings plays a role in developing and supporting personal strategies for healthy ageing (Sixsmith et al., 2014).

In recent studies, PA is associated with better physical health and is a priority of public health with a successful ageing population (Giglio et al., 2015; Moreno et al., 2014). Physical function

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and PA are described as a consequence of well-being, which seems especially important for older people. The importance of PA influences the physical health and functional status, as well as the life satisfaction, the life appraisal and the "age well" perceptions of older adults. The positive psychological effects of PA in disabled subjects is emphasized (Garatachea et al., 2009).

Studies have demonstrated that PA should be especially recommended for the promotion and maintenance of better health and functional ability in older adults, this being a major public health concern. This is due to the increasing life expectancy and that the prevalence of disease rises with age (Giné-Garriga et al., 2014; Rechel et al., 2013; Stephan et al., 2011; Vallance et al., 2012; Withall et al., 2014).

Evidence demonstrates that PA programs in the older community can minimize the effect of diminishing strength and give an improvement in functional ability (Giné-Garriga et al., 2014; Quehenberger et al., 2014). Mobility is also a major problem for older adults because limited mobility can seriously decrease their quality of life (QoL). Quehenberger et al. (2014) and Salguero et al. (2011) suggested that PA can show a benefit in the mental perception as measured with the QoL and also shows a positive impact on depression. These authors have shown that an increase in the amount of PA taken is positively related to a significant improvement in the depressive status. Along the same lines, the recent literature (Hamer et al., 2014; Hupin et al., 2015; Jeoung, 2015; Ofei-Dodoo et al., 2016) shows that older adults have exponential health benefits and longevity as PA increases, whether or not they were considered active, until their activity level reached about ten times the international recommendation (Arem et al., 2015).

Nevertheless, while many studies have focused on the sedentary older adult population, there is a lack of information in the literature regarding specific findings about the association between amounts of PA during daily life activity and important health variables in those older adults considered to be "active" (Nelson et al., 2007), as balance in functional activities and depression symptoms.

To our knowledge, this study is the first to compare varying amounts of PA with health indicators in two active elderly community. Our hypothesis is that higher amounts of PA in the older adult population will correlate with improvements in functionality and balance scores. The secondary objective is to determine the association between depressive symptoms and perceived QoL between groups.

MATERIALS AND METHODS

Study design

This study is a cross-sectional study where we collected data about the relationships among PA and health variables in an active older population attending a dwelling-based community programme in Madrid (Spain), for a fixed time period of three months. This specific community attend 2 times per week to develop PA sessions and the rest of the week had very different amounts of PA. Anonymity was not necessary during the monitoring of the study and only the investigator who did the statistical analysis was 'blind'. All of the procedures used in this study were planned under the ethical norms of the Helsinki Declaration and were approved by the local ethics committee of the Centre for Advanced Studies University La Salle, (CSEULS-PI-046/2015). This study follows the "Strengthening the Reporting of Observational Studies in Epidemiology" (STROBE statement) (von Elm et al., 2008).

Recruitment of participants

Participants had the following inclusion criteria: men and women ranging in age from 65 to 80 yr, attending to different older adult community, with capacity for walking for at least three minutes without help, with maintained cognitive functions, being able to read, write and understand the Spanish questionnaires. On the other hand, the exclusion criteria were: subjects with some incapacity, those hospitalized or with a dependency. Subjects with any cognitive pathology such as dementia, terminal illness and relevant clinical records which may stop PA were also excluded. Participants were collected in three dwelling communities in Madrid where they go every day to participate in different physical activities. The participants completed the questionnaires in a private room in these same locations, under the supervision of the investigator.

Procedure

This protocol was performed by an evaluator who had not participated in the selection and data collection procedures, to ensure the 'blinding' status of the investigation. After consenting to the study, the recruited patients were given a set of questionnaires to complete on the day of the evaluation. All the measures were acquired on the same day, during an hour with each participant. All questionnaires were coded with an identification number rather than a name to blind this data to the other investigators. These included various self-reports for the identification of the PA level,

QoL and depression symptoms. Finally, a test to determine the functionality of the participant was conducted.

All participants in this study were active enough to be considered 'active,' previously characterized in the literature as participating in moderate- to vigorous-intensity PA for at least 150 min per week (Nelson et al., 2007) for older adults without chronic conditions. At present, no cutoff value is defined for active older adults; however, comparing groups with differing amounts of PA could yield important data about how activity affects various health conditions. Therefore, according to the Spanish version of the Yale Physical Activity Survey (YPAS) summary index distribution, the sample was divided into a more activity (MA) and a less activity (LA) group along the median, as described elsewhere (Salpakoski et al., 2011).

Outcomes measures

To evaluate the QoL parameter we used the questionnaire EuroQol (EuroQol five dimensions questionnaire, EQ-5D). This questionnaire, which has been validated to Spanish (Herdman et al., 2001), consists of two phases and a visual analogue scale (VAS), which measure the QoL in both healthy and sick people. The patient state of health is evaluated in five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension has three levels: no problems, some problems, and severe problems, where the patient has to mark in the box the most appropriate item in each dimension. Each level has a quantitative number 1 to 3 but the patient does not know the meaning (Pradas Velasco et al., 2009). A unique health state is produced as a result of combining one level from each of the five dimensions and then calculating a final EQ-5D index. A total of 243 possible health states are defined in this way. Each state is referred to in terms of a 5-digit code. For example, state 11111 indicates no problems in any of the five dimensions. After that the patient again evaluates his/her health in the VAS, a numeric scale extending to 20 cm, where the endpoints are labelled 'Best imaginable health state' and 'Worst imaginable health state' and its high score is 100 points and fall (minimum) score is 0 points. This information can be used as a quantitative measure of health outcome as judged by the individual respondents. The advantages of this questionnaire are that it is short, easy to complete and simple to understand. Furthermore, its administration is rapid, the patient can fill out the questionnaire in 2–3 min (Herdman et al., 2001).

The balance and functional capacity were measured by the Berg balance scale (BBS) which is validated to Spanish (Berg et al., 1992). The BBS is an evaluation tool used to identify the balance capacity during the functionality activities. This scale includes 14 items each with a score ranging from 0 to 4, which are combined to get a final score ranging between 0 (balance is seriously affected) and 56 (excellent balance). These scores will be low if the participant cannot complete the task or has to complete the task with help. The participants must be able to complete the 14 tasks while the examiner evaluates the capacity of each participant in each task. The results were classified into three simpler groups: high risk (0–20), moderate risk (21–40), and low risk (41–56). The investigator demonstrated each task before assessing the participant who replicated it.

The depression level was measured in the subjects by the geriatric depression scale (GDS), which is validated to Spanish (Ramos Brieva et al., 1991) and is an easy questionnaire to fill out. In the study, we used the short form of the GDS with 15 questions. Ten of the 15 questions indicate the level of depression when the participant answers affirmative while the rest of the questions indicated depression when the participants answer negatively. Scores of 0–4 are considered normal; 5–8 indicate mild depression; 9–11 indicate moderate depression; and 12–15 indicate severe depression.

Finally, to measure the level of the subjects' PA and classify them in two groups we used the Spanish version of the YPAS (Katz et al., 2014). The YPAS determines the type and amount of PA and is based on a questionnaire designed for older adults and provides an index for a typical week during the last month. This also provides information on whether activities are light, moderate or high intensity. The activity dimensions summary index (total units) was computed by estimating the number of hours spent in five PA dimensions (vigorous activity, leisurely walking, moving, standing, and sitting), multiplying it by frequency, and multiplying it again by a weighing factor.

Sample size

The sample size was estimated with G*Power 3.1.7 for Windows (G*Power from University of Dusseldorf, Dusseldorf, Germany) (Faul et al., 2007). It was considered a power calculation to detect between-group differences in the BBS. An independent samples Student *t*-test analysis was used to detect mean difference between groups (the MA and LA groups) because it was the main factor of interest. This used an effect-size of 0.65 (medium) based on a pilot study with a sample of 17 subjects (eight from the MA group and nine from the LA group). A medium effect size of 0.79 was used to obtain 90% statistical power (1-β error probability) with an α error level probability of 0.05 suggested a sample size

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of 58 participants (29 per group).

Statistical analysis

All data analyses were performed on IBM SPSS Statistics ver. 21.0 (IBM Co., Armonk, NY, USA). The statistical analyses were conducted at a 95% confidence level and a *P*-value less than 0.05 was considered statistically significant. Descriptive statistics include means and standard deviations.

A normal distribution of the data was confirmed with the Kolmogorov-Smirnoff test. For comparison of the outcomes between the two groups a Student *t*-test for independent samples was used. Effect-sizes (Cohen *d*) were calculated for the outcome variables. According to Cohen method, the magnitude of the effect was classified as small (0.20 to 0.49), medium (0.50 to 0.79), or large (≥0.8) (Cohen, 1988).

The relationship between PA, functionality, depressive symptoms and state of health was examined using Pearson correlation coefficients. A Pearson correlation coefficient greater than 0.60 indicated a strong correlation, a coefficient between 0.30 and 0.60 indicated a moderate correlation, and a coefficient below 0.30 indicated a low or very low correlation (Hinkle et al., 1988).

RESULTS

We measured a total of 64 subjects without missing values. When the sample was divided in two groups with half of the subjects in each group, the LA group had 62% of females and the MA group 50% respectively. All the other characteristics of subjects are shown in the Table 1.

Results of the Student *t*-test for equality of media in the independent samples test demonstrated a significant PA factor for the BBS between groups ($t = 2.21$, $P = 0.03$, $d = 0.27$). There were no statistically significant differences between all the other variables.

The Pearson correlation analysis shows in LA group a moderate correlation within the BBS and other variables as age ($r = -0.539$, $P < 0.01$), EQ-5D VAS ($r = 0.480$, $P < 0.01$), EQ-5D time trade-off (TTO) ($r = 0.385$, $P = 0.03$), and Vigorous Exercise ($r = 0.383$, $P = 0.03$).

Moreover, both groups had a moderate negative correlation between GDS and the the EQ-5D TTO ($r = -0.543$, $P = 0.02$). A higher depression index is in line with lower QoL. All the results are presented in Table 2.

Table 2. Pearson correlations coefficient between the different variables analyzed in the study

Variable	Age	QoL VAS	EQ-5D TTO	EQ-5D VAS	Group
QoL VAS	-0.131	-	-	-	LA
	-0.094	-	-	-	MA
EQ5D TTO	-0.224	-0.049	-	-	LA
	-0.063	0.048	-	-	MA
EQ5D VAS	-0.235	0.040	0.956**	-	LA
	-0.115	0.135	0.929**	-	MA
GDS	0.278	-0.369*	-0.401*	-0.442*	LA
	-0.021	-0.330	-0.543**	-0.506**	MA
BBS	-0.539**	-0.067	0.385*	0.480**	LA
	-0.258	0.282	0.314	0.386*	MA
YPAS	-0.373*	0.072	0.117	0.116	LA
	-0.280	0.332	-0.265	-0.288	MA

QoL VAS, quality of life perceived in visual analogic scale; EQ-5D, EuroQol five dimensions questionnaire; EQ-5D TTO, quality of life score, EQ-5D time trade-off; EQ-5D VAS, quality of life VAS score; MA, more activity; LA, less activity; GDS, geriatric depression scale; BBS, Berg balance scale; YPAS, Yale Physical Activity Survey, final index of physical activity per week.
*The mean difference is significant at the 0.05 level. **The mean difference is significant at the 0.01 level.

Table 1. Summary of demographic variables and comparison between groups with Student *t*-test

Characteristic	MA group (n = 32)		LA group (n = 32)		*t*	Mean difference (95% CI)	Effect size
	Mean ± SD	Range	Mean ± SD	Range			
Age (yr)	69 ± 3.46	65–78	72 ± 6.38	65–88	2.29	2.94 (0.37 to 5.50)*	0.27
Qol VAS	82.03 ± 12.04	60–100	76.47 ± 14.15	40–100	-1.69	-5.56 (-12.13 to 1.00)	-0.21
EQ-5D TTO	0.86 ± 0.15	0.424–1.000	0.78 ± 0.22	0.256–1.000	-1.82	-0.85 (-0.18 to 0.01)	0.21
EQ-5D VAS	0.81 ± 0.15	0.519–1.000	0.75 ± 0.19	0.378–1.000	-1.58	0.07 (-0.15 to 0.18)	0.17
GDS	1.84 ± 1.97	0–8	2.56 ± 2.38	0–7	1.32	0.72 (-0.37 to 1.81)	-0.03
BBS	52.28 ± 3.77	44–56	48.88 ± 7.83	24–56	-2.22	-3.41 (-6.48 to -0.34)*	0.27
YPAS	195.37 ± 100.94	108–602	70.50 ± 26.59	13–105	-6.77	-124.87 (-161.76 to -87.99)**	0.65

MA, more activity; LA, less activity; SD, standard deviation; CI, confidence interval; QoL VAS, quality of life perceived in visual analogic scale; EQ-5D, EuroQol five dimensions questionnaire; EQ-5D TTO, quality of life score, EQ-5D time trade-off; EQ-5D VAS, quality of life VAS score; GDS, geriatric depression scale; BBS, Berg balance scale; YPAS, Yale Physical Activity Survey, final index of physical activity per week.
*The mean difference is significant at the 0.05 level. **The mean difference is significant at the 0.01 level.

DISCUSSION

The purpose of this study is to investigate two groups of active older adults who engage in different amounts of PA. The relationship between PA and functional capacity, QoL, and depression will be discussed.

Similar studies in the adult older population used sedentary and active segmentation of the sample analyzed to describe the grade of PA. However, we used LA and MA groups because, in our study, all the participants took part in a sufficient quantity of PA (Nelson et al., 2007).

Statistically significant differences in the balance and functional capacity of the two groups of active older adults were found. Older adults allocated to the MA group had better BBS scores. Recent literature has shown a medium risk of falling with similar mean values for the BBS in this population (Allison et al., 2013) while other authors suggested that cutoff points below 49 and 50 (Riddle and Stratford, 1999; Shumway-Cook et al., 1997; Yümin et al., 2011) indicate the patient is 3 times more likely to suffer a fall. However, this scale has been found to be more sensitive in inactive older adults (Santos et al., 2011). This data matched with our results of both groups of active elderly, where the LA group mean score is less than 49 and the MA group is greater than 52 points. Moreover, in a recent intervention study involving an elderly population with BBS scores similar to our LA group, participating in a 6-week program achieved an improvement that was comparable to our MA group (Cakar et al., 2010).

When the sample is analysed within groups, the LA group showed several relationships among the BBS and different measured variables, linked to the level of physical functionality in daily life activity and participants' static and dynamic balance abilities. In our study there was a significant observation when the participants get older in this group, there was an association with this functional scale, which may predict a higher risk of falls, as seen in previous studies in the literature where the PA declines with increasing age (Fone and Lundgren-Lindquist, 2003). This data indicates a lower functionality in daily life activity that was very well studied previously, where neuromuscular function seems to be a critical factor for maintaining muscle strength and physical independence (Tanimoto et al., 2012). These results were also in line with findings showing links between brain atrophy and multidimensional physical functioning in older adults where muscle strength, balance and exercise capacity were related to brain volume changes in the medial temporal lobe (Makizako et al., 2011) and a reduced cell loss in sensitive areas like the hippocampus, which may play a decisive role in successful everyday functioning (Colcombe et al., 2003).

Also we have found lower QoL when the BBS variable shows a lower score. Despite the lack of knowledge about the relationship with the type of physical activities on the QoL, some studies in the literature regarding the ageing population often shows similar results with poor functional capacity in their ability to perform daily tasks when this variable is decreased (Motl and McAuley, 2010; Neto et al., 2015). This was also noted in previous studies where declining functionality is associated with changes in hormone levels, with an increase in cortisol blood levels (Mura et al., 2014a).

In our analysis of this group with LA, the type of PA was also statistically associated with this variable, where those with less vigorous activity reported poorer functionality. This issue was also found by Mura et al. (2014b) in an elderly community where they observed that the intervention group with vigorous activity maintained significantly-higher scores of QoL compared with other groups that achieved lower intensity rates. This QoL is frequently studied in this population (Neto et al., 2015) and in our study is associated with lower depression index. In the same manner as our findings, Rodrigues et al. (2015) provided evidence in their study that depression is very prevalent in this population and has a greater impact on QoL than other important comorbidities. Recent studies also found important concerns about the QoL in the older adults population, which is mainly impaired by depression (Unützer, 2009) and is also related to the PA function and general health perceptions (Saarijärvi et al., 2002).

In recent years, several multitude clinical trials (Du et al., 2015; Jeoung, 2014; Lincoln et al., 2011; Pereira et al., 2013; Yoshida et al., 2015) and a systematic review (Cho, 2014) where depression index is being approach have been carried out with very good results associated with special PA programs for the elderly community. This is an important issue to both establish better treatments and a reduction of costs in the public health system (Luber et al., 2001). Therefore, prevention strategies with this type of intervention should be a priority (Rovio et al., 2005).

In conclusion, active older adults with different amounts of PA differ in their BBS score. This functional score was higher in the MA group. With regards to QoL, only the LA group was negatively associated with age while in both groups showed a negative association with the depression index.

Our study has some limitations; first the number of women was relatively higher than men. Second, our sample was enrolled in an

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activity programme and the results may not be comparable with other ageing populations with more sedentary lifestyles. Finally, we consider that an important limitation in this study is that no anthropometric variables were measured, as these could influence the levels of PA. Future studies should investigate the relationship between functionality, QoL, PA levels with anthropometric variables.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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REFERENCES

Abades Porcel M, Rayón Valpuesta E. Ageing in Spain: it's a challenge or social problem? Gerokomos. Ediciones 2012;23:151-155.

Allison LK, Painter JA, Emory A, Whitehurst P, Raby A. Participation restriction, not fear of falling, predicts actual balance and mobility abilities in rural community-dwelling older adults. J Geriatr Phys Ther 2013;36:13-23.

Arem H, Moore SC, Patel A, Hartge P, Berrington de Gonzalez A, Visvanathan K, Campbell PT, Freedman M, Weiderpass E, Adami HO, Linet MS, Lee IM, Matthews CE. Leisure time physical activity and mortality: a detailed pooled analysis of the dose-response relationship. JAMA Intern Med 2015;175:959-967.

Berg KO, Wood-Dauphinee SL, Williams JI, Maki B. Measuring balance in the elderly: validation of an instrument. Can J Public Health 1992;83 Suppl 2:S7-11.

Cakar E, Dincer U, Kiralp MZ, Cakar DB, Durmus O, Kilac H, Soydan FC, Sevinc S, Alper C. Jumping combined exercise programs reduce fall risk and improve balance and life quality of elderly people who live in a long-term care facility. Eur J Phys Rehabil Med 2010;46:59-67.

Cho MH. Are Korean Adults meeting the recommendation for physical activity during leisure time? J Phys Ther Sci 2014;26:841-844.

Cohen J. Statistical power analysis for the behavioral sciences. 2nd ed. Hillsdale (NJ): Lawrence Erlbaum Associates Inc.; 1988.

Colcombe SJ, Erickson KI, Raz N, Webb AG, Cohen NJ, McAuley E, Kramer AF. Aerobic fitness reduces brain tissue loss in aging humans. J Gerontol A Biol Sci Med Sci 2003;58:176-180.

Du WJ, Tan JP, Yi F, Zou YM, Gao Y, Zhao YM, Wang LN. Physical activity as a protective factor against depressive symptoms in older Chinese veterans in the community: result from a national cross-sectional study. Neuropsychiatr Dis Treat 2015;11:803-813.

Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods 2007;39:175-191.

Fone S, Lundgren-Lindquist B. Health status and functional capacity in a group of successfully ageing 65-85-year-olds. Disabil Rehabil 2003;25:1044-1051.

Garatachea N, Molinero O, Martínez-García R, Jiménez-Jiménez R, González-Gallego J, Márquez S. Feelings of well being in elderly people: relationship to physical activity and physical function. Arch Gerontol Geriatr 2009;48:306-312.

Giglio RE, Rodriguez-Blazquez C, de Pedro-Cuesta J, Forjaz MJ. Sense of coherence and health of community-dwelling older adults in Spain. Int Psychogeriatr 2015;27:621-628.

Giné-Garriga M, Roqué-Fíguls M, Coll-Planas L, Sitjà-Rabert M, Salvà A. Physical exercise interventions for improving performance-based measures of physical function in community-dwelling, frail older adults: a systematic review and meta-analysis. Arch Phys Med Rehabil 2014;95:753-769.e3.

Hamer M, Lavoie KL, Bacon SL. Taking up physical activity in later life and healthy ageing: the English longitudinal study of ageing. Br J Sports Med 2014;48:239-243.

Herdman M, Badia X, Berra S. EuroQol-5D: a simple alternative for measuring health-related quality of life in primary care. Aten Primaria 2001;28:425-430.

Hinkle DE, Wiersma W, Jurs SG. Applied statistics for the behavioral sciences. 2nd ed. Boston: Houghton Mifflin; 1988.

Hupin D, Roche F, Gremeaux V, Chatard JC, Oriol M, Gaspoz JM, Barthélémy JC, Edouard P. Even a low-dose of moderate-to-vigorous physical activity reduces mortality by 22% in adults aged ≥60 years: a systematic review and meta-analysis. Br J Sports Med 2015;49:1262-1267.

Jeoung BJ. Relationships of exercise with frailty, depression, and cognitive function in older women. J Exerc Rehabil 2014;10:291-294.

Jeoung BJ. Correlation between physical fitness and fall efficacy in elderly women in Korea. J Exerc Rehabil 2015;11:151-154.

Katz JN, Perez MT, Niu NN, Dong Y, Brownlee SA, Elman SA, Stenquist DS, Santiago A, Sanchez ES, Collins JE. Development and validation of a Spanish translation of the Yale activity questionnaire. BMC Musculoskelet Disord 2014;15:120.

Lincoln AK, Shepherd A, Johnson PL, Castaneda-Sceppa C. The impact of resistance exercise training on the mental health of older Puerto Ri-

can adults with type 2 diabetes. J Gerontol B Psychol Sci Soc Sci 2011;66:567-570.

Luber MP, Meyers BS, Williams-Russo PG, Hollenberg JP, DiDomenico TN, Charlson ME, Alexopoulos GS. Depression and service utilization in elderly primary care patients. Am J Geriatr Psychiatry 2001;9:169-176.

Makizako H, Shimada H, Doi T, Yoshida D, Ito K, Kato T, Shimokata H, Washimi Y, Endo H, Suzuki T. The association between decline in physical functioning and atrophy of medial temporal areas in community-dwelling older adults with amnestic and nonamnestic mild cognitive impairment. Arch Phys Med Rehabil 2011;92:1992-1999.

Moreno G, Mangione CM, Wang PC, Trejo L, Butch A, Tseng CH, Sarkisian CA. Physical activity, physical performance, and biological markers of health among sedentary older latinos. Curr Gerontol Geriatr Res 2014;2014:535071.

Motl RW, McAuley E. Physical activity, disability, and quality of life in older adults. Phys Med Rehabil Clin N Am 2010;21:299-308.

Mura G, Cossu G, Migliaccio GM, Atzori C, Nardi AE, Machado S, Carta MG. Quality of life, cortisol blood levels and exercise in older adults: results of a randomized controlled trial. Clin Pract Epidemiol Ment Health 2014a;10:67-72.

Mura G, Sancassiani F, Migliaccio GM, Collu G, Carta MG. The association between different kinds of exercise and quality of life in the long term. Results of a randomized controlled trial on the elderly. Clin Pract Epidemiol Ment Health 2014b;10:36-41.

Nelson ME, Rejeski WJ, Blair SN, Duncan PW, Judge JO, King AC, Macera CA, Castaneda-Sceppa C; American College of Sports Medicine; American Heart Association. Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. Circulation 2007;116:1094-1105.

Neto GA, Pereira-Junior PP, Mura G, Carta MG, Machado S. Effects of different types of physical exercise on the perceived quality of life in active elderly. CNS Neurol Disord Drug Targets 2015;14:1152-1156.

Ofei-Dodoo S, Rogers NL, Morgan AL, Amini SB, Takeshima N, Rogers ME. The impact of an active lifestyle on the functional fitness level of older women. J Appl Gerontol 2016 Apr 1 [Epub]. http://dx.doi.org/10.1177/0733464816641390.

Owen N, Healy GN, Matthews CE, Dunstan DW. Too much sitting: the population health science of sedentary behavior. Exerc Sport Sci Rev 2010;38:105-113.

Pereira DS, de Queiroz BZ, Miranda AS, Rocha NP, Felício DC, Mateo EC, Favero M, Coelho FM, Jesus-Moraleida F, Gomes Pereira DA, Teixeira AL, Máximo Pereira LS. Effects of physical exercise on plasma levels of brain-derived neurotrophic factor and depressive symptoms in elderly women--a randomized clinical trial. Arch Phys Med Rehabil 2013;94:1443-1450.

Pradas Velasco R, Antonanzas Villar F, Martínez-Zárate MP. Use of european quality of life-5 dimensions (EQ-5D) questionnary to value the health related quality of life variation because of influenza. Gac Sanit 2009;23:104-108.

Quehenberger V, Cichocki M, Krajic K. Sustainable effects of a low-threshold physical activity intervention on health-related quality of life in residential aged care. Clin Interv Aging 2014;9:1853-1864.

Ramos Brieva JA, Montejo Iglesias ML, Lafuente López R, Ponce de León Hernández C, Moreno Sarmiento A. Validation of the geriatric depression screening Scale. Actas Luso Esp Neurol Psiquiatr Cienc Afines 1991;19:174-177.

Rechel B, Grundy E, Robine JM, Cylus J, Mackenbach JP, Knai C, McKee M. Ageing in the European Union. Lancet 2013;381:1312-1322.

Riddle DL, Stratford PW. Interpreting validity indexes for diagnostic tests: an illustration using the Berg balance test. Phys Ther 1999;79:939-948.

Rodrigues GH, Gebara OC, Gerbi CC, Pierri H, Wajngarten M. Depression as a clinical determinant of dependence and low quality of life in elderly patients with cardiovascular disease. Arq Bras Cardiol 2015;104:443-449.

Rovio S, Kåreholt I, Helkala EL, Viitanen M, Winblad B, Tuomilehto J, Soininen H, Nissinen A, Kivipelto M. Leisure-time physical activity at midlife and the risk of dementia and Alzheimer's disease. Lancet Neurol 2005;4:705-711.

Saarijärvi S, Salminen JK, Toikka T, Raitasalo R. Health-related quality of life among patients with major depression. Nord J Psychiatry 2002;56:261-264.

Salguero A, Martínez-García R, Molinero O, Márquez S. Physical activity, quality of life and symptoms of depression in community-dwelling and institutionalized older adults. Arch Gerontol Geriatr 2011;53:152-157.

Salpakoski A, Portegijs E, Kallinen M, Sihvonen S, Kiviranta I, Alen M, Rantanen T, Sipilä S. Physical inactivity and pain in older men and women with hip fracture history. Gerontology 2011;57:19-27.

Santos GM, Souza AC, Virtuoso JF, Tavares GM, Mazo GZ. Predictive values at risk of falling in physically active and no active elderly with Berg Balance Scale. Rev Bras Fisioter 2011;15:95-101.

Shumway-Cook A, Baldwin M, Polissar NL, Gruber W. Predicting the probability for falls in community-dwelling older adults. Phys Ther 1997;77:812-819.

Sixsmith J, Sixsmith A, Fänge AM, Naumann D, Kucsera C, Tomsone S, Haak M, Dahlin-Ivanoff S, Woolrych R. Healthy ageing and home: the perspectives of very old people in five European countries. Soc Sci

http://dx.doi.org/10.12965/jer.1632566.283

Med 2014;106:1-9.
Stephan Y, Boiche J, Trouilloud D, Deroche T, Sarrazin P. The relation between risk perceptions and physical activity among older adults: a prospective study. Psychol Health 2011;26:887-897.
Tanimoto Y, Watanabe M, Sun W, Sugiura Y, Tsuda Y, Kimura M, Hayashida I, Kusabiraki T, Kono K. Association between sarcopenia and higher-level functional capacity in daily living in community-dwelling elderly subjects in Japan. Arch Gerontol Geriatr 2012;55:e9-13.
Unützer J. Top cited papers in International Psychogeriatrics: 2. Quality adjusted life years in older adults with depressive symptoms and chronic medical disorders. Int Psychogeriatr 2009;21:265-266.
Vallance JK, Eurich DT, Lavallee CM, Johnson ST. Physical activity and health-related quality of life among older men: an examination of current physical activity recommendations. Prev Med 2012;54:234-236.
von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. J Clin Epidemiol 2008;61:344-349.
Withall J, Stathi A, Davis M, Coulson J, Thompson JL, Fox KR. Objective indicators of physical activity and sedentary time and associations with subjective well-being in adults aged 70 and over. Int J Environ Res Public Health 2014;11:643-656.
Yoshida Y, Iwasa H, Kumagai S, Suzuki T, Awata S, Yoshida H. Longitudinal association between habitual physical activity and depressive symptoms in older people. Psychiatry Clin Neurosci 2015;69:686-692.
Yümin ET, Şimşek TT, Sertel M, Öztürk A, Yümin M. The effect of functional mobility and balance on health-related quality of life (HRQoL) among elderly people living at home and those living in nursing home. Arch Gerontol Geriatr 2011;52:e180-184.