

# Association between different types of physical activities and quality of life in women aged 60 years or over

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## SUMMARY

**Objective:** To evaluate the association between different types of physical activity and quality of life in a sample of women aged 60 or over. **Subjects and Methods:** A cross-sectional study was carried out, interviewing 271 women. Of these, 141 were recruited in a menopause outpatient clinic and 130 were recruited in a social leisure center, in Brazil. The instruments used were the International Physical Activity Questionnaire (IPAQ) version 8 and the World Health Organization Quality of Life Questionnaire specific for this age group (WHOQOL-OLD). Each IPAQ section was evaluated by multiple linear regression analysis, considering independent and confounding variables. The significance level was set at 5% and the software used was SAS version 9.1.3. **Results:** The mean age of the patients was  $67.4 \pm 5.3$  years. The mean time devoted to physical activity was  $2802.7 \pm 1154.9$  minutes per week. The total WHOQOL-OLD score was  $66.9 \pm 11.7$ . The past, present and future activities (estimated  $\beta = 0.021$ ) and, social participation (estimated  $\beta = 0.03$ ) domains had association with IPAQ transportation section. The leisure-time domain of the IPAQ had an inverse and significant relationship with the quality of life score related to present, past and future activities (estimated  $\beta = -0.0269$ ). **Conclusion:** Quality of life was negatively influenced by leisure, but time spent in this physical activity was the shortest in comparison to other types of physical activities. In this sample, only physical activity for transportation was positively associated with a better quality of life.

**Keywords:** Aging; quality of life; transportation; leisure activities.

## RESUMO

### Associação entre diferentes tipos de atividades físicas e qualidade de vida em mulheres com 60 ou mais anos de idade

**Objetivo:** Avaliar a associação entre diferentes tipos de atividade física e a qualidade de vida em mulheres brasileiras com 60 anos ou mais. **Sujeitos e Métodos:** Estudo de corte transversal, realizado através de entrevista com 271 mulheres. Destas, 141 foram recrutadas em um ambulatório de menopausa e 130 em um centro de convivência no Brasil. Os instrumentos utilizados foram o International Physical Activity Questionnaire (IPAQ) versão 8 e o "Questionário de Qualidade de Vida da Organização Mundial da Saúde" específico para este grupo (WHOQOL-OLD). Cada seção do IPAQ foi avaliada por meio de regressão linear múltipla considerando variáveis independentes e que podem gerar confusão. O nível de significância foi de 5% e o software utilizado foi o SAS versão 9.1.3. **Resultados:** A média etária foi de  $67,4 \pm 5,3$  anos. O tempo médio de atividade física foi de  $2802,7 \pm 1154,9$  minutos na semana. O escore total do WHOQOL-OLD foi de  $66,9 \pm 11,7$ . Os domínios das atividades presentes, passadas e futuras ( $\beta$  estimado = 0,021) e, participação social ( $\beta$  estimado = 0,03) apresentaram associação significativa e direta com a seção de transporte do IPAQ. Os domínios das atividades presentes, passadas e futuras apresentaram relação significativa e inversa com a seção lazer do IPAQ ( $\beta$  estimado = -0,0269). **Conclusão:** A qualidade de vida foi influenciada negativamente pelo lazer, mas o tempo gasto com esta atividade física foi o menor comparado com o das outras atividades físicas. Nesta amostra somente a atividade física no transporte associou-se positivamente à melhor qualidade de vida.

**Unitermos:** Envelhecimento; qualidade de vida; transportes; atividades de lazer.

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## INTRODUCTION

Aging is characterized by a number of physical, physiological, biochemical and molecular changes<sup>1</sup>. However, the rhythm of these changes varies among individuals and is influenced by environmental and genetic factors. Life style factors, such as physical activity, diet, and smoking are associated with human aging. The positive effects of physical activity on physiological ability and decreased risks of certain diseases in the general population and specifically in the elderly have been well-documented<sup>2-5</sup>. There is an improvement in aerobic capacity, coordination and flexibility<sup>2</sup>, decreasing the risk of chronic comorbidities. In addition, the progression of disability is postponed, decreasing the risk of cardiovascular disease and overall mortality<sup>3-5</sup>.

Physical activity is defined as energy expenditure through body movements produced by the skeletal muscles<sup>6</sup>. It includes activities in diverse contexts such as leisure-time, means of transportation, household tasks and paid employment<sup>7</sup>.

For the evaluation of physical activity, the International Physical Activity Questionnaire-Version 8; long form (IPAQ-Version 8.0) is one of the most widely used instruments<sup>8</sup>. In a validation study of physical activity in Latin America, a high reliability and moderate validity of IPAQ criteria were observed in relation to the accelerometer evaluation. Nevertheless, it was observed that the leisure-time and transport sections of the IPAQ are recommended for studies aimed at documenting physical activity levels in Latin America<sup>9</sup>.

In addition to promoting physical benefits, physical activity seems to have an important role in quality of life, encompassing domains such as functional capacity; emotional role; social interaction; intellectual activity; self-care; family support; health status; cultural, ethical and religious values; lifestyle; satisfaction with work and/or activities of daily living and home environment. It is related to self-esteem and well-being of an individual<sup>7,10</sup>.

In a recent population-based study carried out with adults in Croatia, a positive association was observed between leisure-time physical activity and a better quality of life. In contrast, an inversely proportional relationship was observed between physical activity for transportation and quality of life<sup>11</sup>. In the population aged sixty years or over, physical activity has been shown to improve quality of life<sup>10</sup>. However, which types of physical activity have a positive impact on quality of life remain largely unknown. This knowledge may permit health professionals to give better advice to this population. The aim of the present study was to evaluate the association between IPAQ sections and quality of life in a population of Brazilian women aged 60 years or over.

## METHODS

A cross-sectional study of 271 women aged 60 years or over was carried out. Women were recruited from: 1) a social and leisure center, performing any of the different types of activity (sewing, dancing, reading, painting, gymnastics and others) offered by the center; 2) an outpatient clinic at the Professor José Aristodemo Pinotti Women's Hospital of the *Universidade Estadual de Campinas* (UNICAMP). Both study groups were located in Campinas, São Paulo state (Brazil), from June 2009 to June 2010. The study protocol was approved by the Research Ethics Committee of the UNICAMP Medical School and participants signed a free and written informed consent term. Women who had difficulty in responding to the questionnaire or those with severe physical disability that prevented them from performing any type of physical activity were excluded from the study.

Sample size was calculated by setting the significance level at 5% (the power of the test was 80%), according to the Student's *t* test, with at least a 10% difference between means of the IPAQ sections. It was calculated that 57 individuals were needed for each physical activity level. Considering that 21% of individuals were less physically active and 79% were moderately active or very active,<sup>12</sup> 271 women were to be evaluated.

The selection process was random in both locations of study recruitment. In the social/leisure center, the women were approached and invited to participate in the study. In the Menopause Outpatient Clinic, the women were selected by outpatient admission chart to check for eligibility before medical consultation. After selection, these women read and signed a free and written informed consent term (FICT). No one refused to participate in the study. Women were interviewed to obtain information about characteristics such as age, weight, height, marital status, school education, smoking, and self-perception of health, number of medications taken and history of diseases. Economic classification was performed according to recommendations of the Brazilian Association of Research Companies (BARC).

The level of physical activity was evaluated by the long form of the International Physical Activity Questionnaire - Version 8 (IPAQ-Version 8.0) validated in Brazil by Benedetti *et al.*<sup>13</sup> in 2004. IPAQ has been used in previous studies in postmenopausal women<sup>14</sup>. It is an instrument that permits estimation of the weekly time spent on the performance of physical activities according to intensity, in different contexts of life (workplace, household tasks, transport and leisure). It is possible to estimate the time spent on less intense activities such as those done in the sitting position. This questionnaire considers physical activity as every body movement that involves any physical effort. These efforts are divided into vigorous (requiring

great physical effort) and moderate (requiring some physical effort). The questionnaire is composed of five sections. Section 1 includes questions about the presence of physical activities at the workplace (voluntary or paid) outside the house. Section 2 contains questions about physical activity as a means for transport (walking or using an automobile or bicycle). Section 3 contains questions about physical activity at home, household tasks and family care. Section 4 includes questions about the practice of physical activity of recreation, sports, exercises and leisure. Finally, section 5 addresses activities done when the woman is seated. Women who were engaged in each of these activities in the five sections were asked about the duration and frequency of these activities. The final score was expressed by the sum of time (in minutes) devoted to physical activity on the week before the study began, for each section of the questionnaire<sup>13</sup>.

Quality of life was assessed by the World Health Organization questionnaire, the WHOQOL-OLD, specific for the elderly population, validated in Brazil by Fleck *et al.*<sup>15</sup> in 2006. The questionnaire is divided into six domains. The first domain refers to sensory abilities and involves asking questions about feelings related to the five senses (sight, smell, hearing, taste and touch). The second domain, autonomy, addresses feelings related to decisions and the capacity to perform activities. The third domain asks questions about current, past and future activities and feelings. The fourth domain assesses social participation, the involvement of feelings and social integration. The fifth domain, related to death and dying, asks questions about concerns and fears of this situation. The sixth domain, intimacy, includes questions about feelings of love and companionship. Higher scores were related to better quality of life. Zero (0) corresponds to the worst and 100 to the best quality of life.

The WHOQOL-OLD domains were considered dependent variables, and the four IPAQ sections and total sitting time were considered independent variables. The confounding variables were: place of origin, age, number of medications used, social class, body mass index (BMI), smoking, marital status, school education, perception of health, history of disease and paid job. Each IPAQ section was evaluated by multiple linear regression analysis considering all the independent and confounding variables. The significance level was set at 5% and the software used for data analysis was SAS version 9.1.3

## RESULTS

Two-hundred and seventy-one (271) women were interviewed. Of these women, 130 (48%) participated in activities in a Leisure Center, (Social Trade Service) in Campinas/SP and 141 (52%) were patients from the Menopause Out-

patient Clinic in CAISM/UNICAMP. The average age of the patients was 67.4 ( $\pm$  5.3 years). Of these, 70.1% of these women were aged between 60 and 69 years. In the BMI classification, the majority was classified as overweight (38%) and obese (33.2%). Of the sample studied, 50.2% lived with a partner and 40.6% reported schooling that ranged from complete primary to incomplete secondary school education. When asked about smoking, the majority (73.8%) denied smoking. When asked about self-perception of health, 59.7% responded that their health was excellent, very good or good. The majority of women (70.8%) used from one to four medications and (90%) had a history of a previous disease. Regarding social class, 61.6% of the women belonged to classes C and D (data not shown).

Data analysis of the sections of the physical activity questionnaire (IPAQ) showed the following results: in section one, 67.5% of the women reported not having any paid job or being a volunteer outside the house. Most women reported not engaging in vigorous-intensity activity (98.2%) or moderate-intensity activity (90.4%) at the workplace. Of those employed, 83.4% denied walking at work. In section 2 (activities as a means of transportation), women interviewed described using an automobile (87.5%), walking from one place to another (77.1%) and cycling (1.8%) to move around. In analysis of section 3 (home activities), 95.2% and 62% of women did no vigorous-intensity or moderate-intensity activities in the garden or yard, and 83.4% engaged in moderate-intensity activities at home on the previous week. Concerning the results of section 4 (leisure), 56.8% of the women did not engage in walking for exercise, 86.7% did no vigorous physical exercise and 50.6% of the women reported doing moderate-intensity physical exercise.

In Table 1, the average time devoted to physical activity was 2802.7  $\pm$  1154.9 minutes on the week before the interview, i.e. 46.6 hours in seven days. Analysis of each IPAQ section showed that 60.8% of the time was spent on sitting physical activity and 13.0% was spent on moderate-intensity activities at home. The remaining activities had low representation in the total IPAQ.

The average total quality of life score was 66.9  $\pm$  11.7. The highest value was observed in the domain related to sensory abilities (72.0  $\pm$  18.8) and the lowest value was related to autonomy (60.3  $\pm$  16.2).

Table 2 shows an association between domains that compose the WHOQOL-OLD (dependent variables) and IPAQ sections that were considered independent variables. A significant association was found between the transportation section of the IPAQ and the domains social participation and quality of life related to present, past and future activities. These associations were directly proportional because higher levels of physical activity in the transport

**Table 1** – Physical Activity Index (total IPAQ) and order of representation in each section

Variable	n	Order of representation	Time spent (minutes/week) in IPAQ	
			Mean	Standard deviation
<b>IPAQ</b>				
Work	54		661.7	849.9
Vigorous intensity activity at work	5	(12)	88.0	46.0
Moderate intensity activity at work	26	(9)	480.8	629.4
Walking at work	45	(8)	506.4	665.2
Commuting	263		309.7	274.5
Days and time of automobile use	237	(3)	220.3	219.9
Riding a bicycle	5	(13)	198.0	158.2
Walking from one place to another	209	(4)	135.2	132.6
Household tasks	232		534.3	482.0
Vigorous intensity physical activities at home	13	(11)	297.7	478.9
Moderate intensity activities in the garden or yard	103	(7)	176.2	221.7
Moderate intensity activities at home	226	(2)	451.0	409.1
Leisure time	195		293.7	220.1
Walking for physical exercise	117	(6)	209.0	141.2
Vigorous intensity physical exercise	36	(10)	202.4	141.8
Moderate intensity physical exercise	137	(5)	186.4	134.8
Sitting time	271	(1)	1701.6	986.1
Total	271		2802.7	1154.9

Mean time of physical activity (IPAQ) 46.6 hours/week or 6.6 hours/day. Order of representation: percentage of time in activity in relation to total time.

**Table 2** – Multiple linear regression analysis of the association between diverse IPAQ sections and quality of life domains (WHOQOL-OLD)

	Independent Variables		Sections of parameter	IPAQ estimated (B)		
	Work	Transportation	Household tasks	Leisure-time	Sitting time	Multiple R2
<b>Dependent variables WHOQOL-OLD domains</b>						
Sensory abilities	-0.0007	0.0199	-0.0055	-0.0001	0.0045	0.59
Autonomy	0.0011	0.0059	-0.0027	-0.0078	-0.0039	0.70
Activities past, present and future	0.0019	0.0207*	-0.0030	-0.0269*	-0.0077	0.83
Social participation	0.0019	0.0334*	-0.0110	-0.0165	-0.0024	0.57
Death and dying	0.0006	-0.0250	0.0082	0.0267	0.0085	0.39
Intimacy	0.0040	-0.0006	0.0041	0.0103	0.0100	0.65
Total	0.0015	0.0090	-0.0016	-0.0024	0.0015	0.44

Adjusting for variables (confounding): place of origin, age, number of medications used, social class, BMI, smoking, marital status, school education, perception of health, history of disease and paid job; Estimated parameter = standardized regression coefficient; \*p ≤ 0.05.

domain correspond to higher quality of life scores. The leisure-time domain of the IPAQ had an inverse and significant relationship with the quality of life score related to present, past and future activities. Higher leisure-time physical activity values correspond to lower quality of life scores in this domain. For the remaining IPAQ sections, significant relationships with WHOQOL-OLD domains were not found, as measured by multiple linear regression analysis.

## DISCUSSION

This cross-sectional study examined an association between different IPAQ domains and quality of life in women aged 60 years or over. Physical activity for transportation was shown to be positively associated with the quality of life domain that refers to present, past and future activities and social participation. In contrast, leisure-time physical activity was inversely associated with present, past and future activities. These results are different from those presented in a study of female adults conducted in Croatia, where a positive association between leisure-time physical activity and quality of life was identified. In contrast, an inversely proportional relationship was observed between physical activity for transportation and quality of life in this population<sup>11</sup>. Differences between both studies may be explained because the Croatian group was a population-based study in adults and the present study was conducted in a specific population of women attended in a healthcare service or culture/leisure center in a city in southeast Brazil. The age group of the women included in the present evaluation is also noteworthy.

In addition, the total time (minutes/week) devoted to leisure-time physical activity was the shortest in comparison to other types of physical activities. As 61.6% of this sample of women belonged to social classes C and D, they probably had less access to leisure physical activities or they had insufficient time for it, so this may explain the shorter time they had spent in leisure activity. It is in line with literature which shows the lowest levels of physical activity participation are found in adults of poorer socioeconomic status<sup>16</sup> and fewer exercise facilities are found in low socioeconomic status neighborhoods<sup>17</sup>. Therefore, these women did not seem to benefit substantially from leisure activities. These results are similar to another study of elderly women reporting that leisure activities offered in a social center, such as stretching exercises and local gymnastics, aroused weak interest and low adherence. In physical activities for transportation, it was observed that all elderly women engaged in walking as a means of locomotion, achieved an average of 60.6 min/week<sup>18</sup>. Other studies have also shown that older women, who engage in physical activity for transportation are physically active<sup>19</sup>,

find it easier to shop, visit friends and relatives and go to leisure centers. As a consequence, these women have a better quality of life<sup>20</sup>, as observed in the current investigation. An association between mobility, independence, well-being and quality of life was also observed in a research study conducted in Canada with an elderly population<sup>21</sup>.

A positive association between physical activity when commuting and quality of life may also indicate characteristics of the environment where an individual lives. This relationship reflects both the need to move to have access to activities of daily living and to reduce stress caused by traffic, pollution and lack of safety<sup>22</sup>. However, the current study did not evaluate home location in this group of women and its association with physical activity for transportation and quality of life.

The IPAQ sections related to household tasks, work and sitting time were not associated with quality of life. This result is in agreement with a study of IPAQ sections that best documented physical activity in Latin America and observed that the two IPAQ sections recommended are leisure-time and transportation<sup>9</sup>.

We emphasize that the results of this study should not be generalized, because we assessed women receiving care in a tertiary healthcare center specialized in postmenopausal women, or were users of activities available in a Brazilian social center. The population of this center has specific characteristics and needs, making these women different from other population groups. Therefore, the nature of the study permits us to establish only associations between variables and not cause and effect relationships. We highlight the random selection of individuals, and the use of questionnaires that are nationally validated and adapted to this population. In view of the exposed text, further prospective and ideally population-based research studies are necessary.

In the current study, the magnitude of physical activity for transportation was confirmed. This type of activity is utilitarian in nature, tends to frequently repeat itself and creates a pattern of behavior that is easy to follow. Regular walking for transportation results in aggregation of physical activity, health benefits and improved quality of life, since specialized centers for the practice of physical exercise are less attended and less accessible to deprived populations. Walking as a primary means of self-transportation should be stimulated because it denotes being physically active<sup>23</sup>.

## CONCLUSION

Quality of life was negatively influenced by leisure-time physical activity, but the time devoted to this physical activity was the shortest in comparison to other types, so it might have influenced this result.



Only physical activity when commuting was positively associated with a better quality of life. Health professionals should encourage the practice of physical activity when commuting because this may improve quality of life. The performance of more intense movement, as well as the use of longer routes should be stimulated. Further studies are required to confirm the association between home environment, physical when commuting and quality of life. In addition, the possibility of more creative and stimulating leisure activities should be evaluated.

## REFERENCES

1. Harman D. The free radical theory of aging. *Antioxidants & Redox Signaling*; 2003. p. 557-61.
2. Spirduso WW, Francis KL, MacRae PG. *Physical dimensions of aging*. Champaign: Human Kinetics; 2005.
3. Penedo FJ, Dahn JR. Exercise and well-being: a review of mental physical health benefits associated with physical activity. *Curr Opin Psychiatry* 2005;18(2):189-93.
4. Bijnen FC, Caspersen CJ, Feskens EJ, Saris WH, Mosterd WL *et al*. Physical activity and 10-year mortality from cardiovascular diseases and all causes: The Zutphen Elderly Study. *Arch Intern Med* 1998;158(14):1499-505.
5. Kvaavik E, Batty GD, Ursin G, Huxley R, Gale CR. Influence of individual and combined health behaviors on total and cause-specific mortality in men and women: the United Kingdom health and lifestyle survey. *Arch Intern Med* 2010;170(8):711-8.
6. Sims J, Hill K, Hunt S, Haralambous B. Physical activity recommendations for older Australians. *Aust J Ageing* 2009;29(2):81-7.
7. Annear MJ, Cushman G, Gidlow B. Leisure time physical activity differences among older adults from diverse socioeconomic neighborhoods. *Health Place* 2009;15(2):482-90.
8. Benedetti TB, Mazo GZ, Barros MVG. Aplicação do questionário internacional de atividades físicas para avaliação do nível de atividades físicas de mulheres idosas: validade concorrente e reprodutibilidade teste-reteste. *Rev Bras Ciênc Mov* 2004; 12(1): 25-34.
9. Hallal PC, Gomez LF, Parra DC, Lobelo F, Mosquera J, Florindo AA *et al*. Lessons learned after 10 years of IPAQ use in Brazil and Colombia. *J Phys Act Health* 2010;7(Suppl 2):S259-64.
10. Franchi KMB, Junior RMM. **Atividade física: uma necessidade para boa saúde na terceira idade**. *Rev Bras Promoç Saúde* 2005;18(3):152-6.
11. Jurakić D, Pedisić Z, Greblo Z. Physical activity in different domains and health-related quality of life: a population-based study. *Qual Life Res* 2010;19(9):1303-9.
12. Mazo GZ, Liposcki DB, Ananda C, Prevê D. Condições de saúde, incidência de quedas e nível de atividade física dos idosos. *Rev Bras Fisioter* 2007;11(6):437-42.
13. Benedetti TB, Mazo GZ, Barros MVG. Aplicação do questionário internacional de atividades físicas para avaliação do nível de atividades físicas de mulheres idosas: validade concorrente e reprodutibilidade teste-reteste. *Rev Bras Ciênc Mov* 2004;12(1):25-34.
14. Ferreira M, Matsudo S, Matsudo V, Braggion G. Efeitos de um programa de orientação de atividade física e nutricional sobre o nível de atividade física de mulheres fisicamente ativas de 50 a 72 anos de idade. *Rev Bras Med Esporte* 2005;11(3):172-6.
15. Fleck MP, Chachamovich E, Trentini C. Development and validation of the Portuguese version of the WHOQOL-OLD module. *Rev Saúde Pública* 2006;40(5):785-91.
16. Toscano JJO, Oliveira ACC. Qualidade de vida em idosos com distintos níveis de atividade física. *Rev Bras Med Esporte*. 2009;15(3):169-73.
17. Sproston K, Primates P, editors. *Health survey for England volume 2: Risk factors for cardiovascular disease*. London: The Stationery Office; 2004.
18. Estabrooks PA, Lee RE, Gyurcsik NC. Resources for physical activity participation: does availability and accessibility differ by neighborhood socioeconomic status? *Ann Behavior Med* 2003;25(1):100-4.
19. Maltais DB, Dumas F, Boucher N, Richards CL. Factors related to physical activity in adults with cerebral palsy may differ for walkers and non walkers. *Am J Phys Med Rehabil* 2010;89(7):584-97.
20. Cerin E, Leslie E, Toit L, Owen N, Frank LD. Destinations that matter: Associations with walking for transport. *Health Place* 2007;13(3):713-24.
21. Spinney JEL, Scott DM, Newbold KB. Transport mobility benefits and quality of life: a time-use perspective of elderly Canadians. *Transp Policy* 2009;16(1):1-11.
22. Parra DC, Gomez LF, Sarmiento OL, Buchner D, Brownson R, Schmid T *et al*. Perceived and objective neighborhood environment attributes and health-related quality of life among the elderly in Bogotá, Colombia. *Soc Sci Med* 2010;70(7):1070-6.
23. Saelens BE, Sallis JF, Frank LD. Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. *Ann Behav Med* 2003; 25(2):80-91.