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original article

What is the intensity of exercise sessions of a physical exercise program for older adults?

Qual a intensidade das aulas de um programa de exercício físico para idosos?

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Abstract – The objectives of this study were to describe and determine the intensity of sessions of a physical exercise program (PEP) for older adults developed within the primary healthcare network of Florianópolis, and to compare the intensity of the sessions between groups using three cutoffs. Eight sessions involving 31 older adults divided into groups I and group II were analyzed. The total time spent during the sessions was considered. Intensity was measured with a triaxial accelerometer and classified according to three different cutoffs. Sociodemographic data, perceived health status, functional fitness, nutritional status and physical activity level at the beginning of the program were also evaluated. The majority of older adults was insufficiently active, was overweight, had low functional fitness, and reported that their health status did not impair physical activity. The mean time spent in moderate physical activity ranged from 1.4 and 16.3 min in group I and from 6.6 and 23.2 min in group II, with the difference being significant. The mean time spent in sedentary activities was 18.7 and 20.5 min for groups I and II, respectively. The findings suggest that the PEP sessions mainly consisted of light or sedentary activities and that the short time spent in more intense activities might be related to the characteristics of the group and to the teaching method adopted by the professionals.

Key words: Accelerometer; Health promotion; Motor activity; Older adult; Physical exercise.

Resumo – *O presente estudo objetivou descrever e verificar a intensidade das aulas de um programa de exercício físico (PEF) para idosos, desenvolvido na rede de atenção primária à saúde de Florianópolis – SC; e comparar os grupos quanto à intensidade das aulas, segundo três pontos de corte. Foram analisadas oito aulas, as quais envolveram 31 idosos, divididos nos grupos I e II. Utilizou-se tempo total despendido durante a aula, sendo a intensidade classificada por três diferentes pontos de corte e mensurada por acelerômetros triaxiais. Variáveis sociodemográficas; de saúde; aptidão funcional; estado nutricional e nível de atividade física (AF) ao iniciar o PEF também foram avaliados. Os resultados evidenciaram que ao iniciarem o PEF, a maioria dos idosos era pouco ativa, apresentava excesso de peso, baixa aptidão funcional e afirmou que o estado de saúde não dificultava a prática de AF. A média de tempo despendido por aula em AF moderada variou de 1,4 a 16,3 min no grupo I e de 6,6 a 23,2 min no grupo II, diferindo estatisticamente. O tempo médio geral das aulas em atividades sedentárias foi de 18,7 e 20,5 min para os grupos I e II, respectivamente. Os resultados indicam que as aulas do PEF caracterizaram-se, em sua maioria, por atividades de intensidade leve ou sedentárias e que o pouco tempo despendido em atividades mais intensas pode estar relacionado às características do grupo e à metodologia de ensino adotada pelos professores.*

Palavras-chave: *Acelerômetro; Atividade motora; Exercício; Idoso; Promoção da saúde.*

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INTRODUCTION

The health benefits of regular physical activity (PA) for the elderly population are well established in the literature[1,2] and the importance of PA for the maintenance of independence, prevention of disease and improvement of quality of life has been documented[3]. The recommendations of the American College Sports Medicine (ACSM)[4] of 150 minutes of moderate/vigorous PA are widely used for the classification of PA level (PAL)[3] and as a basis for professional practice. In this respect, the minimum intensity of PA necessary to achieve health benefits has been a matter of debate[5]. Studies have shown that activities of moderate or vigorous intensity are more effective[6-8] and that there is an intensity limit to obtain significant results[9]. However, low-intensity activities are also important for the health of this age group[7,10,11].

In Brazil, the development of community-based programs for the promotion of PA is being encouraged and older adults are the main target group of these programs[12]. However, questions remain regarding the development of the sessions of these programs and specifically regarding their intensity, how much these programs have contributed to reach the PA recommendations proposed by ACSM and how much time is spent in low-intensity activities during each session. Furthermore, there are few Brazilian studies evaluating and/or monitoring the intensity of physical exercise sessions or PAL[13] using objective measures such as an accelerometer.

Therefore, the objectives of the present study were i) to describe and determine the intensity of sessions of a physical exercise program for older adults developed within the primary healthcare network of the city of Florianópolis, Santa Catarina, Brazil, and ii) to compare the intensity of the sessions between groups using three cutoff values.

METHODOLOGICAL PROCEDURES

This study is part of the project "VIA - Vida ativa: descobrindo caminhos saudáveis", currently called "VAMOS - Vida Ativa Melhorando a Saúde", which is a collaborative research between Brazil (Centro de Desportos, Universidade Federal de Santa Catarina) and the United States (University of Illinois at Urbana, Champaign). Details of the method have been described previously[14].

The main objective of the project is to test the implementation of a program promoting PA in older adults within the primary healthcare network based on behavioral changes. The study was conducted at the health centers of Florianópolis, three located in the Northern Regional Health District and three in the Eastern Regional Health District. The health centers were randomized into different groups: behavioral change (2 health centers), physical exercise (2 health centers), and control (2 health centers). However, the present study analyzed only the two health centers that developed the Physical Exercise Program (PEP), called group I (Northern District) and group II (Eastern District).

The PEP was offered three times per week over a period of 3 months, with each session lasting 60 min (total of 36 sessions) in order to develop components of health-related physical fitness. The sessions were held by two physical education professionals of the Center for Family Health Support.

The population of this study comprised all participants in the two PEP groups. Criteria for inclusion were age of 60 years or older and participation in at least two sessions in which exercise intensity was evaluated. Older adults presenting cognitive decline evaluated by the Mini-Mental State Examination were excluded because of limitations in understanding. The final sample consisted of 31 older adults (15 in group I and 16 in group II).

The following variables were analyzed: sociodemographic (gender, age, marital status, education level, and income); health (perception whether the health status impairs PA); functional fitness (five tests); nutritional status; PAL at the beginning of PEP (objective measure obtained at baseline); intensity of the sessions (minutes spent in sedentary, light, moderate, and vigorous activities).

The sociodemographic and health variables were obtained by interview. Functional fitness was evaluated with the Fullerton test battery[15] using the tests of upper and lower limb strength, lower limb flexibility, dynamic balance, and aerobic endurance. The classification adopted (very weak, weak, regular, good, and very good) was based on gender and age percentiles of older adults participating in physical activity extension programs of Federal and State Universities in Santa Catarina[16]. For the evaluation of nutritional status, the body mass index (BMI) was used to identify low weight, normal weight and overweight subjects (BMI < 22 kg/m^2 and BMI > 27 kg/m^2)[17]. Baseline PAL was evaluated with an ActiGraph GT3X accelerometer used around the waist for 7 days. The data were collected using an epoch length of 60 seconds. Valid data were those of older adults who accumulated at least 10 hours of daily recording over a minimum period of 4 days, including days of the week and at least one weekend day. The PAL (min/week) was calculated by the sum of minutes spent in moderate and vigorous physical activity (MVPA) on valid days. The cutoff value proposed by Freedson et al.[18] was used for classification. The classification of PAL was based on health-related PA recommendations[4]. Mean daily MVPA (min/day) was determined by the sum of time spent in moderate/vigorous activities recorded on valid days divided by the number of valid days.

The intensity of the sessions (n=8) was evaluated with the ActiGraph GT3X accelerometer placed around the waist using an epoch length of 60 seconds. The total time spent in activities of different intensities during the session was determined. The log corresponding to the time when each session started and ended was used for validation of the data. The following cutoff values were used: sedentary (0-99), light (100-1951), moderate (1952-5724), vigorous (5725- 9498), and very vigorous activity (9499 counts/min or more)[18]; sedentary (0-99), low-light (100-1040), high-light (1041-1951), and moderate+vigorous activity (1952 counts/min or more)[2]; light (0-2690), moderate (2691-6166), vigorous (6167-9642), and very vigorous

activity (9643 counts/min or more)[19]. It should be noted that these studies on cutoff values differ in terms of the recording axis of counts/min. Two studies involved the vertical axis and used uniaxial accelerometers[2,18] and the third study used the results of the vertical, mediolateral and anteroposterior axes[19].

A description of the sessions including information such as the number of participants, exercise executed, time of beginning and end of the session and of each exercise, material used, type of exercise (individual or group) and type of music, as well as observations and general comments about the older adults, teacher or environment were also obtained.

The sociodemographic data, health variables, functional fitness and PAL were collected at baseline (March and April 2012) and data regarding intensity of the sessions were obtained in June and July 2012. The data collection team consisted of adequately trained researchers and physical education professionals participating in the VAMOS research project. The following procedures were adopted for the evaluation of exercise intensity: i) the accelerometer was handed over minutes before the beginning of the session and the name of the participant was recorded for each device; ii) the observer did not assist with any activity of the session nor did he/she provide feedback to the participants or teacher, and was only responsible for recording the field diary; iii) the professional responsible for the PEP sessions was unaware about the date of observation performed by the team to avoid changes in session planning; iv) the accelerometers were collected at the end of the session.

The data were processed using the ActiLife 6.7.2® software and analyzed descriptively (mean, standard deviation, frequency, and percentage) using the Statistical Package for the Social Sciences 20.0. The Student *t*-test was used for comparison between groups. A level of significance of 5% was adopted for all analyses.

The study was conducted according to ethical guidelines and was approved by the National Ethics Committee (No. 480.560) and by the Ethics Committee on Human Research of Universidade Federal de Santa Catarina (Permit No. 2387) on February 3, 2012.

RESULTS

The mean age of the older adults was 69.2 years (± 6.1). Most participants had a low education level (1 to 7 years of schooling), were married, retired, and had a monthly household income of up to 4 minimum wages. Additionally, most participants were classified as poorly active before the beginning of PEP, with an average of approximately 20 min of daily MVPA, and reported that their health status did not impair PA (Table 1).

At the beginning of PEP, the older adults were overweight and had low functional fitness, with most being classified as weak or very weak in the flexibility, dynamic balance and aerobic endurance tests. The strength tests (upper and lower limbs) achieved the best classifications (Table 2).

Table 1. Sociodemographic and health characteristics and physical activity level of older adults participating in a physical exercise program. Florianópolis, 2012.

Variable	n	Group I	Group II
Gender			
Male	5	4	1
Female	26	11	15
Age (years)			
60 – 69	18	9	9
70 – 79	12	5	7
80 or more	1	1	0
Education level (years of schooling)			
Illiterate (0)	3	2	1
Incomplete elementary school (1-7)	18	7	11
Complete elementary school (8)	4	0	4
Incomplete high school (9-10)	1	1	0
Complete high school (11)	3	3	0
Complete higher education	1	1	0
Postgraduation	1	1	0
Marital status			
Single	2	1	1
Married/stable union	17	8	9
Widowed	9	4	5
Separate/divorced	3	2	1
Monthly household income (minimum wages)†			
< 1	2	2	0
1–2	6	3	3
2–3	6	2	4
3–4	10	3	7
4–6	3	2	1
> 6	2	2	0
Health status impairs physical activity			
Yes	8	3	5
No	23	12	11
Physical activity level††			
Active (≥150 min/week)	10	4	6
Poorly active (≥10 and ≤149 min/week)	20	11	9
Inactive (<10 min/week)	1	0	1
Average AFMV (min/days)	20.9 (± 19.2)	20.4 (± 17.8)	21.3 (± 21.0)

† n=29. Minimum wage: R$ 622.00 (US$ 177.71). †† Moderate and vigorous weekly physical activity (MVPA). Group I (Northern District); group II (Eastern District).

The duration of the sessions ranged from 52 to 66 min, with a mean of 60.7 min (± 4.9).

Table 2. Functional fitness and nutritional status of the older adults at the beginning of the physical exercise program. Florianópolis, 2012.

Variable	n	Group I	Group II
Body mass index			
Normal	7	3	4
Overweight	24	12	12
Lower limb strength†			
Very weak	7	2	5
Weak	8	3	5
Regular	10	6	4
Good	3	2	1
Very good	2	2	0
Upper limb strength			
Very weak	3	0	3
Weak	9	2	7
Regular	15	10	5
Good	3	2	1
Very good	1	1	0
Flexibility			
Very weak	9	3	6
Weak	11	6	5
Regular	6	4	2
Good	3	1	2
Very good	2	1	1
Dynamic balance†			
Very weak	8	3	5
Weak	11	5	6
Regular	8	5	3
Good	3	2	1
Very good	0	0	0
Aerobic endurance			
Very weak	8	4	4
Weak	15	4	11
Regular	6	5	1
Good	1	1	0
Very good	1	1	0

† n=30. Group I (Northern District); group II (Eastern District).

Table 3 shows the time spent by the two groups in sedentary, light, moderate and vigorous activities per session using three cutoff values. In group I, the mean time spent per session in moderate activity ranged from 1.4 to 16.3 min, while this time ranged from 6.6 to 23.2 min in group II. The overall mean time spent in sedentary activities was 18.7 min in group I and 20.5 min in group II. Considering the description per session, the highest means were obtained for light activities. Regarding vigorous activities, only one session of group II reached this intensity according to the cutoff value of Freedson et al.[18] and the mean time spent by this group was 0.7 min according to the cutoff value of Sasaki et al.[19].

The overall mean of the PEP sessions analyzed indicates a predominance of sedentary and light activities in the two groups, irrespective of the cutoff adopted. Comparison showed a significant difference in the mean intensity of the sessions between groups, with higher means for high-light, moderate and vigorous activities in group II (Table 3).

Descriptive analysis showed that the PEP sessions could be divided into three phases: beginning (warming up), main (development of physical skills), and final (stretching). The overall mean time spent per phase was 22.3, 25.1 and 8.9 min, respectively. The exercises were performed individually, in pairs or small groups (circuits), or involving all students (e.g., in a circle holding hands). Music was a resource used in all sessions; however, in group I the main part of the sessions was performed without music. Barbells, dumbbells, leg weights, balls, mats, and bows were the equipment used. Exercises without equipment were also performed. Metric counting (with or without verbalization) was a strategy adopted for execution of the exercises. The heart rate was monitored manually in group I at the end of warm-up by counting the radial pulse. However, the responsible person did not take any action during this monitoring if the heart rate was below or above the recommended. The responsible persons provided some feedback regarding the correct execution of the exercises and the possibility to perform the exercise more intensely. The relationship between the teacher and student was positive, with the observation of proximity and respect. The PEP occurred during winter and the climate was cold and rainy in all sessions of group I and in one session of group II.

Table 3. Description of the intensity of the activities developed in the physical exercise program according to different cutoffs. Florianópolis, 2012.

		Freedson et al.[17]					Copeland et al.[2]				Sasaki et al.[18]			
		S	L	M	V	VV	S	LL	HL	MV	L	M	V	VV
Session	Group	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
1	I	19.9	42.4	2.7	0	0	19.9	35.4	7.0	2.7	55.1	9.9	0	0
2	I	21.2	38.4	1.4	0	0	21.2	32.1	6.2	1.4	55.6	5.4	0	0
3	I	20.8	28.7	2.6	0	0	20.8	23.3	5.3	2.6	46.1	5.9	0	0
4	I	12.8	41.8	6.5	0	0	12.8	33.0	8.8	6.5	44.8	16.3	0	0
	Mean	18,7	37.8	3.3	0	0	18.7	31.0	6.8	3.3	50.4	9.4	0	0
	±	4,0	6.3	2.2	0	0	4.0	5.3	1.5	2.2	5.7	5.0	0	0
1	II	13.0	34.8	7.2	0	0	13.0	24.4	10.4	7.2	30.9	23.2	0.9	0
2	II	24.5	30.1	7.4	0	0	24.5	19.0	11.1	7.4	44.1	17.1	0.8	0
3	II	22.3	34.8	6.6	0.2	0	22.3	25.5	9.4	6.8	45.1	17.7	1.2	0
4	II	22.0	34.5	9.5	0	0	22.0	26.5	8.0	9.5	45.5	20.5	0	0
	Mean	20,5	33.6	7.7†	0.1	0	20.5	23.9	9.7†	7.7†	41.4	19.6†	0.7†	0
	±	5,1	2.3	1.3	0.1	0	5.1	3.3	1.3	1.2	7.0	2.8	0.5	0
Total (PEP)														
	Mean	19.6	35.7	5.5	0.02	0	19.6	27.4	8.3	5.5	45.9	14.5	0.36	0
	±	4.3	5.0	2.9	0.07	0	4.3	5.6	2.0	2.9	7.6	6.6	0.5	0

PEP = physical exercise program. †$p<0.05$; S: sedentary; L: Light; M: moderate; V: vigorous; VV: Very Vigorous; LL: Low-Light; HL: High-Light; MV: Moderate/Vigorous.

DISCUSSION

The present study addresses an important topic within the context of health and PA promotion by determining the intensity of exercise sessions of a PEP offered to older adults within the primary healthcare network of a capital in the southern region of Brazil using an objective measure. The results showed that the activities developed during the PEP sessions were mainly sedentary and light activities, irrespective of differences in the classification of intensity between the cutoff values used[2,18,19]. Comparison between groups revealed that the sessions of group II differed in terms of the time spent in high-light, moderate and vigorous intensity activities. However, despite this difference the time spent in higher intensity activities is still insufficient.

The recommendations of the ACSM published in 2009[4] for the prescription of physical exercise to older adults highlight that MVPA are the activities that most contribute to the prevention of diseases and to the preservation of health. However, in the same statement[4], the ACSM clarifies that, if it is not possible to perform 150 min of MVPA per week due to the limitations of chronic conditions, older adults should be as physically active as their capacities and conditions permit.

The literature has demonstrated that higher intensity activities, such as moderate and vigorous activities[6,8], are able to provide greater health benefits to older adults. A recent study[6] evaluated the effect of light- and vigorous-intensity exercise on balance, gait and the ability to sit and stand up in healthy older adults and found that vigorous-intensity exercises are more adequate to improve static and dynamic motor tasks of daily living. Using accelerometers to verify the association between PAL and the presence of C-reactive protein in diabetic and non-diabetic American older adults, Hawkins et al.[8] observed that vigorous-intensity activities were more effective since they had a greater impact on reducing the inflammatory state, irrespective of the degree of diabetes. However, the same study suggested that light-intensity activities help reduce inflammation in non-diabetic older adults.

Recent studies[10,11] indicate that PA of light intensity also favors other health aspects in older adults, such as the maintenance of physical independence. Marques et al.[10] found that both light PA and MVPA reduced the risk of physical independence loss during life in community-dwelling older adults. Furthermore, a follow-up study demonstrated a robust association between PA and survival, in which light and more intense PA was associated with a lower mortality risk in individuals aged 50 years or older living in England[11].

In this respect, considering the evidence on the benefits of light PA, the older adults studied here possibly gained some health benefits despite the low intensity of the activities performed. It should be taken into consideration that the participants in the present study were beginners of the PEP at the time of evaluation, little physically active and had some limitations,

such as low functional fitness and overweight, indicating that light PA seems to be adequate or even the only activity possible.

Excess weight, together with low functional fitness, seems to be inversely associated with session intensity and may be a possible explanation for the low intensity of the sessions evaluated, although this association was not the focus of analysis of this study. However, a study involving community-dwelling older adults demonstrated an inverse association of PA volume and intensity with body adiposity[20]. Another study reported an association between excess weight and low functional fitness in older adults[21], suggesting that these variables deserve attention in health promotion programs for this population.

Another important finding was the time spent in sedentary activities during the PEP sessions, which requires efforts on the part of older adults and physical education professionals in an attempt to replace them with more intense activities. An increase in functional fitness and weight loss could be important facilitators for this purpose.

The description of the sessions permitted to evaluate general features and specific observations regarding the environment, students and performance of the professionals, and can also contribute to understand the low intensity of the activities during most part of the sessions. The division of the sessions into three phases and the type of activities developed agree with the recommendations of studies on older adults[22]. However, the mean time spent warming up was high and was similar to that dedicated to the main part of the sessions, i.e., the development of physical skills. This division may have affected the results of the present study since light activities are emphasized during warm-up. The objective of the latter is to increase blood circulation and muscle temperature, facilitating metabolism and improving the response to exercise[22].

With respect to the use of music during the sessions, this is an interesting strategy since it helps motivate older adults[22,23]. Music facilitates the execution of activities[23], rendering physical effort more pleasant, especially for sessions that occur during winter and on cold and rainy days, as described in the results.

The use of heart rate for monitoring exercise intensity requires special care since this parameter may be altered due to the use of certain medications or to specific health conditions (e.g., heart diseases). In these cases, heart rate is not a reliable parameter to monitor the intensity of PA[24]. Heart rate was evaluated during the sessions observed, but no clear objective for this monitoring was identified. In this respect, the Borg scale may be a useful parameter for programs involving older adults, especially community-dwelling older adults, since it permits individual adjustment of the desired load[22].

Positive professional-student and student-student relationships could be identified during the sessions, a finding characterizing the sessions as an important space of social life. Socialization has been indicated as one objective of the participation of older adults in PEP[25]. Socializing is a psy-

chological need of the individual, to be accepted and to belong to a group, and the fulfillment of this need is associated with intrinsic motivation, which is a favorable feature to maintain older adults in PEP[25].

Limitations of this study are the lack of evaluation of the rating of perceived exertion in the older adults and of the self-perception of the physical education professionals about the intensity of the sessions. The randomness of the observation was another limitation since the four sessions analyzed in each group did not follow the weekly frequency at which the sessions occurred (Monday, Wednesday and Friday). In contrast, a strength of this study was the use of an objective measure (accelerometer) to evaluate the intensity of the sessions.

CONCLUSION

The sessions observed mainly consisted of sedentary and light activities. Considering the different cutoff values, the overall mean time per group ranged from 18.7 to 20.5 min for sedentary activities, from 23.9 to 50.4 min for light activities, and from 3.3 to 19.6 min for moderate activities. With respect to PEP means, the overall mean time spent in moderate activities ranged from 5.5 to 14.5 min.

The results indicate that, although the older adults participated in a PEP, approximately 20% of the time of the sessions consisted of sedentary activities. Light activities also accounted for an important part of the session and the time spent with more intense movements was therefore low. Although the relationship between intensity and health variables was not the focus of this study, some characteristics of the sample at the beginning of PEP should be highlighted. Most participants were older adults with low functional fitness and overweight, characteristics that may have contributed to the short time spent in moderate and vigorous PA. Encouragement by the teacher and systematization of the program can also contribute to increase and maintain the exercise intensity during the sessions. However, this is related to the individual characteristics of the group involved.

The present study permits to reflect about the sessions of community-based PA programs for older adults, particularly about the session we have, about the session we want to have, and what older adults actually need and like and whether their physical conditions permit them to perform these activities and to benefit from them. Further studies are needed to compare the results and to evaluate other programs elaborated for this population.

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