ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 10, Issue, 08, pp. 39240-39246, August, 2020
https://doi.org/10.37118/ijdr.19762.08.2020

RESEARCH ARTICLE OPEN ACCESS

HEALTH-RELATED QUALITY OF LIFE OF OLDER BRAZILIANS FROM A PHYSICAL PROGRAM: A 5-YEAR LONGITUDINAL STUDY

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ARTICLE INFO

Article History:
Received 19th May 2020
Received in revised form
27th June 2020
Accepted 09th July 2020
Published online 30th August 2020

Key Words:
Quality of Life,
Physical Activity,
Aged, Follow-Up.

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ABSTRACT

The health-related quality of life (HRQoL) enables in understanding of older adult's behavior. Regular physical (PA) activity improves the HRQoL. Longitudinal intervention studies are lacking in the world, especially on the relationship between HRQoL and PA in older adults. The objective was to investigate the impact of an intervention program in the HRQoL of active older adults over a five-year period. A multi-component physical program was developed between 2014-2018 with older person from an extension project in Brazil. The sample was 94 individuals, aged 60 to 93 years old (M=70.57, SD=6.99). The instruments used sociodemographic questionnaire and MOS SF-36. For the GEE analysis, the time factor was adopted for the five years, the group factor was organized by age. The analysis showed interaction between Group and Time in some domains. From groups, there was a statistically significant in the physical functioning domain; the younger presented higher scores. The results showed that the HRQoL was maintained over the 5 years, with results indicating improvements, despite the changes associated with the aging process. This longitudinal study provided evidence of the positive impact of a multi-component physical program in HRQoL.

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Citation: ***Valéria Feijó Martins, Andréa Kruger Gonçalves, Eliane Mattana Griebler, Vanessa Dias Possamai et al.*** "Health-related quality of life of older Brazilians from a physical program: a 5-year longitudinal study*", International Journal of Development Research*, 10, (08), 39240-39246

INTRODUCTION

Population aging is a worldwide phenomenon that results from improved health conditions, hygiene, nutrition, as well as schooling and socioeconomic status. In Brazil, more specifically, there is an accelerated process of demographic aging with implications for society (World Health Organization, 2015). Official population statistics of Brazil indicate an increase in the population's average life expectancy: 48 years in 1950, 57.6 years in 1970, 66.9 years in 1990, 73.9 years in 2010. This change in age distribution of the Brazilian population provides opportunities and imposes challenges, but it can generate social and economic problems if there is no planning (Melo, Ferreira, Santos, & Lima, 2017; Miranda, Mendes, & Silva, 2016). According to the last census in Brazil, the number of individuals over 60 years old exceeded 21 million, 11% of the country' total population (Instituto Brasileiro de Geografia e Estatística, 2010).

A country is considered to be aged when at least 7% of the total population is composed of older adults (World Health Organization, 2015). World Health Organization proposed the Active Ageing framework that addresses the role of public health strategies in building and maintaining in older adults based on opportunities for health, participation, and security to enhance quality of life (World Health Organization, 2012). Furthermore, the interaction of biological, psychological, and social factors can affect the potential for good health and physical and mental functionality (Physical Activity Guidelines Advisory Committee, 2018; Piercy *et al*. 2018). Quality of life (QoL) has been understood as people's perceptions of their own life, goals, expectations, standards, and concern within the culture of the place where they live (The Whoqol Group, 1995). Additionally, the concept of health-related quality of life (HRQoL) refers to the state of physical and mental health from the perspective of care

(Awick *et al*., 2015; Olivares, Gusi, Prieto, & Hernandez-Mocholi, 2011), especially to older people (Ferrans, Zerwic, Wilbur, & Larson, 2005; Halaweh, Willen, Grimby-Ekman, & Svantesson, 2015). HRQoL includes the perceptions of general quality of life and health, disease symptoms, biological and functional status, as well as social and emotional perceptions.

The concern about health-related quality of life (HRQoL) has increased worldwide in the last decades (Ciprandi, Bertozzi, Zago, Sforza, & Galvani, 2018; Ku, Fox, Liao, Sun, & Chen, 2016). The framework of HRQoL encompasses QoL, based on aspects of health that are influential at an individual level (physical and mental health perceptions) and an environmental level (conditions and practices) (Zubritsky *et al*., 2013). HRQoL enables a better understanding of older adult's behavior because it involves several aspects of well-being that are influenced by changes throughout life (Bakas *et al*., 2012; Shiu, Choi, Lee, Yu, & Man Ng, 2014). Physical activity is directly associated with health because it poses lower risk of morbidity and mortality for chronic diseases, improves the perception of physical and mental aspects of HRQoL (Vagetti *et al*., 2015), and increases well-being, engagement and social support (Ku, Fox, Liao, Sun, & Chen, 2016). Functional performance is associated with independence (Bae, Suh, Ryu, & Heo, 2017) and HRQoL (Ku, Fox, Liao, Sun, & Chen, 2016; Olivares, Gusi, Prieto, & Hernandez-Mocholi, 2011), showing a positive association between physical activity and domains of functional capacity and mental health of the HRQoL (Olivares, Gusi, Prieto, & Hernandez-Mocholi, 2011). In the case of the older adult, the benefits are more evident because there are more negative consequences of inactivity at more advanced ages (Halaweh, Willen, Grimby-Ekman, & Svantesson, 2015).

Regular physical activity improves the quality of life because it is associated with changing lifestyles, controlling chronic diseases and maintaining functionality longer. Self-efficiency, social relief and physical function are aspects that respond positively to physical activity, contributing to the improvement of the quality of life and health (Choi *et al*., 2013). However, systematic reviews (Gómez-Morales *et al*., 2019; Vagetti *et al*., 2014) no found consensus in the results on the effects of physical exercise intervention on HRQoL, suggesting that interventions that occurred for a maximum of six months are not sufficient to confirm the results of the studies. Cross-sectional studies (Anokye, Trueman, Green, Pavey, & Taylor, 2012; Choi *et al*., 2013; Ku, Fox, Liao, Sun, & Chen, 2016; Olivares, Gusi, Prieto, & Hernandez-Mocholi, 2011) suggest a relationship between QoL and physical activity, but it is unclear whether this relationship exists as a function of physical activity intervention.

Longitudinal intervention studies are lacking in Brazil, especially on the relationship between HRQoL and physical activity in older adults. In view of the rapid aging of this population, further research is needed to take strong risks about strategies that improve quality of life. The perceptions of HRQoL could change over time with an exercise-focused intervention. The objective of this study was to assess the health-related quality of life (HRQoL) of older adults' participants in a 5-year physical activity program. There is still a need to identify strategies that can contribute more effectively to the quality of life of the older adult. Thus, a study that followed older people who practiced physical activity for a long period of time could help to identify the quality of life variables most affected by time.

MATERIALS AND METHODS

Participants and Design: A longitudinal study was realized in a real-life setting about the quality of life of older adults participating in a physical program, with the feature of a 5-year time frame. Studies performed in real world conditions, in addition to controlled and randomized studies, are necessary to identify the intervention effects (Robitaille *et al*., 2012). The study protocol complies with the Declaration of Helsinki and the Brazilian National Health Council Resolution 506/2016 and was approved by the research ethics committee of the local university (CAAE: 32472813.7.0000.5347). The older people (community-dwelling) in the study were participants of a community program developed at a public university in southern Brazil. The program called Center for the Study of Leisure and Physical Activity for the Aged/CELARI, since 1999, promotes regular physical activity, at the university, with a focus on functional independence and encouraging healthy and active aging. Approximately 250 older adults participate in activities two to four times a week during the year. The study was conducted with a voluntary community sample that represents the real intervention conditions. CELARI´s older adults were invited to participate in a given year, as long as the eligibility criteria were respected: 60 years of age or older and enrollment in the physical activity program in year 1 or 2. The exclusion criteria were cognitive impairment or physical limitations, dropout program, engaged in at least seventy assessments (70%) over the five years of study (this reference was considered as effective participation in the physical activity program). During the 5 years of study (2014 - 2018), 423 older adults participated in CELARI. In the initial two years of the study (2014 and 2015), 279 participants met the study's inclusion criteria. In the final year of the survey (2018), the sample consisted of 94 individuals, aged 60 to 93 years old (M = 70.57, SD = 6.99). The reduction from the initial number (n = 279) to the final number (n = 94) was due to different factors, such as physical or cognitive limitations, withdrawal from CELARI or the study, death, participation in less than 70% of the evaluations of the study.

Instruments: A sociodemographic questionnaire was used to describe participants' sex, marital status, education, housing, occupation, and personal income. The Medical Outcomes Study 36-item Short-Form Health Survey (MOS SF-36) (Ware & Sherbourne, 1992) was used to assess the participants' health perceptions. The SF-36 is easy to administer and has been validated in Brazil (Ciconelli, Ferraz, & Santos, 1998). The MOS SF-36 is composed of 36 items grouped into eight subscales: Physical Functioning, Role-Physical, Role-Emotional, Bodily Pain, Vitality, Social Functioning, Mental Health, General Health. Raw scores were obtained from each domain, with scores ranging from 0 to 100; higher scores represent higher perceptions of functional health and well-being. The research team (Physical Education students and a university professor) were trained to use the assessments and to accompany the physical program. The instruments were applied in March (pre-test) and December (pos-test) for each of the 5 years of the study. Each participant read and answered the instrument (MOS SF-36) individually; if the participants had difficulty understanding the instrument or had questions, they were assisted by one of the researchers.

Intervention: The physical program of CELARI adopts the guidelines of the American College of Sports Medicine Guidelines (American College of Sports Medicine, 2013). Different types of physical exercise are proposed and

organized to three objectives: cardiorespiratory fitness (modality: water aerobics ou aquatic jogging), muscular strength (modality: strength training or gymnastic), coordination (modality: balance and dance). Flexibility was practice along all intervention sections. Each modality occurs twice a week and the public can choose up to two on different days, totaling 4 weekly classes. Classes last 45 to 50 minutes organized in three moments: initial, main and final. Each modality is periodized with volume and intensity following its specificities (more details in other study (Gonçalves *et al*., 2019).

Analysis: The sample characterization is presented from demographic data by frequency for sample characterization. The longitudinal data were analyzed using the generalized estimating equations (GEE). For the GEE analysis, the time factor was adopted for the year 1 to year 5 with two evaluations for year (pre and post every year). The group factor was organized by age (GR1: ≤74 years and GR2: ≥75 years) based on life expectancy of the country's population. The effect size was calculated using the difference between the average of the baseline (year 1) and follow-up (year 5), considering the time factor. Cohen's d was adopted as insignificant <.19, small .20-.49, medium .50-.79 and large >.80 (Cohen, 1992). The Bonferroni procedure was used as the follow-up test (α = .05). The software Statistical Package for the Social Sciences (SPSS) 21.0 was used in all the analyses.

RESULTS

The sociodemographic characteristics (table 1) with the highest frequencies were GR1: sex female (89%), marital status married (48%), dwelling with spouse (45%), occupation retired (70%), higher education level (48%), income more than 5 national minimum wages (41%); from GR2: sex female (77%), marital status widower (46%), dwelling with family (52%), occupation retired (58%), high school level (32%), income 2-4 national minimum wages (42%). The GEE analyzes the change in the average behavior over time of the MOS 36-F domains per year of study (Table 2).

Table 1. General characteristics sociodemographic of participants

Variável	-≤74 anos N(%)	≥75 anos N(%)	Total N(%)
Sex			
Woman	64(89)	17(77)	81(86)
Man	8(11)	5(23)	13(14)
Marital Status			
Single	8(11)	2(11)	10(11)
Married	33(48)	6(32)	39(45)
Divorced	13(19)	2(11)	14(17)
Widower	15(22)	9(46)	24(27)
Dwelling			
Spouse	31(45)	5(26)	36(41)
Unattended	18(26)	4(22)	27(31)
Children and/or grandchildren	2(3)	1(5)	22(25)
Other relatives	18(26)	9(47)	3(3)
Occupation			
Retired	48(70)	11(58)	59(67)
To work	7(10)	-	7(8)
Working + retired	3(4)	-	3(3)
Has worked	9(13)	3(16)	12(14)
Never worked	2(3)	5(26)	7(8)
Education			
≤4 years (incomplete elementary)	9(13)	5(26)	14(16)
5-8 years (complete elementary)	11(16)	4(21)	15(17)
9-11 years (high school)	16(23)	6(32)	22(25)
≥12 years (university)	34(48)	4(21)	37(42)
Personal Income*			
Without own income	7(10)	1(5)	8(9)
≤1 minimum wage	7(10)	4(21)	11(12)
2-4 minimum wage	27(39)	8(42)	35(40)
≥5 minimum wage	28(41)	6(32)	34(39)

Note. *minimum wage converted to dollar US$ 311.00.

When analyzing the means between the domains, by group, six domains indicated the same behavior in both groups. In four domains there was a reduction in the mean between baseline (pretest year 1) and follow-up (pos test year 5): Vitality, Social Functioning, Mental Health, General Health; in two domains, GR1 increased and GR2 decreased (Role-Physical, Role-Emotional). In the other domains, one improved (Physical Functioning) in both groups and the other worsened in GR1 and enhanced in GR2 (Bodily Pain). The GR1 showed a reduction in the average in five domains and GR2 in six. In general, the changes were related to time and not to the group. The GEE pointed out that there was a difference between the groups in the Physical Functioning domain (p=.001). Regarding time, there was a difference in all domains Physical Functioning (p=.000), Role-Emotional (p=.010), Bodily Pain (p=.000), Vitality (p=.000), Social Functioning (p=.000), Mental Health (p=.000), General Health (p=.000), with the exception of a Role-Physical (p=.258). Interaction occurred between group and time for the domains Physical Functioning (p=.005), Social Functioning (p=.041) and General Health (p=.050). The comparison of time and group factors for MOS SF-36 domains with Bonferroni test (table 3) shows differences between the pre and posttest of each year for the domains with interaction in the analysis GEE. In the time factor there was a significant difference in the domains Social Functioning (year 2 p=.000) and General Health (year 1 p=.001, year 2 p=.000, and year 3 p=.000). There were differences between groups for assessment (pre and post) by year: Physical Functioning domain for year 1 in GR1 (p=.014); Social Functioning for year 2 for the GR1 (p=.000) and GR2 (p=.048); General Health in year 1 for GR1 (p=.000) and GR2 (p=.000), in year 2 GR1 (p=.000) and GR2 (p=.010), in year 3 GR1 (p=.000) and GR2 (p=.000). In the comparison between pre and post-tests by group, there was a difference only in the latter: Physical Functioning in year 1 (p=.025) and year 3 (p=.000), Social Functioning in year 3 (p=.046). Considering the behavior of the 8 domains over the 5 years of study, years 2 and 3 were in the years that showed difference in the domains, after behavior stabilization, without positive or negative changes. The following data refer to an analysis directed to the MOS SF-36 domains the difference between at the follow-up and baseline (Table 4), and effect size in the five years. There was a significant improvement over time (p=.000) with a medium effect size (*d*=.51) for the Physical Functioning domain.

DISCUSSION

We implemented a study to investigate the impact of an intervention program on the perceptions of HRQoL of active older adults over a five-year period. First, it is crucial to highlight that the interactions between individuals and the context can shape one's perception. Consequently, the factors relative to older individuals' engagement in physical activity need to be clearly understood (Mudrak, Stochl, Slepicka, & Elavsky, 2016). Developing countries, like Brazil, have few activities for the older people. Our sample was characterized by a higher number of women, similarly, to results found in a cohort study and population-based previous research (Lima e Costa, Guerra, Firmo, & Uchôa, 2002; Neri *et al*., 2013). Physical activity programs for older adults usually have more females, most of them with basic formal education, similarly to our results (Caporicci & Neto, 2011; Cipriani, Meurer, Benedetti, & Lopes, 2010).

Table 2. Mean and standard deviation of the MOS SF-36 domains by groups (GR1: ≤74 years; GR2: ≥75 years) at the pre and post test across the five years

MOS SF-36		Mean (SD) by Groups				*p* GEE		
Domains	Year	GR1 pre	GR1 post	GR2 pre	GR2 post	Group	Time	G*T
Physical	1	71.8(2.2)	76.9(2.2)	70.2(2.0)	64.3(5.2)	.047*	.000*	.005*
Functioning	2	71.5(2.6)	75.0(2.2)	65.6(5.2)	69.1(4.1)			
	3	74.3(2.1)	77.0(1.9)	66.0(4.4)	57.2(3.9)			
	4	70.2(2.5)	71.1(2.4)	65.2(5.4)	65.9(5.2)			
	5	85.0(2.3)	82.6(1.9)	77.2(3.9)	78.1(4.0)			
Role	1	73.6(3.5)	74.1(3.8)	88.7(3.6)	69.3(7.6)	.990	.258	.211
Physical	2	75.0(4.3)	71.6(4.0)	71.0(8.2)	63.9(7.7)			
	3	72.7(3.2)	75.7(3.2)	75.0(7.7)	78.7(5.9)			
	4	78.0(3.7)	69.7(4.4)	72.3(8.3)	76.1(7.7)			
	5	73.8(4.3)	83.3(8.2)	82.8(4.4)	70.6(7.2)			
Role	1	75.7(3.3)	78.2(3.6)	87.1(2.5)	77.7(7.4)	.804	.010*	.199
Emotional	2	84.0(3.3)	77.7(3.6)	86.0(4.3)	77.6(6.4)			
	3	70.5(4.3)	73.9(3.4)	74.5(8.2)	73.0(5.7)			
	4	75.7(3.8)	76.2(4.1)	78.9(7.4)	80.9(5.8)			
	5	78.1(3.7)	84.1(3.3)	81.1(4.7)	68.7(8.1)			
Bodily	1	66.0(2.4)	67.3(2.0)	64.7(3.2)	61.8(3.9)	.694	.000*	.156
Pain	2	65.1(2.5)	64.1(2.4)	65.0(5.2)	63.8(5.0)			
	3	69.3(2.4)	54.8(1.7)	64.3(4.4)	49.2(3.4)			
	4	65.5(2.4)	63.8(2.6)	66.9(5.0)	64.9(4.5)			
	5	66.5(2.1)	61.9(2.2)	62.2(2.9)	68.2(4.3)			
Vitality	1	69.7(1.6)	71.7(1.9)	69.7(2.0)	69.9(3.9)	.800	.000*	.645
	2	67.1(1.8)	79.7(1.6)	64.5(4.8)	81,2(3.2)			
	3	70.6(1.7)	42.0(1.2)	68.3(4.4)	44.2(1.7)			
	4	64.3(1.1)	63.6(1.2)	64.2(2.5)	58.3(2.9)			
	5	65.4(2.1)	65.7(1.8)	67.1(3.0)	66.1(4.0)			
Social	1	81.1(2.2)	79.2(2.1)	85.9(2.6)	72.0(4.4)	.716	.000*	.041*
Functioning	2	85.2(2.1)	74.7(1.5)	80.6(4.1)	71.7(3.6)			
	3	85.1(2.4)	84.1(1.8)	80.3(5.6)	75.8(3.7)			
	4	83.1(2.4)	83.2(2.3)	82.9(4.0)	85.7(3.6)			
	5	78.2(3.0)	80.7(2.3)	83.8(3.9)	85.4(3.8)			
Mental	1	79.8(1.4)	76.0(1.9)	80.0(1.6)	72.7(3.6)	.474	.000*	.075
Health	2	77.3(1.8)	63.0(1.8)	76.0(4.2)	63.2(3.0)			
	3	79.9(1.5)	63.0(1.0)	76.0(4.3)	56.0(2.2)			
	4	80.3(1.5)	79.1(1.7)	80.6(3.9)	73.9(3.8)			
	5	74.9(2.0)	76.7(1.6)	76.5(3.9)	76.0(3.3)			
General	1	61.8(1.4)	73.0(2.2)	64.8(2.0)	70.2(3.8)	.766	.000*	.050*
Health	2	64.1(1.6)	80.9(2.3)	63.1(3.5)	81.9(4.6)			
	3	61.7(1.9)	47.2(1.0)	65.6(3.0)	42.2(2.5)			
	4	62.2(1.6)	60.8(1.9)	65.2(3.3)	65.5(3.0)			
	5	62.6(1.9)	59.6(1.8)	65.0(3.2)	58.1(3.4)			

Note. *: p≤.005.

Table 3. Comparison of time and group factors for MOS SF-36 domains (year by year)

MOS SF-36 Domains	Factors	Bonferroni comparisons				
		Year 1	Year 2	Year 3	Year 4	Year 5
		Pre-Post	Pre-Post	Pre-Post	Pre-Post	Pre-Post
Physical Functioning	Time	1.000	1.000	1.000	1.000	1.000
	GR1	.014*	1.000	1.000	1.000	1.000
	GR2	1.000	1.000	1.000	1.000	1.000
	GR1xGR2 Pre	.600	.318	.092	.404	.096
	GR1xGR2 Post	.025*	.205	.000*	.369	.312
Social Functioning	Time	.088	.000*	1.000	1.000	1.000
	GR1	1.000	.000*	1.000	1.000	1.000
	GR2	.134	.048*	1.000	1.000	1.000
	GR1xGR2 Pre	.230	.322	.436	.962	.266
	GR1xGR2 Post	.146	.456	.046*	.563	.303
General Health	Time	.001*	.000*	.000*	1.000	.894
	GR1	.000*	.000*	.000*	1.000	1.000
	GR2	1.000	.010*	.000*	1.000	1.000
	GR1xGR2 Pre	.244	.808	.281	.427	.546
	GR1XGR2 Post	.530	.851	.069	.196	.697

Note. *: p≤.005.

Table 4. Statistics results for the GEE and effect size

MOS 36-SF Domains	M(SD) & Statistics results				
	Baseline (2014)*	Follow-up (2018)*	*p*	Δ**	Effect size***
Physical Functioning	71.0(1.5)	80.4(2.2)	.000¨	9.4	.51
Social Functioning	83.8(1.7)	83.1(2.2)	1.000	- 0.7	.04
General Health	63.3(1.2)	58.8(1.9)	1.000	- 4.5	.29

Note. M(SD): mean and standard deviation; *GEE factor analysis; Δ**: difference between year 1 and year 5; ¨: p≤.001; ***Cohen's d effect size (insignificant <.19; small .20-.49; medium .50-.79; large >.80).

This longitudinal intervention study was particularly conducted to investigate the perceptions of HRQoL in older adults. Longitudinal designs are lacking in the international literature (Anokye, Trueman, Green, Pavey, & Taylor, 2012; Cipriani, Meurer, Benedetti, & Lopes, 2010), and they are even scarcer in developing countries, such as Brazil. The longitudinal design enables us to show the behavioral trends and improvement in the perception of HRQoL (Vagetti *et al*., 2015). In general, our results indicated that healthy older adults have maintained their perceptions of HRQoL over the years. Support of health status is dependent on adequate opportunities to engage in physical activity (Olivares, Gusi, Prieto, & Hernandez-Mocholi, 2011), and as a result of rapid aging in Brazil, research on the older population is necessary. The present contribution of our study indicates how feasible it is to age while having good quality of life. Research on the impact of the physical activity program is necessary to develop public health policies and to provide better care for this population. Moreover, this population needs to receive guidelines to integrate the practice of physical activity into their daily lives (McMahon *et al*., 2017).

Previous studies that identified the HRQoL scores, with older active adults reported higher social and emotional perceptions in a cross-sectional study in Brazil (Oliveira, Souza, Rodrigues, Fett, & Piva, 2019; Sonati *et al*., 2014) and in a longitudinal study in Spain (Zubala *et al*., 2017). There was a similar trend in our finding; the higher scores were related to emotion and social functioning, followed very closely by mental health scores. Furthermore, contrary to the study of (Oliveira, Souza, Rodrigues, Fett, & Piva, 2019), we also found high scores for the Physical Functioning domain, and those scores improved over time. Developed countries, such as Italy (Ciprandi, Bertozzi, Zago, Sforza, & Galvani, 2018) and the United States (Bae, Suh, Ryu, & Heo, 2017), which have a large number of older adults, reported no influence of physical activity in individual perceptions of HRQoL, contrary to our findings. Although our results were restricted to improvement in one dimension of the HRQoL, we acknowledge that perceptions of the Physical Functioning domain are capable of improving older adults' satisfaction with life and integration into society (Oliveira, Souza, Rodrigues, Fett, & Piva, 2019). The results show that independence can be preserved over time, even in those with more advanced ages. Although the participants in both age groups have improved their perceptions, more noticeable improvements were found for the younger group. The changes in perception were not linear across the five years in the present study. Perceptions of health vary throughout the participants' life span (Anokye, Trueman, Green, Pavey, & Taylor, 2012), and physical activity supports the maintenance of health perceptions for older adults (Olivares, Gusi, Prieto, & Hernandez-Mocholi, 2011). Our results showed maintenance of several domains, although non-linear, and improvements of scores throughout the years for the Physical Functioning domain. This domain improved across the first and last year of the study, i.e., it was a substantial effect for a group of healthy individuals who were aging.

It should be noted that the Physical Functioning domain is related to independence in carrying out activities of daily living and the sample of this study is characterized as a physically active group. The improvement in physical fitness - strength muscle, endurance, flexibility, body balance - is one of the results of regular physical activity that is directly related to functionality (Gonçalves *et al*., 2019; Physical Activity Guidelines Advisory Committee, 2018; Robitaille *et al*., 2012). Previous longitudinal studies support the present findings regarding the effects of physical activity on perceptions of HRQoL across different countries. This association has also been found in systematic reviews (Gómez-Morales *et al*., 2019; Vagetti *et al*., 2014; Zubala *et al*., 2017). As an example, a 3-year cohort-study with older adults in the community who did not exercise found a reduction in HRQoL perceptions over time. Maintenance of HRQoL was associated with physical activity over the years, but past physical activity does not protect against future decline (Vasiliadis & Bélanger, 2018) .Another study, conducted with British older women over a seven-year period, found similar results. Inactive participants had lower levels and a significant decline in the perceptions of HRQoL, where as active participants showed higher scores (Choi *et al*., 2013). Longitudinal study conducted for six years in Spain also showed that physical activity reduces the age-related decline in perceptions of QoL (Balboa-Castillo, León-Muñoz, Graciani, Rodríguez-Artalejo, & Guallar-Castillón, 2011). One of the few longitudinal studies on this topic, although older, was carried out with Australian women for three years and showed that physical activity increased the scores in the emotional and mental health domains (Lee & Russell, 2003).

The role of psychological variables on the relationship between physical activity and HRQoL has also been investigated (Anokye, Trueman, Green, Pavey, & Taylor, 2012; McAuley & Morris, 2007; White, Wójcicki & McAuley, 2009); over time, the influence of physical activity on HRQoL seems to be mainly mediated by changes in positive health and subjective well-being (Ciprandi, Bertozzi, Zago, Sforza, & Galvani, 2018), self-esteem (Anokye, Trueman, Green, Pavey, & Taylor, 2012; McAuley & Morris, 2007; White, Wójcicki & McAuley, 2009), self-efficacy, and affection (McAuley & Morris, 2007; White,Wójcicki & McAuley, 2009). The interaction between subjective well-being, self-esteem, satisfaction, social support in the mediation with physical activity and HRQoL need further investigation and maybe an exciting approach for future studies. Other factors could also be influential in HRQoL, and should also be incorporated into research on physical activity in older adults, such as physical and mental health, living conditions and income (Ku, Fox, Chang, Sun, & Chen, 2014). Our study has some limitations. First, it is a voluntary sample, which limits our possibility to generalize results. Second, the sample is composed of active older adults, lacking, therefore, the heterogeneity of the aged population in terms of health conditions, physical activity and physical fitness. Third, the longitudinal design of real-life settings makes it difficult to use a control group.

Conclusion

The HRQoL has been maintained over the years in general, and the Physical Functioning domain has improved in this sample of physically active older adults. The Physical Functioning domain proved to be the most responsive domain for physical activity since it indicated an improvement in the study period. This domain is related to functional independence. Perceptions about health and social aspects have also shown positive changes over the years. In addition to contributing to current knowledge, the results of the two study groups showed that it is possible to maintain or improve the quality of life even at the most advanced ages. The

longitudinal design allows the advancement of knowledge of physical activity and HRQoL, making it possible to analyze the effect of time on the perceptions of active older adults. The present study provided evidence of an intervention impact across a five-years period; few studies so far have undertaken the challenge of following up older adults in such a long time window. Collecting data over time is complicated and costly.
Another relevant aspect is that the results show that HRQoL, even in older people, was maintained and improved, despite the changes associated with the aging process. In developing countries, such as Brazil, there is still a lack of adequate public health policies, as well as practical disease prevention initiatives. Therefore, it is vital to promote opportunities to improve health and quality of life in older adults and implement long-term intervention at university settings.

Acknowledgments

The authors are grateful for the funding the master's and doctorate scholarships by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

REFERENCES

American College of Sports Medicine. 2013. *ACSM's guidelines for exercise testing and prescription*. Lippincott Williams & Wilkins. http://antoinedl.com/fichiers/public/ACSM-guidelines-2014.pdf

Anokye, N. K., Trueman, P., Green, C., Pavey, T. G. & Taylor, R. S. 2012. Physical activity and health related quality of life. *BMC Public Health*, *12*624, 1-8. doi:10.1186/1471-2458-12-624

Awick, E. A., Wójcicki, T. R., Olson, E. A., Fanning, J., Chung, H. D., Zuniga, K., ... & McAuley, E. 2015. Differential exercise effects on quality of life and health-related quality of life in older adults: a randomized controlled trial. *Quality of Life Research, 24*2, 455-462. doi:10.1007/s11136-014-0762-0

Bae, W., Suh, Y., Ryu, J., &Heo, J. 2017. Physical activity levels and well-being in older adults. *Psychological Reports, 120*2, 192-205. doi:10.1177/0033294116688892

Bakas, T., McLennon, S. M., Carpenter, J. S., Buelow, J. M., Otte, J. L., Hanna, K. M., ... & Welch, J. L. 2012. Systematic review of health-related quality of life models. *Health and Quality of Life Outcomes, 10*134, 1-12. doi:10.1186/1477-7525-10-134

Balboa-Castillo, T., León-Muñoz, L., Graciani, A., Rodríguez-Artalejo, F. &Guallar-Castillón, P. 2011. Longitudinal association of physical activity and sedentary behavior during leisure time with health-related quality of life in community-dwelling older adults. *Health and Quality of Life Outcomes, 9*47, 2-10. doi:10.1186/1477-7525-9-47

Caporicci, S. &Neto, M. F. O. 2011. Estudocomparativo de idososativos e inativosatravés da avaliação das atividades da vidadiária e medição da qualidade de vida. *Motricidade, 7*2, 15-24. http://www.scielo.mec.pt/pdf/mot/v7n2/v7n2a03.pdf

Choi, M., Prieto-Merino, D., Dale, C., Nüesch, E., Amuzu, A., Bowling, A., ... & Casas, J. P. 2013. Effect of changes in moderate or vigorous physical activity on changes in health-related quality of life of elderly British women over seven years. *Quality of Life Research, 22*8, 2011-2020. doi:10.1007/s11136-012-0332-2

Ciprandi, D., Bertozzi, F., Zago, M., Sforza, C., & Galvani, C. 2018. Associations between objectively measured physical activity levels and physical fitness and health-related quality of life in elderly women. *Sport Sciences for Health, 14*1, 183-191. doi:10.1007/s11332-018-0428-3

Cipriani, N. C. S., Meurer, S. T., Benedetti, T. R. B. & Lopes, M. A. 2010. Functional fitness of older women performing physical activities. *Revista Brasileira Cineantropometria & Desempenho Humano, 12*2, 106-111. doi:10.1590/1980-0037.2010v12n2p106

Cohen, J. 1992. A power primer. *Psychological Bulletin*, *112*1, 155-159. doi:10.1037/0033-2909.112.1.155

Ferrans, C. E., Zerwic, J. J., Wilbur, J. E., & Larson, J. L. 2005. Conceptual model of health□related quality of life. *Journal of Nursing Scholarship, 37*4, 336-342. doi:10.1111/j.1547-5069.2005.00058.x

Gómez-Morales, A., Miranda, J. M. A., Pergola-Marconato, A. M., Mansano-Schlosser, T. C., Mendes, F. R. P. & Torres, G. V. 2019. Influencia de las actividades en la calidad de vida de los ancianos: revision sistemática. *Ciência & Saúde Coletiva*, *24*1, 189-202. doi:10.1590/1413-81232018241.05452017.

Gonçalves, A. K., Teixeira, A. R., Valentini, N. C., Vargas, A. S. R., Possamai, V. D. & Martins, V. F. 2019. Multicomponent physical activity program: study with faller and non-faller older adults. *Journal of Physical Education*, *30*, e3077. doi:10.4025/jphyseduc.v30i1.3077

Halaweh, H., Willen, C., Grimby-Ekman, A., &Svantesson, U. 2015. Physical activity and health-related quality of life among community dwelling elderly. *Journal of Clinical Medicine Research, 7*11, 845. doi:10.14740/jocmr2307w

Instituto Brasileiro de Geografia e Estatística. 2010. *Sinopse do CensoDemográfico 2010.* https://censo2010.ibge.gov.br/resultados.html

Instituto Brasileiro de Geografia e Estatística. 2018. *Tábuascompletas de mortalidade*. https://www.ibge.gov.br/estatisticas/sociais/populacao/9126-tabuas-completas-de-mortalidade.html

Ku, P. W., Fox, K. R., Chang, C. Y., Sun, W. J. & Chen, L. J. 2014. Cross-sectional and longitudinal associations of categories of physical activities with dimensions of subjective well-being in Taiwanese older adults. *Social Indicators Research*, *117*3, 705-718. doi:10.1007/s11205-013-0394-8

Ku, P. W., Fox, K. R., Liao, Y., Sun, W. J., & Chen, L. J. 2016. Prospective associations of objectively assessed physical activity at different intensities with subjective well-being in older adults. *Quality of Life Research, 25*11, 2909-2919. doi:10.1007/s11136-016-1309-3

Lee, C. & Russell, A. 2003. Effects of physical activity on emotional well-being among older Australian women: cross-sectional and longitudinal analyses. *Journal of Psychosomatic Research, 54*2, 155-160. doi:10.1016/S0022-39990200414-2

Lima e Costa, M. F. F. D., Guerra, H. L., Firmo, J. O. &Uchôa, E. 2002. Projeto Bambuí: um estudoepidemiológico de características sociodemográficas, suporte social e indicadores de condição de saúde dos idosos em comparação aos adultosjovens. *Informe Epidemiológico do SUS*, *10*4, 147-161. doi:10.5123/S0104-16732001000400002

McAuley, E. & Morris, K. S. 2007. Advances in Physical Activity and Mental Health: Quality of Life. *American*

Journal of Lifestyle Medicine, *15*, 389-396. doi:10.1177/1559827607303243

McMahon, S. K., Lewis, B., Oakes, J., Wyman, J. F., Guan, W. & Rothman, A. J. 2017. Assessing the effects of interpersonal and intrapersonal behavior change strategies on physical activity in older adults: a factorial experiment. *Annals of Behavioral Medicine,51*3, 376–390. doi:10.1007/s12160-016-9863-z

Melo, L. A. D., Ferreira, L. M. D. B. M., Santos, M. M. D., & Lima, K. C. D. 2017. Socioeconomic, regional and demographic factors related to population ageing. *Revista Brasileira de Geriatria e Gerontologia, 20*4, 493-501. doi:10.1590/1981-22562017020.170004

Miranda, G. M. D., Mendes, A. D. C. G., & Silva, A. L. A. D. 2016. Population aging in Brazil: current and future social challenges and consequences. *Revista Brasileira de Geriatria e Gerontologia*, *19*3, 507-519. doi:10.1590/1809-98232016019.150140

Mudrak, J., Stochl, J., Slepicka, P. &Elavsky, S. 2016. Physical activity, self-efficacy, and quality of life in older Czech adults. *European Journal of Ageing, 13*1, 5-14. doi:10.1007/s10433-015-0352-1

Neri, A. L., Yassuda, M. S., Araújo, L. F. D., Eulálio, M. D. C., Cabral, B. E., Siqueira, M. E. C. D., ... & Moura, J. G. D. A. 2013. Metodologia e perfil sociodemográfico, cognitivo e de fragilidade de idososcomunitários de sete cidades brasileiras: Estudo FIBRA. *Cadernos de Saúde Pública, 29*4, 778-792. https://www.scielosp.org/pdf/csp/2013.v29n4/778-792/pt

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, 1-9. doi:10.1186/1477-7525-9-117

Oliveira, L. S. S. C. B., Souza, E. C., Rodrigues, R. A. S., Fett, C. A. &Piva, A. B. 2019. The effects of physical activity on anxiety, depression, and quality of life in elderly people living in the community. *Trends Psychiatry Psychother, 41*1, 36-42. doi:10.1590/2237-6089-2017-0129

Physical Activity Guidelines Advisory Committee. 2018. *Physical Activity Guidelines Advisory Committee Scientific Report*. Washington, DC: U.S. Department of Health and Human Services. https://health.gov/sites/default/files/2019_09/PAG_Advisory_Committee_Report.pdf

Piercy, K. L., Troiano, R. P., Ballard, R. M., Carlson, S. A., Fulton, J. E., Galuska, D. A., ... & Olson, R. D. 2018. The physical activity guidelines for Americans. *JAMA, 320*19, 2020-2028. doi:10.1001/jama.2018.14854

Ribeiro, J. A. B., Cavalli, A. S., Cavalli, M. O., Pogorzelski, L. V., Prestes, M. R., Ricardo, L. I. C. 2012. Adesão de idosos a programas de atividade física: motivação e significância. *Revista Brasileira de Ciências do Esporte*, *34*4, 969-984. doi:10.1590/S0101-32892012000400012

Robitaille, Y., Fournier, M., Laforest, S., Gauvin, L., Filiatrault, J. & Corriveau, H. 2012. Effect of a fall prevention program on balance maintenance using a quasi-experimental design in real-world settings. *Journal of Aging and Health*, *24*5, 827–845. doi:10.1177/0898264312436713

Shiu, A. T. Y., Choi, K. C., Lee, D. T. F., Yu, D. S. F., & Man Ng, W. 2014. Application of a health□related quality of life conceptual model in community□dwelling older Chinese people with diabetes to understand the relationships among clinical and psychological outcomes. *Journal of Diabetes Investigation, 5*6, 677-686. doi:10.1111/jdi.12198

Sonati, J. G., Vilarta, R., Maciel, É. D. S., Modeneze, D. M., Vilela Junior, G. D. B., Lazari, V. O., &Muciacito, B. 2014. Análisecomparativa da qualidade de vida de adultos e idososenvolvidos com a prática regular de atividadefísica. *Revista Brasileira de Geriatria e Gerontologia, 17*4, 731-739. doi:10.1590/1809-9823.2014.13122.

The WHOQOL Group. 1995. The World Health Organization quality of life assessment WHOQOL: position paper from the World Health Organization. *Social Science & Medicine, 41*10, 1403-1409. doi:10.1016/0277-95369500112-k

Vagetti, G. C., Barbosa Filho, V. C., Moreira, N. B., de Oliveira, V., Mazzardo, O., & de Campos, W. 2015. The association between physical activity and quality of life domains among older women. *Journal of Aging and Physical Activity, 23*4, 524-533. doi:10.1123/japa.2013-0070

Vagetti, G. C., Barbosa Filho, V. C., Moreira, N. B., Oliveira, V. D., Mazzardo, O., & Campos, W. D. 2014. Association between physical activity and quality of life in the elderly: a systematic review, 2000-2012. *Brazilian Journal of Psychiatry, 36*1, 76-88. doi:10.1590/1516-4446-2012-0895

Vasiliadis, H. & Bélanger, M. 2018. The prospective and concurrent effect of exercise on health related quality of life in older adults over a 3 year period. *Health and Quality of Life Outcomes, 16*15. doi:10.1186/s12955-018-0843-9

Ware, J. E. J. &Sherbourne, C. D. 1992. MOS 36-item short-form health survey SF-36. I. Conceptual framework and item selection. *Medical Care*, *30*6, 473-83. http://www.jstor.org/stable/3765916

White, S. M., Wójcicki, T. R. & McAuley, E. 2009. Physical activity and quality of life community dwelling older adults. *Health Quality Life Outcomes*, *7*10. doi:10.1186/1477-7525-7-10.

World Health Organization. 2002. *Active ageing:* A policy framework No. WHO/NMH/NPH/02.8. Geneva: World Health Organization. https://apps.who.int/iris/handle/10665/67215

World Health Organization. 2015. *World report on ageing and health*. World Health Organization. https://www.who.int/ageing/publications/world-report-2015/en/

Zubala, A., MacGillivray, S., Frost, H., Kroll, T., Skelton, D. A., Gavine, A., ... & Morris, J. 2017. Promotion of physical activity interventions for community dwelling older adults: a systematic review of reviews. *PloS One, 12*7. e0180902. doi:10.1371/journal.pone.0180902

Zubritsky, C., Abbott, K. M., Hirschman, K. B., Bowles, K. H., Foust, J. B., & Naylor, M. D. 2013. Health-related quality of life: Expanding a conceptual framework to include older adults who receive long-term services and supports. *The Gerontologist, 53*2, 205-210. doi:10.1093/geront/gns093

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