Olivares, P.R.; Merellano-Navarro, E.; Perez-Sousa, M.; Collado-Mateo, D. (2021) Fitness, Physical Functionality and Quality of Life in Elderly: A Mediation Analysis. Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte vol. 21 (82) pp. 307-318 http://cdeporte.rediris.es/revista/revista82/artcondicion1250.htm

DOI: https://doi.org/10.15366/rimcafd2021.82.007

ORIGINAL

FITNESS, PHYSICAL FUNCTIONALITY AND QUALITY OF LIFE IN ELDERLY: A MEDIATION ANALYSIS

CONDICIÓN FÍSICA, CAPACIDAD FUNCIONAL Y CALIDAD DE VIDA EN MAYORES: ANÁLISIS DE MEDIACIÓN

Olivares, P.R.¹; Merellano-Navarro, E.²; Perez-Sousa, M.³; Collado-Mateo, D.⁵

Spanish-English translator: Claudia Daza, claudiaelena.daza@gmail.com

Financing

The study was supported by the Internal Research Fund of the Universidad Autónoma de Chile (DIUA136-2018).

Código UNESCO / UNESCO Code: 320107 Geriatría / Geriatrics Clasificación Consejo de Europa / Council of Europe Classification: 11 Medicina del Deporte / Sport Medicine

Recibido 31 de mayo de 2019 Received May 31, 2019 Aceptado 28 de marzo de 2020 Accepted March 28, 2020

ABSTRACT

The aim of this work was to analyze the association between fitness and health-related quality of life, assessing the physical functionality impact as a mediator. Different tests of physical condition were carried. The composite physical function (CPF) questionnaire was used to measure the physical functionality and the EQ-5D-5L to quantify the HRQoL. The mediation analysis confirms the

¹ PhD, Facultad de Educación, Psicología y Ciencias del Deporte, Universidad de Huelva, Huelva (España) Grupo de Investigacion EFISAL. Universidad Autónoma de Chile, Talca (Chile) <u>olivares.pedro@gmail.com</u>

² PhD, Grupo de Investigacion EFISAL. Universidad Autónoma de Chile, Talca (Chile) emerellanon@uautonoma.cl

³ PhD, Facultad de Educación, Psicología y Ciencias del Deporte, Universidad de Huelva, Huelva (España) perezsousa@gmail.com

⁴ PhD, Centro de Estudios del Deporte, Universidad Rey Juan Carlos, Madrid (España) danicolladom@gmail.com

physical functionality mediator role between fitness and HRQoL (B=.051; CI= .036 to .067). The direct association of fitness and HRQoL had an effect of B=.0314, t=3.313. p=.001. It is concluded that the fitness, regardless its impact on physical functioning, is related to HRQoL.

KEYWORDS: Elderly; Physical function; Quality of Life

RESUMEN

El estudio tiene como objetivo analizar la relación entre la condición física y la calidad de vida relacionada con la salud (CVRS), midiendo el efecto mediador de la funcionalidad física. Se realizaron diferentes pruebas de condición física a adultos mayores. El cuestionario composite physical function se utilizó para medir la funcionalidad física y el EQ-5D-5L para valorar la CVRS. El análisis de mediación confirma el papel de mediador de la funcionalidad física entre la condición física y la CVRS (B = .051; CI = .036 a .067). La asociación directa de la condición física y CVRS tuvo un efecto B = .0314, t = 3.313. p = .001. Se concluye que la relación entre la condición física y la CVRS está parcialmente mediada por la función física en mayores.

PALABRAS CLAVES: Ancianos, capacidad funcional, Calidad de Vida

INTRODUCTION

The concept of health-related quality of life (HRQL) is widely used in the scientific field and is associated with the way in which the individual ages (Gouveia et al., 2017). This concept is a global and multidimensional concept referring to both, objective conditions and subjective components regarding a person's health (Urzúa & Caqueo-Urízar, 2012). For the older adult, being functional means being able to carry out daily activities autonomously. HRQL in this age group involves aspects of physical health, life satisfaction, psychological state, social well-being and the possibility of carrying out different activities of daily life autonomously (Herrera & Guzmán, 2012).

Functional fitness could be defined as the capacity of performing daily activities in an independent and safely way, without excessive fatigue (R. E. Rikli & C. J. Jones, 1999). During aging there is a decrease in physical condition, especially in older ages (Milanović et al., 2013), mainly due to the decline in levels of physical activity, which generates a decrease in aerobic resistance, flexibility, loss of strength, speed, agility and balance. All these components of physical condition are directly related to the possibility that the elderly have to carry out activities of daily life autonomously (Paterson, Jones, & Rice, 2007; Paterson & Warburton, 2010).

Currently, there are studies that link physical condition with functional dependence in older adults (AM) (Merellano-Navarro, Collado-Mateo, García-Rubio, Gusi, & Olivares, 2017; Rikli & Jones, 2013; Sardinha, Santos, Marques, & Mota, 2015). This statement indicates that those with a level of

fitness in the lowest percentiles have a lower level of functionality. On the other hand, physical condition has been shown to be related to HRQL in the AM population (Alves et al., 2019; Chung, Zhao, Liu, & Quach, 2017; Gusi, Hernandez-Mocholi, & Olivares, 2015; Horder, Skoog, & Frandin, 2013; Olivares, Gusi, Prieto, & Hernandez-Mocholi, 2011; Sartor-Glittenberg et al., 2014; Wanderley et al., 2011), mainly, when the physical condition favors the dimensions that are associated to the physical component of HRQL. Finally, there are studies that relate the level of functional dependence with HRQL (Boonen et al., 2004; Suriyawongpaisal, Chariyalertsak, & Wanvarie, 2003), therefore, the level of physical functionality can act as a mediating variable when relating the physical condition and HRQL.

Mediation analysis is a statistical procedure used to determine the link between two variables and the degree to which this relationship can be modified, mediated or confused by a third variable (Baron & Kenny, 1986; Hayes, 2017). The objective of this study was to analyze the relationship between physical condition and HRQL, evaluating the effect of physical functionality as a mediating variable between this relationship.

METHOD

PARTICIPANTS

The study was carried out in the Maule Region (Chile) through a single measurement. The selection of the sample was non-probabilistic and for convenience. Taking as reference the last "National Survey of Socioeconomic Characterization (CASEN)" (Ministerio de Desarrollo Social, 2017), the population of older adults in the Maule Region is 190931, taking a margin of error of 5% and a confidence interval 95% would require a sample of 384 participants. The total sample was 406 older adults ≥ 60 years old, belonging to different cities and towns in the Maule region. The following exclusion criteria were considered: a.- indicate severe cognitive impairment in the Pfeiffer Test (Martínez de la Iglesiaa et al., 2001), b.- severe motor problems that made testing impossible and c.- hypertension uncontrolled arterial. The study was approved by the bioethics committee of the Universidad Autónoma de Chile (Ethical Application Ref: N°028-15). Participants accepted the terms of the study by signing an informed consent.

APPLICATION OF QUESTIONNAIRES AND FITNESS TEST

The application of the questionnaire and the measurement of the fitness tests were carried out on the same day. All participants conducted a warm-up prior to the of the tests through joint mobility and stretching exercises for 5 minutes. The total application time of the test was approximately 45 minutes. All measurements were made by the research team, made up of physical education students and trained by researchers with experience in elderly studies

Sociodemographic characteristics and lifestyles: age, marital status, educational level, tobacco and alcohol habits, as well as the amount of weekly physical activity were consulted. Following previous studies, physical activity was categorized in "0 hours/week", "3 hours/week" and "≥3 hours/week" (Gusi et al., 2012; Olivares et al., 2011).

Health-related quality of life: The Spanish version of the EQ-5D-5L was used to evaluate the HRQoL (Herdman et al., 2011). The EQ-5D-5L value set based on Uruguayan population preferences (Augustovski et al., 2016) was used to calculate this instrument since it is the only one developed for a South American country.

Physical Functionality: It was measured via Composite Physical Function scale (CPF), developed and validated by Rikli and Jones (Rikli & Jones, 1998), and adapted for its use in Chile (Merellano-Navarro et al., 2015). For sample characterization, CPF score was categorized as high functionality (score 24), moderate functionality (score between 14-23) and low functionality (score 13 or less) (Rikli & Jones, 1998).

Fitness: Lower body strength was measured with the 30-s chair-stand test (R. Rikli & C. Jones, 1999a). The hand-grip test was used for the upper body strength (Rodríguez et al., 1998). Lower body flexibility was valued using the Chair Sit-and-Reach test modified test (Jones, Rikli, Max, & Noffal, 1998); and the Back scratch test was used for the upper body (R. Rikli & C. Jones, 1999a). Agility was measured with the Timed up and go test (TUG) (R. Rikli & C. Jones, 1999b) and aerobic endurance was assessed through the Six Minute Walking test (Enright et al., 2003). All these tests were carried out between 9 and 13 hours, after a 5-minute warm-up consisting of joint mobility exercises and stretching (Olivares, Hernandez-Mocholi, Merellano-Navarro, Gusi, & Collado-Mateo, 2019).

Weight and Height: This data was gathered following previously published techniques and protocols (Lohman, Roache, & Martorell, 1992) besides, body mass Index (BMI) was also calculated. Body weight was measured using a body weight scale (model 803, Seca, Ltd) with a 0.1 Kg accuracy, and height was assessed using a stadiometer (model 213, Seca, Ltd) with a 0.1 cm accuracy. For sample characterization, BMI was categorized according to the World Health Organization criteria (World Health Organization, 2000).

STATISTICAL ANALYSIS

Sample characteristics were obtained through a descriptive analysis using averages ± standard deviation for the continuous variables, and frequency distribution for categorical variables. Fitness tests z-scores included in the study were calculated and used to estimate a mean value as a global physical condition index. Gender was accounted for the z-scores calculation, and inverted for the TUG test.

Simple mediation analysis was conducted using ordinary least squares path analysis to examine whether the association between fitness and HRQoL was mediated by physical functionality, using the PROCESS macro for SPSS (IBM, Chicago, IL, USA) (Hayes, 2013). The model was composed of the fitness as an independent variable, EQ-5D-5L score as a dependent variable, and CPF as mediator. Mediation hypothesis was tested using the bias-corrected bootstrap method with 10,000 samples to calculate confidence intervals (95 %). The point estimate was considered significant when the confidence interval did not contain any zeros.

RESULTS

Table 1 shows characteristics of the participants by gender. A total of 111 men (27.33~%) and 295 women (72.66~%) aged 72.23 ± 6.84 participated in the study. Only 20 percent of the participants had a regular weight, and 30.3 percent conducted 3 or more hours of physical activity per week. CPF showed that 59.1 % of participants had moderate or low functionality. Most fitness tests showed differences between sex, being females scores better in all tests except upper body strength. Results in lower body strength and aerobic endurance were similar for both sexes.

Table 1. Characteristics of the study sample, by gender

1 0.010 11 0.1	All participants	Female		
	(n=406)	Males (n=111)	(n=295)	
Age (years)	72.23 ± 6.842	74.02 ± 6.71	71.56 ± 6.78	
Age Categories. n (%)				
60-69	153 (37.7)	28 (25.2)	125 (42.4)	
70-74	119 (29.3)	38 (34.2)	81 (27.5)	
75-79	61 (15)	21 (18.9)	40 (13.6)	
80 +	73 (18)	24(21.6)	49 (16.6)	
ВМІ				
Normoweight	81 (20.0)	29 (26.1)	52 (17.6)	
Overweight	168 (41.4)	54 (48.6)	114 (38.6)	
Obese	157 (38.7)	28 (25.2)	129 (43.7)	
Physical Activity at week, n (%)				
0 hours/week	149 (36.7)	47(42.3)	102(34.6)	
<3 hours/ week	134(33.0)	34(30.6)	100(33.9)	
≥3 hours/ week	123(30.3)	30(27.0)	93(31.5)	
CPF, n(%)	,	, ,	, ,	
High functionality	166(40.9)	57(51.4)	109(36.9)	
Moderate functionality	183(45.1)	39(35.1)	144(48.8)	
Low functionality	57(14)	15(13.5)	42(14.2)	
EuroQol	0.8916 ± 0.1268	0.9037 ± 0.1405	0.8870 ± 0.1212	
Functional fitness				
Upper body flexibility (cm)	-20.90 ± 13.64	-26.68 ± 14.77	-18.72 ± 12.53	
Lower body flexibility (cm)	-6.70 ± 10.29	-9.95 ± 12.16	-5.47 ± 9.22	
Upper body strength (kg)	45.49 ± 15.13	56.60 ± 18.15	41.31 ± 11.31	
Lower body strength (number of repetitions)	11.58 ± 4.08	11.35 ± 4.62	11.68 ± 3.86	
Agility (s)	8.55 ± 5.68	10.01 ± 9.41	8.01 ± 3.21	
Aerobic endurance (m)	395.15 ± 119.58	388.10 ± 134.77	397.66 ± 113.86	

Abbreviations: BMI: body mass index; CPF: composite physical function; Data are presented as mean ± Standard Deviation

The multiple regression analysis conducted to assess each component of the proposed mediation model, reported that fitness was positively associated with HRQoL (B = .082, t = 10.442, p < .001) as well as with physical functionality (B = 5.210, t = 16.476, p < .001). Additionally, results indicated that the mediator (physical functionality) was positively associated with HRQoL (B = .010, t = 8.403, p < .001). Results of mediation analysis confirmed the mediating role of physical functionality in the relation between fitness and HRQoL with a significant indirect effect (B = .051; CI = .036 to .067). Furthermore, results indicated that the direct impact of fitness over HRQoL continues to be significant (B = .031, t = 3.313, p = .001) when controlling for physical

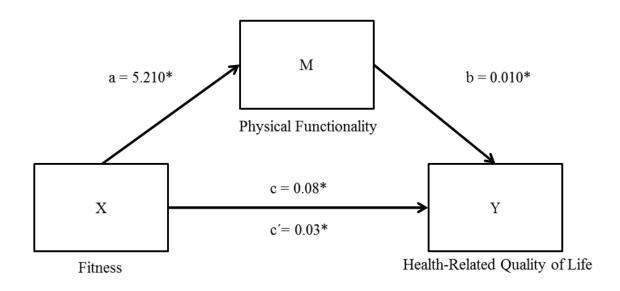
functionality, suggesting thus partial mediation. Figure 1 displays the results and table 2 shows all coefficients for the model.

Table 2. Model Coefficients

Antecedent		Consequent							
		M (Physical Functionality)			Y (HRQoL)				
		Coeff.	SE	р		Coeff.	SE	р	
X (Fitness)	а	5.210	0.316	< .001	C´	0.031	0.009	.001	
M (Physical Functionality)					b	0.010	0.001	< .001	
Constant	İ ₁	19.578	0.218	< .001	i ₂	0.701	0.023	< .001	
		$R^2 = 0.411$				$R^2 = 0.339$			
		F(1.389) = 271.454 p < .001				F(2.388) = 99.578 p < .001			

HRQoL: Health-Related Quality of Life; SE: Standard Error.

Figure 1. Indirect effect of Fitness on Health-Related Quality of Life through Physical Functionality.



Legend: Note: *p < .001 Indirect effect: B=0.051, SE=0.008, 95%IC (0.036-0.067)

DISCUSSION

The mediation concept refers to the indirect influence an independent variable has over a dependent variable, looking to answer how and why this effect is

produced through a mediator variable (Hayes, 2013). In the present study, this kind of analysis allowed us to understand the impact of the independent variable (fitness) over the dependent one (HRQoL), as well as the physical functionality's mediator impact in this association. The indirect effect obtained in this mediation is higher than the direct effect of x –y (β =.051 y 95%IC .036-.067). These results show the physical functionality acting as a partial mediator in the association between fitness and HRQoL, and suggest that the fitness level directly affects the HRQoL, as does it also indirectly through its impact on physical functioning.

Previous studies show that a better fitness level is associated with a better HRQoL (Chung et al., 2017; Gusi et al., 2015; Horder et al., 2013; Jesús Ruiz-Montero, Castillo-Rodríguez, Mikalački, & Delgado-Fernández, 2015; Olivares et al., 2011), and a higher functional independence (Merellano-Navarro et al., 2017; Rikli & Jones, 2013; Sardinha et al., 2015). According to our knowledge, this is the first study analyzing the association of these three variables (fitness, physical functionality, and HRQoL) together, giving a higher understanding of this relation.

Studies mentioned above analyzed the association between fitness and HRQoL using the values obtained in each physical condition tests individually. In this study, fitness variables have been considered as standardized mean value (from the z-scores) of different fitness tests results according to previous studies (Santos et al., 2012). Through an index, as the one proposed, a more representative value of the general physical condition of each person is obtained, allowing thus a more global relation analysis between fitness and HRQoL. Likewise, the HRQoL was evaluated in a general form, and not by dimensions. New studies are needed to analyze the mediation impact of physical functionality on the fitness, as well as the different HRQoL dimensions with instruments giving HRQoL values by dimensions.

This study had some limitations. The cross-sectional design did not allow us to make cause and impact inferences. Additionally, it is plausible that variables in Figure 1 are related in a different causal order, although the sequence presented is logical. Moreover, one of the dimensions of EQ-5D is related to the ability to do usual activities, which coincides with the assessment objective of the CPF. Although we have used the EQ-5D-5L as global score, in which calculation the responses for all dimensions of this instrument are used, this could influence the mediation results.

CONCLUSION

Fitness and HRQoL association is partially mediated by the physical function in older adults. This affirmation suggests that the fitness, regardless its impact on physical functioning, is related to HRQoL.

REFERENCES

- Alves, W. M., Alves, T. G., Ferreira, R. M., Lima, T. A., Pimentel, C. P., Sousa, E. C., . . . Alves, E. A. (2019). Strength training improves the respiratory muscle strength and quality of life of elderly with Parkinson's disease. *The Journal of sports medicine and physical fitness*. doi: 10.23736/s0022-4707.19.09509-4
- Augustovski, F., Rey-Ares, L., Irazola, V., Garay, O. U., Gianneo, O., Fernandez, G., . . . Ramos-Goni, J. M. (2016). An EQ-5D-5L value set based on Uruguayan population preferences. *Quality of life research: an international journal of quality of life aspects of treatment, care and rehabilitation*, 25(2), 323-333. doi: 10.1007/s11136-015-1086-4
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of personality and social psychology, 51*(6), 1173-1182. doi: 10.1037//0022-3514.51.6.1173
- Boonen, S., Autier, P., Barette, M., Vanderschueren, D., Lips, P., & Haentjens, P. (2004). Functional outcome and quality of life following hip fracture in elderly women: a prospective controlled study. *Osteoporosis international*, *15*(2), 87-94. doi: 10.1007/s00198-003-1515-z
- Chung, P. K., Zhao, Y., Liu, J. D., & Quach, B. (2017). A canonical correlation analysis on the relationship between functional fitness and health-related quality of life in older adults. *Archives of gerontology and geriatrics*, 68, 44-48. doi: 10.1016/j.archger.2016.08.007
- Enright, P. L., McBurnie, M. A., Bittner, V., Tracy, R. P., McNamara, R., Arnold, A., & Newman, A. B. (2003). The 6-min walk test: a quick measure of functional status in elderly adults. *Chest*, *123*(2), 387-398. doi: 10.1378/chest.123.2.387
- Gouveia, E. R. Q., Gouveia, B. R., Ihle, A., Kliegel, M., Maia, J. A., SB, I. Badia, & Freitas, D. L. (2017). Correlates of health-related quality of life in young-old and old-old community-dwelling older adults. *Quality of life research:* an international journal of quality of life aspects of treatment, care and rehabilitation, 26(6), 1561-1569. doi: 10.1007/s11136-017-1502-z
- Gusi, N., Hernandez-Mocholi, M. A., & Olivares, P. R. (2015). Changes in HRQoL after 12 months of exercise linked to primary care are associated with fitness effects in older adults. *European journal of public health*, *25*(5), 873-879. doi: 10.1093/eurpub/ckv079
- Gusi, N., Prieto, J., Olivares, P. R., Delgado, S., Quesada, F., & Cebrian, C. (2012). Normative fitness performance scores of community-dwelling older adults in Spain. *Journal of Aging and Physical Activity, 20*(1), 106-126. doi: 10.1123/japa.20.1.106
- Hayes, Andrew F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*: Guilford Publications.
- Herdman, M, Gudex, Claire, Lloyd, A, Janssen, MF, Kind, P, Parkin, D, . . . Badia, Xavier. (2011). Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Quality of life research, 20*(10), 1727-1736. doi: 10.1007/s11136-011-9903-x

- Herrera, P Adela;, & Guzmán, H Andrés; . (2012). Reflexiones sobre calidad de vida, dignidad y envejecimiento. *Revista Médica Clínica Las Condes,* 23(1), 65-76.
- Hörder, H., Skoog, I., & Frandin, K. (2013). Health-related quality of life in relation to walking habits and fitness: a population-based study of 75-year-olds. Quality of life research: an international journal of quality of life aspects of treatment, care and rehabilitation, 22(6), 1213-1223. doi: 10.1007/s11136-012-0267-7
- Ruiz-Montero, P., Castillo-Rodríguez, A., Mikalački, M., & Delgado-Fernández, M. (2015). Physical Fitness Comparison and Quality of Life between Spanish and Serbian Elderly Women through a Physical Fitness Program. *Collegium antropologicum*, 39(2).
- Jones, C. J., Rikli, R. E., Max, J., & Noffal, G. (1998). The reliability and validity of a chair sit-and-reach test as a measure of hamstring flexibility in older adults. Res Q Exerc Sport, 69(4), 338-343. doi: 10.1080/02701367.1998.10607708
- Lohman, TG, Roache, AF, & Martorell, R. (1992). Anthropometric standardization reference manual. *Medicine & Science in Sports & Exercise*, 24(8), 952.
- Martínez de la Iglesiaa, Jorge , Dueñas Herrerob, Rosa, Onís Vilchesa, M Carmen , Aguado Tabernéa, Cristina , Colomerc, Carmen Albert, & Luque Luquec, Rogelio (2001). Adaptación y validación al castellano del cuestionario de Pfeiffer (SPMSQ) para detectar la existencia de deterioro cognitivo en personas mayores e 65 años. *Medicina Clínica, 117*(4), 129-134. doi: 10.1016/S0025-7753(01)72040-4
- Merellano-Navarro, Eugenio, Collado-Mateo, Daniel, García-Rubio, Javier, Gusi, Narcís, & Olivares, Pedro R. (2017). Criterion-Referenced Fitness Standards associated with maintaining functional capacity in Chilean Older Adults. Rejuvenation Research. doi: 10.1089/rej.2016.1913
- Merellano-Navarro, Eugenio, Lapierre, Michelle, García-Rubio, Javier, Gusi, Narcís, Collado-Mateo, Daniel, & Olivares, Pedro R. (2015). Traducción y adaptación cultural del cuestionario de independencia física Composite Physical Function para su uso en Chile. Revista médica de Chile, 143(10), 1314-1319. doi: 10.4067/S0034-98872015001000010.
- Milanović, Zoran, Pantelić, Saša, Trajković, Nebojša, Sporiš, Goran, Kostić, Radmila, & James, Nic. (2013). Age-related decrease in physical activity and functional fitness among elderly men and women. *Clinical interventions in aging*, *8*, 549.
- Ministerio de Desarrollo Social. (2017). Encuesta de Caracterización Socioeconómica (CASEN). Santiago: Ministerio de Desarrollo Social.
- Olivares, P. R., Gusi, N., Prieto, J., & Hernandez-Mocholi, M. A. (2011). Fitness and health-related quality of life dimensions in community-dwelling middle aged and older adults. *Health and quality of life outcomes*, 9, 117. doi: 10.1186/1477-7525-9-117
- Olivares, P. R., Hernandez-Mocholi, M., Merellano-Navarro, E., Gusi, N., & Collado-Mateo, D. (2019). Análisis de la edad sobre la fiabilidad de pruebas fitness en mayores/Analysis of Age on Fitness Reliability in Elderly. *Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte, 19*(76), 627-639. doi: 10.15366/rimcafd2019.76.005

- Paterson, Donald H, Jones, Gareth R, & Rice, Charles L. (2007). Ageing and physical activity: evidence to develop exercise recommendations for older adults. *Applied Physiology, Nutrition, and Metabolism*, 32 (Suppl. 2E), S69-S108. doi: 10.1139/H07-111
- Paterson, Donald H, & Warburton, Darren ER. (2010). Review Physical activity and functional limitations in older adults: a systematic review related to Canada's Physical Activity Guidelines. *International Journal of Behavioral Nutrition and Physical Activity*, 7(38), 1-22. doi: 10.1186/1479-5868-7-38
- Rikli, R., & Jones, C. (1998). The reliability and validity of a 6-minute walk test as a measure of physical endurance in older adults. *Journal of Aging and Physical Activity*, 6(4), 363-375. doi: 10.1123/japa.6.4.363
- Rikli, R., & Jones, C. (1999a). Development and validation of a functional fitness test for community-residing older adults. *Journal of aging and physical activity*, 7, 129-161. doi: 10.1123/japa.7.2.129
- Rikli, R., & Jones, C. (1999b). Functional fitness normative scores for community-residing older adults, ages 60-94. *Journal of Aging and Physical Activity*, 7, 162-181. doi: 10.1123/japa.7.2.162
- Rikli, R., & Jones, C. (2013). Development and validation of criterion-referenced clinically relevant fitness standards for maintaining physical independence in later years. *The Gerontologist*, *53*(2), 255-267. doi: 10.1093/geront/gns071
- Rodríguez, F.A., Gusi, N., Valenzuela, A., Nácher, S., Nogués, J., & Marina, M. (1998). Evaluation of health-related fitness in adults (I): background and protocols of the AFISAL-INEFC battery. *Apunts Educación Física y Deportes*, 52, 54-75.
- Santos, D. A., Silva, A. M., Baptista, F., Santos, R., Vale, S., Mota, J., & Sardinha, L. B. (2012). Sedentary behavior and physical activity are independently related to functional fitness in older adults. *Experimental Gerontoly*, 47(12), 908-912. doi: 10.1016/j.exger.2012.07.011
- Sardinha, Luís B, Santos, Diana A, Marques, Elisa A, & Mota, Jorge. (2015). Criterion-referenced fitness standards for predicting physical independence into later life. *Experimental gerontology*, *61*, 142-146. doi: 10.1016/j.exger.2014.12.012
- Sartor-Glittenberg, C., Lehmann, S., Okada, M., Rosen, D., Brewer, K., & Bay, R. C. (2014). Variables explaining health-related quality of life in community-dwelling older adults. *Journal of geriatric physical therapy* (2001), 37(2), 83-91. doi: 10.1519/JPT.0b013e3182a4791b
- Suriyawongpaisal, P., Chariyalertsak, S., & Wanvarie, S. (2003). Quality of life and functional status of patients with hip fractures in Thailand. *The Southeast Asian journal of tropical medicine and public health, 34*(2), 427-432.
- Urzúa, Alfonso, & Caqueo-Urízar, Alejandra. (2012). Calidad de vida: Una revisión teórica del concepto. *Terapia psicológica, 30*(1), 61-71. doi: 10.4067/S0718-48082012000100006
- Wanderley, F. A., Silva, G., Marques, E., Oliveira, J., Mota, J., & Carvalho, J. (2011). Associations between objectively assessed physical activity levels and fitness and self-reported health-related quality of life in community-dwelling older adults. *Quality of life research: an international journal of*

quality of life aspects of treatment, care and rehabilitation, 20(9), 1371-1378. doi: 10.1007/s11136-011-9875-x

World Health Organization. (2000). *Obesity: preventing and managing the global epidemic*: World Health Organization.

Número de citas totales / Total references: 37 Número de citas propias de la revista /Journal's own references: 1

Rev.int.med.cienc.act.fís.deporte-vol. X - número X - ISSN: 1577-0354