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Association between physical activity and quality of life in adults

ABSTRACT

OBJECTIVE: To summarize and analyze evidences of the association between physical activity and quality of life.

METHODS: Systematic literature review in three electronic databases — PubMed, Lilacs and SciELO— using the following descriptors: "physical activity," "motor activity," "exercise," "walking," "running," "physical fitness," "sport," "life style," "quality of life," "WHOQOL" and "SF." There were selected 38 studies published between 1980 and 2010 that used any instrument to measure physical activity and any version of the Medical Outcomes Study 36-Item Short-Form Health Survey or the World Health Organization Quality of Life to assess quality of life.

RESULTS: Most studies reviewed were cross-sectional (68%), 18% experimental, 8% prospective follow-up cohort and 5% mixed-design (cross-sectional and longitudinal). The most widely used questionnaire to assess quality of life was SF-36 (71%), and physical activity was self-reported in 82% of the studies reviewed. Higher level of physical activity was associated with better perception of quality of life in the elderly, apparently healthy adults and individuals with different clinical conditions.

CONCLUSIONS: There is a positive association between physical activity and quality of life that varies according to the domain analyzed.

DESCRIPTORS: Motor activity. Exercise. Quality of Life. Review.

INTRODUCTION

Quality of life (QoL) is a multidimensional subjective construct[41] that is hardly defined and systematized and thus of complex operationalization. QoL is conceptually defined as an individual's perception of his/her stand in life within a sociocultural context with regards to their goals, expectations, standards and concerns.[52] It is related to personal well-being and includes several aspects such as health, leisure, personal satisfaction, habits, and lifestyle.[30]

The operationalization of QoL involves its measurement. Several instruments have been proposed to assess QoL in different populations,[41] but most of them have been developed in high-income countries and adapted to other contexts.[4,9,18] The instruments for overall assessment of QoL include the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36)[50] and the World Health Organization Quality of Life-100 (WHOQOL-100),[18] both available in abridged versions for use in specific population groups and/or domains. These instruments have enabled an increasing number of studies on the association between QoL and health behaviors such as diet, smoking and physical activity (PA).[4,37]

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Regular PA increases QoL at different ages.[4,19,26,31,39,51] Studies have investigated the association between PA and overall QoL, and the effects of PA on specific domains of QoL,[4,37] and it has often been reported an association with the "physical" and "mental" domains.[19,39,41,42,46,51]

Evidence supports a positive association between PA and QoL, but the state of the art is not well established. The magnitude of this association is conflicting in different populations[4,37] and inconsistent results have been found when instruments for measuring PA and QoL, as well as designs, were compared.[4] A recent review study[4] assessed the association between PA and perception of QoL in apparently healthy adults and, despite reporting a positive association, the authors stressed the importance of further exploring this same association in other age groups, health conditions and using more specific instruments to measure PA and QoL.[4]

The current study aimed to summarize and analyze evidence of the association between PA and perception of QoL in adults.

METHODS

A systematic review was carried out in the electronic databases PubMed, Lilacs, and SciELO following the procedures described in the literature.[23] There were selected studies that met the following inclusion criteria: report of the association or effect of PA on QoL; use of an instrument for measuring PA; use of any version of the SF or WHOQOL for assessing QoL; year of publication from 1980; adults (≥18 years); empirical cross-sectional or longitudinal, randomized controlled, cohort or case-control studies; and studies published in English or Portuguese. Studies that did not report any instrument for the measurement of PA and/or failed to assess QoL using either SF or WHOQOL, review studies, opinion articles, letters to the editor, books or book chapters, and dissertations and theses were excluded.

The review was limited to QoL assessment instruments that are recommended by health organizations and have psychometric properties that have been widely studied in the literature. While this choice may limit the number of studies included, the analyses or evidence obtained are not affected.

The following English terms were searched in PubMed: "physical activity," "motor activity," "exercise," "walking," "running," "physical fitness," "sport," and "lifestyle." The following QoL terms were also searched: "quality of life," "WHOQOL," and "SF." The same descriptors in Portuguese were searched in the SciELO and Lilacs databases. Terms were combined using Boolean operators "AND" and "OR." The search was conducted between March and August 2010.

The Figure shows a flowchart of the search, selection, and related reasons for excluding references. Three researchers familiar with the methodology selected and evaluated the references.

There were identified general aspects of publication, methodological description, measurement instruments of PA and QoL, and main results. The researchers screened the studies separately and then compared their findings in a consensus meeting. Items that showed agreement between at least two researchers were considered adequate and were included in the description of results.

The results of experimental and cohort studies were analyzed for the percentage of agreement of evidence (Table 1). The agreement of the results was estimated by dividing the number of studies pointing towards an association by the number of studies reviewed and then the results were categorized. This procedure is used in reviews on PA and provides the level of agreement of the findings.[40]

RESULTS

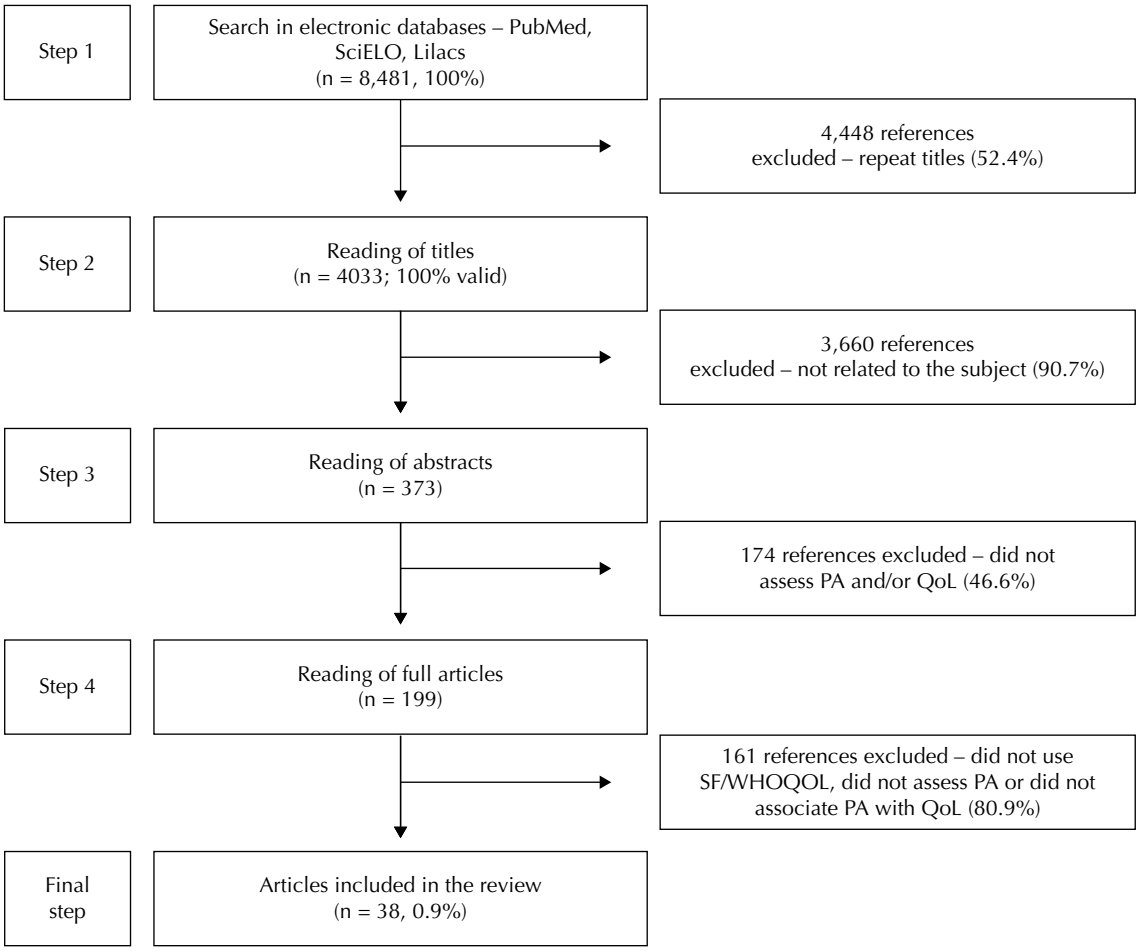
Thirty-eight studies met the inclusion criteria (Table 2). They were published from 1998 and 92% were published from 2003 on. Most studies were conducted in North America (42%), Europe (21%), and Asia (18%).

Most (71%) investigated both female and male individuals, but 29% were limited to one gender, predominantly female (26%). Several different population groups were studied: 32% in the elderly and 24% in apparently healthy adults. The clinical conditions studied included heart disease (11%); overweight/obesity (5%); breast cancer (5%); hypertension (5%); diabetes, lung cancer, fibromyalgia, colon cancer, hepatitis C, liver transplantation and multiple sclerosis (3%).

The majority were cross-sectional studies (68%), seven were experimental (18%), three prospective cohort (8%) and two (5%) had a mixed design (cross-sectional and longitudinal).

The level of PA was self-reported in 82% of studies and general questions were asked in 21%. The International Physical Activity Questionnaire (11%) and Godin Leisure-Time Exercise were the most commonly used questionnaires (11%), a direct measure of PA was used in 16% (accelerometer and/or pedometer) and both measures of PA were used in 3%. About half of the studies reviewed (53%) investigated overall PA, 21% the leisure-time domain, 24% associated leisure-time PA with another domain, and the domain evaluated could not be identified in 3%.

The most widely used questionnaire to assess QoL was SF-36 (71%), followed by the SF-12 (13%), WHOQOL-BREF (11%), SF-8 (3%) and WHOQOL-OLD (3%).



PA: physical activity; SF: Medical Outcomes Study 36-Item Short-Form Health Survey; WHOQOL: World Health Organization Quality of Life.

Figure. Search, selection and exclusion of studies on the association between physical activity and quality of life.

Higher level of PA was associated with better perception of QoL in the elderly, apparently healthy adults and individuals with different health conditions (Table 3). Two studies found an inverse association between PA and any domain of QoL.[8,27] Most studies examined the association between PA and overall QoL score. But as the instruments used were different, different domains of QoL were included.

The results of experimental and cohort studies were summarized (Table 4). There was no agreement of findings on the association between PA and QoL in the "social functioning," "bodily pain," and "social relations" domains.

DISCUSSION

The current review showed that most studies were published from 2003, indicating a recent interest in this area. There were few studies conducted in low- and middle-income countries such as Latin American countries. Since PA and perception of QoL are influenced by cultural, social and physical factors, this scarcity of studies prevents the generalization of results and comparisons of different contexts.[20] This is true for Latin America as social inequalities are a major factor associated with people's health.[11] The level of development of a country also seems to be related to PA patterns of their populations.[16]

Leisure-time was the most widely investigated domain of PA. It is the most commonly explored domain in the literature and it has consistently reported that it favors health promotion.[21] Self-reported measures were most widely used. Specific questionnaires were developed for some studies but their psychometric properties were not reported.[7,17,28,36]

The SF-36 was the most commonly used QoL questionnaire, which corroborates previous reports in the literature.[14] This can be attributed to longer experience using SF-36 since its was developed in the early 1990s[50] while the WHOQOL was developed in the late 1990s.[18] To increase the reliability of results, it was opted for

Table 1. Classification of evidence according to the association between physical activity and quality of life.

Studies supporting this association (%)	Code	Direction of association
0 – 33	0	Lack of association
34 – 59	?	Inconclusive
≥ 60	+	Positive
	–	Negative

establishing the use of SF and/or WHOQOL for the assessment of QoL as an inclusion criterion. In their literature review, Bize et al[4] stressed the need for more accurately measuring PA and QoL.

Most cross-sectional studies showed a positive association between PA and QoL (Table 3). However, this study design does not allow to establishing a time association between cause (PA) and effect (QoL) and thus a causal relationship. Other variables can also affect this association: in addition to the levels of PA, self-efficacy can also influence health perception, fitness and vitality of individuals.[4,51]

The results of experimental and cohort studies (Table 4) show agreement of findings of a positive association between PA and SF domains including "physical functioning," "vitality," "mental health," "role-physical," "role-emotional," "general health" and "physical and mental components." This result may due to a greater number of studies using SF. Despite evidence showing an association between PA and QoL using WHOQOL, the results were inconclusive due to the small number of studies.

The domains "physical functioning," "vitality," and "mental health" showed higher agreement among the studies reviewed. These findings are corroborated in other studies showing greater association of these domains with PA regardless of the study design, population studied, age, gender or type of intervention.[4,37,38,47] Despite the small number of studies, the results indicate a need to further explore the benefits of PA in the "social functioning," "social relations," and "bodily pain" domains of QoL, as well as to investigate physiological mechanisms and social and cultural factors involved.

Two studies had a mixed (longitudinal and cross-sectional) design[28,51] with inconsistent results. In Wendel-Vos study,[51] cross-sectional associations were not confirmed by longitudinal analyses. The cross-sectional analysis showed an association between leisure-time PA and the physical component of QoL, but the prospective analysis showed associations predominantly with the mental component. These inconsistencies may arise from methodological differences as the results may show a false association between PA and QoL because a causal relationship cannot be established

Table 2. Studies included in the systematic review on physical activity and quality of life, by study design.

Author	Year	Country	Design	Gender	n	Age (years)	Health condition	PA measure	QoL measure
Culos-Reed & Brawley[13]	2000	Canada	CS	M, F	86	49,2 (SD=11.2)	Fibromyalgia	SR (NI)	SF-12
Koltyn[26]	2001	US	CS	F	200	>60	Elderly	SR (Yale Physical Activity)	WHOQOL-BREF
Painter et al[16]	2001	US	CS	M,F	180	55 (SD=11.6)	Liver transplant	SR (NI)	SF-36
Stewart et al[46]	2003	US	CS	M, F	82	55–75	Hypertension	SR (Stanford 7-day Physical Activity Recall)	SF-36
Mummery et al[33]	2004	Australia	CS	M, F	337	55–89	Elderly	SR (Active Australia Questionnaire)	SF-12
Cassidy et al[7]	2004	Australia	CS	F	278	>70	Elderly	SR (NI)	SF-36
Okano et al[34]	2004	Japan	CS	M,F	97	22–77	Hypertension	OB (accelerometer)	SF-36
Olson et al[35]	2005	US	CS	M,F	140	≥18	Hepatitis C	SR (NI)	SF-36
Morimoto et al[31]	2006	Japan	CS	M,F	5107	>20	Healthy	SR (NI)	SF-36
Chyun et al[8]	2006	US	CS	M, F	106	50–75	Diabetes	SR (Framingham Physical Activity Índex)	SF-36
Acree et al[1]	2006	US	CS	M, F	112	60–89	Elderly	SR (Johnson Space Center Physical Activity Scale)	SF-36
Ko[25]	2006	China	CS	M, F	876	34.8 (SD=7.9)	Healthy	SR (Godin-Shepard Activity Questionnaire)	SF-36
Yasunaga et al[54]	2006	Japan	CS	M, F	181	65–85	Elderly	OB (accelerometer)	SF-36

To be continued

Table 2 continuation

Author	Year	Country	Design	Gender	n	Age (years)	Health condition	PA measure	QoL measure
Shibata et al[42]	2007	Japan	CS	M, F	1211	20–59	Healthy	SR (International Physical Activity Questionnaire, IPAQ)	SF-8
Blacklock et al[5]	2007	England	CS	M, F	351	>30	Healthy	SR (Godin Leisure-Time Exercise Questionnaire)	SF-36
Van den Berg et al[49]	2008	Netherlands	CS	M,F	1141	18–63	Healthy	SR (Stanford Wellness Inventory)	SF-12
Motl et al[32]	2008	US	CS	M, F	292	48 (SD=10.3)	Multiple sclerosis	SR and OB (Godin Leisure-Time Exercise Questionnaire and accelerometer)	SF-12
Winter et al[53]	2008	Germany	CS	M, F	47	21–69	Heart dysfunction	SR (Short Questionnaire to Assess Health-Enhancing Physical Activity)	SF-36
Lobo et al[29]	2008	Portugal	CS	M, F	185	>65	Elderly	OB (accelerometer)	SF-36
Ekwall et al[17]	2009	Sweden	CS	M, F	4360	>70	Elderly	SR (NI)	SF-12
Coups et al[12]	2009	US	CS	M, F	175	39–89	Lung cancer	SR (Godin Leisure-Time Exercise Questionnaire)	SF-36
Toscano & Oliveira[47]	2009	Brazil	CS	F	238	>60	Elderly women	SR (International Physical Activity Questionnaire, IPAQ)	SF-36
Johnson et al[24]	2009	US	CS	M,F	843	≥65	Coloretal cancer	SR (CHAMPS Physical Activity Questionnaire for Older Adults)	SF-36
Silva et al[43]	2010	Brazil	CS	M,F	863	NR	Healthy	SR (Questionnaire of Habitual Physical Activity)	WHOQOL-BREF
Aoyagi et al[3]	2010	Japan	CS	M,F	109	65–85	Elderly	OB (pedometer and accelerometer)	SF-36
Alencar et al[2]	2010	Brazil	CS	F	30	≥60	Elderly women	SR (Modified Baecke Questionnaire for the Elderly)	WHOQOL-OLD
Lee et al & Russell[28]	2003	Australia	MI	F	10063	70–78	Elderly	SR (NI)	SF-36
Wendel-Vos et al[51]	2004	Netherlands	MI	M, F	2129	20–59	Healthy	SR (NI)	SF-36
Rippe et al[39]	1998	US	RE	F	44	20–49	Overweight	SR (Ross and Jackson scale)	SF-36
Smith et al[45]	2004	Canada	RE	M, F	198	>55	Cardiac rehabilitation	SR (Physical Activity Scale for the Elderly)	SF-36
Collins et al[10]	2004	US	RE	M	27	64 (SD=10)	Heart disease	SR (Three-day Physical Activity Recall)	SF-36
Lawton et al[27]	2009	NZ	RE	F	1089	40–74	Healthy	SR (International Physical Activity Questionnaire, IPAQ)	SF-36
Izawa et al[22]	2004	Japan	E	M, F	109	63.5 (SD=10.1)	Myocardial infarction	OB (pedometer)	SF-36
Fox et al[19]	2007	England	E	M, F	176	>70	Elderly	OB (accelerometer)	WHOQOL-BREF
Bond et al[6]	2008	US	PE	M, F	199	18–65	Obese	SR (International Physical Activity Questionnaire, IPAQ)	SF-36
Valenti et al[48]	2008	Italy	C	F	212	42–65	Breast cancer	SR (Godin Leisure-Time Exercise Questionnaire)	WHOQOL- BREF
Dugan et al[15]	2009	US	C	F	2400	45.9 (SD=2.7)	Healthy	SR (Kaiser Physical Activity Survey)	SF-36
Smith et al[44]	2009	US	C	F	1183	>45	Breast cancer	SR (Modifiable Activity Questionnaire	SF-36

U.S.: United States; NZ: New Zealand; CS: cross-sectional and experimental; RE: randomized experimental; PE: pre-experimental; QE: quasi-experimental, C: cohort, MI: mixed (longitudinal and cross-sectional), M: male, F: Female, SR: self-reported, OB: objective, NI: not identified

Table 3. Association between physical activity and perceived quality of life in the studies reviewed.

Authors[ref]	PA exposure/intervention	Direction of association	Main results
Culos-Reed et al[13]	Two groups exposed to PA: ≤2 times/ week vs. ≥3 times/week	↑	Individuals who engaged in PA ≥3 times/week had higher QoL scores in the physical component (32.3 [SD=7.3] vs. 27.9 [SD=5.4], p<0.005).
Koltyn[26]	Independent elderly women who engaged in PA (32 SD=16 h/week) vs. elderly women living in nursing homes who engaged in PA (6 SD=7 hours/week).	↑	Significant association of overall QoL scores with energy expenditure (r=0.45, p<0.05) and vigorous PA (r=0.58, p<0.05). Significant association of the score of the physical domain with total PA (r=0.47, p<0.01), energy expenditure (r=0.46, p<0.01) and vigorous PA (r=0.54, p<0.01).
Painter et al[36]	Active individuals were those who reported PA ≥3 times/week, ≥30 min at a moderate, vigorous or very vigorous intensity level.	↑	Active individuals had higher scores in the domains physical functioning (p<0.001), role-physical (p=0.041), bodily pain (p=0.002), general health (p<0.001), vitality (p=0.001) and physical component (p<0.001).
Stewart et al[46]	Exposure to moderate, vigorous and very vigorous PA calculated as METs and expressed in energy expenditure (kcal/kg/day).	↑	The higher the level of PA the higher QoL score in the bodily pain domain (r=0.28, p=0.01).
Mummery et al[33]	Three groups were compared regarding leisure-time and commuting PA: inactive (≤150 min/week), moderately active (151–420 min/ week, and active (≥421 min/week).	↑	Moderately active and active groups had significantly higher QoL scores in the physical and mental components when compared to the inactive group.
Cassidy et al[7]	Exposure to PA defined as: inactive (<3 h/week), and active (≥3 h/week).	↑	The active group showed a higher overall QoL score (78.7 [SD=13.7] vs. 66.5 [SD=19.7], p<0.001)
Okano et al[34]	PA was measured using an accelerometer (steps and counts/min). Individuals used an accelerometer and pedometer for one day.	↑	Positive relationship between PA and the physical functioning (r=0.265, p<0.02) and role-emotional domains (r=0.269, p=0.01).
Olson et al[35]	Individuals were divided into two groups: leisure-time PA ≥1 day/week; PA <1 day/week.	↑	The individuals in the leisure-time PA group ≥1 time/week showed higher QoL scores in the physical and mental components (p<0.01).
Morimoto et al[31]	Exposure to PA was defined based on: - energy expenditure: no PA (0 kcal/ week), moderate PA (1–1000 kcal/ week), and high PA (≥1001 kcal/ week). - intensity level of PA: no PA, mild (3 METs); moderate (6 METs), and vigorous (9 METs).	↑	Individuals with high energy expenditure (>1000 kcal/week) had higher QoL scores in all domains (p<0.001). Women who engaged in vigorous PA had higher QoL scores in almost all domais (p<0.05) except social functionting and mental health.
Chyun et al[8]	Individuals were evaluated according to the average time they were exposed to regular PA (h/week).	↑	Individuals who engaged in PA ≥3 hours/week had higher QoL scores in the physical functioning and vitality domains.
Acree et al[1]	The level of PA was stratified into two groups: low level when individuals did not engage in PA or engage in mild or moderate PA <1 h/week; high level when moderate PA >1 h/week or vigorous PA ≥30 min/week.	↑	The group with high PA had higher QoL scores in the physical functioning (82 [SD=20] vs. 68 [SD=21], p=0.029), role-physical (83 [SD=34] vs. 61 [SD=36], p=0.022), bodily pain (83 [SD=22] vs. 66 [SD=23], p=0.001), vitality (74 [SD=15] vs. 59 [SD=16], p=0.001) and social functioning (92 [SD=18] vs. 83 [SD=19], p=0.040) after adjustment for gender and hypertension.
Ko[25]	The individuals were divided into three groups according to exposure to PA: no PA, occasional PA and regular PA.	↑	The higher the frequency of PA the higher QoL scores. Specifically, higher scores in the role-physical (p=0.007) and role-emotional domains (p=0.013) among men and higher overall QoL scores (p<0.001) and in the physical functioning (p<0.001), vitality (p<0.001), mental health (p=0.03) and bodily pain domains (p=0.007) among women.

To be continued

Table 3 continuation

Authors[ref]	PA exposure/intervention	Direction of association	Main results
Yasunaga et al[54]	The level of PA was stratified into quartiles (1 = least active, 4 = most active) according to the intensity level of PA ≥3 METs.	↑	The higher the level of PA the higher overall QoL scores for both men (p<0.01) and women (p<0.001). More active women had higher QoL scores in the physical functioning (p<0.001), social functioning (p=0.004) and bodily pain (p=0.002) domains. Most active men had higher scores in the role-emotional (p=0.006), vitality (p<0.08) and physical functioning domains (p=0.020).
Shibata et al[42]	Three groups were exposed to PA: inactive, insufficiently active, active. The active group followed PA recommendations for the Japanese population (>23 METs/h/week).	↑	Active individuals had significantly higher QoL scores in the physical functioning and vitality domains (p<0.001) when compared with inactive and insufficiently active ones. Inactive individuals had significantly lower QoL scores in the physical functioning and vitality domains when compared to insufficiently active ones (p<0.05). The associations were significant when adjusted for age, marital status, education and socioeconomic condition (p<0.05).
Blacklock et al[5]	Exposure to frequency and duration of walking and total PA during leisure time stratified into mild, moderate or vigorous.	↑	Significant association of overall QoL scores and frequency (r=0.13, p<0.05), time (r=0.17, p<0.01), minutes of walking (r=0.14, p<0.005), frequency of moderate (r=0.18, p<0.01) and vigorous PA (r=0.26, p<0.01), total time of moderate (r=0, 21, p<0.01) and vigorous PA (r=0.28, p<0.01) and total leisure-time PA (r=0.25, p<0.001).
Van den Berg et al[49]	PA was assessed based on two outcomes: individuals who meet the recommendations of moderate PA (5 days/week ≥30 min/day) and individuals who meet the recommendations of vigorous PA (3 days/week ≥20min/dia).	↑↔	Individuals who met the recommendations of vigorous PA had higher QoL scores in the mental and physical components. There was no association between QoL and meeting the recommendations of moderate PA after adjusting for age, gender, work-related psychosocial factors, lifestyle, body mass index and oxygen consumption.
Motl et al[32]	Two measures of PA were used: counts/minute (accelerometer) and self-report questionnaire.	↑	Significant association between PA and the physical and mental components of QoL regardless of assessment method of PA. When using the direct method the association of PA had a greater magnitude. Direct measurement: physical component r=0.38; mental component r=0.09. Indirect measure: physical r=0.28, mental component r=0.07.
Winter et al[53]	Frequency, intensity and amount of PA in min/week for individuals with heart dysfunction (less active) vs. apparently healthy individuals (more active).	↑	Individuals with cardiac dysfunction (less active) had similar QoL scores to that seen in apparently healthy individuals (most active) in the mental component. However, in the physical components and bodily pain domain the scores were significantly lower (p<0.001 and 0.05, respectively).
Lobo et al[29]	PA was measured in counts/min and stratified into tertiles: first (less active), second (moderately active) and third tertile (very active).	↑	Significant association between moderate PA and the role-physical and bodily pain domains (p=0.01). Moderately active men had higher physical functioning (p=0.01), vitality (p=0.05) and mental health scores (p=0.05) compared to inactive ones. For total PA (counts/hour), the same was found, except for the role-physical domain among women.
Ekwall et al[17]	PA was defined by intensity (mild or vigorous) and frequency (never, rarely, sometimes, often).	↑	Mild (OR=1.62, p=0.003) and vigorous exercise (OR=1.20 p<0.001) were associated with the physical component of QoL. The same was seen in the mental component: mild (OR=1.58, p=0.003) and vigorous exercise (OR=1.48, p=0.001).
Coups et al[12]	PA was evaluated pre- and post-diagnosis of lung cancer and at current time (follow-up). Individuals were classified as: inactive (no PA), lowly active active (≥150 min/week of moderate PA or ≥60 min/week of vigorous PA).	↑	In the physical functioning domain inactive and lowly active individuals had lower QoL scores compared to active ones (41.1, 44.6 and 49.6, respectively, p<0.001). In the vitality domain the inactive group had significantly lower scores than the lowly active (48.1 vs. 52.2, p<0.042) and active group (48.1 vs. 54.3, p<0.004). In the role-physical domain, inactive had lower scores than active ones (44.1 vs. 51.0, p<0.006) and lowly active had lower scores than active ones (43.9 vs. 51.0, p<0.001). The analyses were adjusted for gender, age, race, education and marital status.

To be continued

Table 3 continuation

Authors[ref]	PA exposure/intervention	Direction of association	Main results
Toscano et al[47]	Exposure to PA defined as more active (≥150 min/week of PA) and less active (<150 min/week) individuals.	↑	More active elderly women had higher QoL scores in the physical functioning, role-physical, general health, bodily pain, social functioning, role-emotional and mental health domains (p<0.001).
Johnson[24]	There were evaluated duration and frequency of PA during leisure time, commuting and at home and then converted to METS/week: mild PA (<3 METs) and moderate/vigorous PA (≥3 METs). The groups were divided into quartiles (1st quartile = less active; 4th quartile = more active).	↑	More active individuals (4th quartile) had higher QOL scores in the physical functioning domain compared with less active ones (1st quartile) (66.0 vs. 42.7) when adjusted for age, gender, education, alcohol consumption, body mass index, pain, recent hospitalization, recent falls, comorbidities and other levels of intensity of PA.
Silva et al[43]	Individuals were classified as inactive, moderately active, active, and very active.	↑	Active individuals had significantly higher scores in the physical, psychological and environment domains (p<0.001).
Aoyagi et al[3]	Individuals were grouped into four categories according to the time spent for PA at an intensity >3 METs (<–20%, –20 to 0%, 0% to <20% and ≥20%).	↑	Individuals who spent ≥20% of total PA time in ≥3 MET activities had higher scores in the physical functioning (p<0.001), bodily pain (p=0.020), vitality (p=0.007) and mental health domains (p=0.228) when adjusted for age, gender and steps/day.
Alencar et al[2]	Two groups were evaluated: inactive elderly women, and elderly women who engaged in walking 30 min/day for at least 3 times/week.	↑	Active elderly women had higher scores in the past, present and future activities and social involvement domais.
Lee et al[28]	There were assessed frequency and intensity of PA in min/week and classified based weekly frequency and minutes of PA in the last week as: no PA/very low PA, low PA, moderate PA, and high PA.	↑	The higher the level of PA the higher the score in the role-emotional, social functioning, vitality and mental health domains. Women who discontinued PA had negative changes in the emotional domain when compared to those who were inactive. Those who had an active behavior had higher scores in all domains of QoL. Those who maintain their PA had higher scores in the vitality, social and "environment domains.
Wendel-Vos et al[51]	Leisure-time PA was categorized into quintiles: 1st quintile (0–3 h/week), 2nd quintile (3–5 h/week), 3rd quintile (5–7.5 h/week), 4th quintile (7.5–11.5 h/week) and 5th quintile (≥11.5 h/week).	↑	The most active group (5th quintile) had higher overall QoL scores compared to the least active group (1st quintile) in both men (p=0.003) and women (p<0.001). The same was seen in the physical functioning and vitality domains among men (p<0.05). In the "social functioning domain, the most active women (5th quintile) had higher scores than the least active ones (1st quintile) (p=0.04).
Rippe et al[39]	Twelve-week program of self-selected PA in overweight women. Intervention group: increase the level of PA in a progressive manner (≥1500 kcal/week) Control group: no intervention.	↑	There was improvement in mean QoL scores in the intervention group in the physical functioning (intervention group: increased 13.5 [SD=16.7] vs. control group: reduced 1.4 [SD=9.5], p=0.0005), vitality (intervention group: increased 21.7 [SD=7.9] vs. control group: rduced 2.9 [SD=20.8], p=0.001) and mental health domains (intervention group: increased 10.4 [SD= 16.0] vs. control group: reduced 2.3 [SD=10.1], p=0.003).
Smith et al[45]	Two cardiac rehabilitation programs were conducted for 6 months: one group at home and the other in the hospital. After the program, individuals were instructed to continue aerobic exercises for at least 5 times/week (40–75 min). Individuals were assessed pre-, post-intervention and 12 months after the completion of the rehabilitation program.	↑	The home group had higher QoL scores in the physical and mental components pre- and post-internvetion and post-12 months compared with the hospital group (p=0.047 and p=0.049, respectively). For both groups the score of the physical component was reduced between post-intervention and post-12 months (p=0.003), but remained higher than pre-intervention (p=0.002). After 12 months the score of the mental component was reduced in both groups, but not significantly.

To be continued

Table 3 continuation

Authors[ref]	PA exposure/intervention	Direction of association	Main results
Collins et al[10]	Twelve-week aerobic PA program in patients with heart disease. Intervention group: 45–50 min, intensity of 50–70% of VO_2 max; control group: no intervention.	↑	The intervention group showed an 14% increase in the score in the physical functioning domain. There was a significant increase of 10.4 [SD=18.5] in the QoL score in the intervention group and a decrease of 4.7 [SD=12.4] in the control group (p<0.001).
Lawton et al[27]	Individuals were divided into control and intervention groups. Both were assessed at the baseline, at 12 months and 24 months. The intervention group received a guide with guidelines on PA.	↑↓	The scores in the physical functioning (p=0.03) and mental health domains (p<0.05) increased between 12 and 24 months in the intervention group, but it decreased in the role-physical domain (p<0.01). The intervention group improved QoL scores in more domains than the control group.
Izawa et al[22]	After a cardiac rehabilitation program, two groups were followed for 6 months. One maintained PA (mean 9,252 steps/day, 1,909 kcal/day) and the other one did not maintain it (mean 4,246 steps/day, 1,672 kcal/day).	↑	The group that maintained PA had higher overall QoL scores (p<0.001) in the physical functioning, role-physical, role-emotional, vitality, mental health, bodily pain and general health domains (p<0.001).
Fox et al[19]	Twelve-month PA program that involved strength, flexibility and aerobic exercises. Frequency of 3 times/week and 60–90 min of duration. Two times/week PA was in a group and the third session was at home. PA was measured in min/day and joules/day.	↑	The higher the energy expenditure and moderate PA per day the higher the overall QoL score (p<0.05) and in the physical (p<0.05), environment (p<0.01) and psychologica domains (p<0.01).
Bond et al[6]	Individuals were divided into three groups according to pre- and post-operative PA: inactive/active (<200 min/week and ≥200 min/week), active/active (≥200 min/week and ≥200 min/week) and inactive/inactive (<200 min/week and <200 min/week).	↑	Inactive/active and active/active groups reported improved mental component (F=5.7, p=0.004), general health (F=4.9, p=0.009), vitality (F=5.5, p=0.005) and mental health (F=4.9, p=0.008) than the inactive/inactive group, after adjusting for differences in QoL in the preoperative to postoperative period, body mass index, age, gender and ethnicity.
Valenti et al[48]	Leisure-time PA (min/week) during and after treatment of breast cancer was evaluated and stratified into three levels: low, moderate, and high.	↑	More active women had higher scores in the physical (r=0.41 during treatment and r=0.44 post-treatment), psychological (r=0.32 during treatment and r=0, 33 post-treatment), social relations (r=0.44 during treatment and r=0.45 post-treatment) and environment (r=0.45 during treatment and r=0.51 post treatment).
Dugan et al[15]	The frequency of PA was assessed using a 2-10 scale (2 = never/rarely PA and 10 = very active).	↑	Three models of analysis were used to explore the relationship between PA and the role-physical domain. The model 1 was adjusted for age and plance (OR=1.15, 95% CI 1.09 to 1.19); in the model 2 the variables ethnicity, education and menopause were included (OR=1.14, 95% CI 1.08 to 1.19) and in the model 3 body mass index, smoking, depression and chronic diseases were included (OR=1.07, 95% CI 1.02 to 1.13). The analyses were also conducted for bodily pain: model 1 (OR=1.20, 95% CI 1.14 to 1.27), model 2 (OR=1.20, 95% CI 1.13 to 1.26) and model 3 (OR=1.10, 95% CI 1.04 to 1.17).
Smith et al[44]	Three groups were exposed to different levels of PA: inactive (0 h/week), lowly active (<2.5 h/week) and active (≥2.5 hours/without)	↑	The group of active women had higher scores in the social functioning, vitality, role-emotional and mental health domains (p<0.01).

↑: positive association; ↓: negative association; ↔: neutral association PA: physical activity; MET: metabolic equivalent task

Table 4. Summary of evidence on the association between physical activity and quality of life in experimental and cohort studies.

Domains	Association				
	Yes		No	Agreement of results	
	Positive	Negative		% of studies	Association
Medical Outcomes Study 36-Item Short-Form Health Survey					
Physical functioning	6, 10, 22, 27, 39, 44			100	+
Social functioning	44		6, 22, 27, 39	20	0
Bodily pain	15, 22		6, 27, 39	40	
Vitality	6, 22, 39, 44		27	80	+
Mental health	6, 22, 27, 39		44	80	+
Role-physical	6, 15, 22, 27	27	39	67	+
Role-emotional	6, 22, 44		27, 39	60	+
General health	6, 22, 44		27, 39	60	+
Physical component	6, 45		10	67	+
Mental component	6, 45		10	67	+
World Health Organization Quality of Life BREF					
Overall quality of life	19			100	+
Physical	19, 48			100	+
Psychological	19, 48			100	+
Social relations	48		19	50	?
Environment	19, 48			100	+

0: lack of association, ?: inconclusive association, + positive association

in a cross-sectional analysis. In Lee et al[28] study, the cross-sectional analyses showed that higher levels of PA were associated with better QoL in all domains of the mental component. After a three-year follow-up, the longitudinal analysis found that women who initiated or maintained PA had higher QoL scores. However, active women at baseline who discontinued PA had lower QoL scores. These results point to a transient effect of PA on QoL. Despite different results seen among the study designs, PA is associated with improved mental health in elderly women.[28]

It was not feasible to assess the quality of the studies reviewed using a common instrument for the studies had different designs and information on the methods used (e.g., cutoffs for PA; sample size; selection criteria; control for confounders, etc.) was not available. The application of a single instrument could produce inaccurate scores, which would lead to miscategorization of studies to the detriment of the quality of the findings. The review followed strict inclusion criteria and there were selected studies with any measure of level of PA and perception of QoL using SF or WHOQOL. This approach increase the strength of evidence of the associations found.

In conclusion, there is a positive association between PA and perception of QoL, which varies according to the domains of QoL assessed. Further studies should be encouraged to investigate the association between PA and the different domains of QoL, particularly in low- and middle-income countries in Latin America. Methodological issues such as design and quality of measurement of PA should be optimized.

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