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EFFECTS OF PARTICIPATION IN THE PROGRAMME OF RECREATIONAL ACTIVITY FOR AGED PEOPLE ON WORK CAPACITY ASSESSED FROM WALKING TEST

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ABSTRACT

The Programme of Recreational Activity for Aged People (PRAAP) was designed for the purpose of promoting healthy and active life style among sedentary subjects over 60 years of age. The aim of the study was to find out whether PRAAP induces measurable changes in physiological indicators of physical performance of aged people subjected to walking test.

Fifteen women aged 65 – 75 years not engaged previously in any regular physical activities, having no medical contraindications, participated in the study.

Exercise intensity applied in PRAAP, even as low as 30 – 50% of individual maximal heart rate (HRmax), brought about improved cardiovascular function, as reflected by decreased heart rate at standard load (walking speed equal to 4.8 km•h^{-1}).

Key words: aged people, physical activity programme, walking

Introduction

Reluctance to undertake exertion and an augmented physical activity is typical of aged people and gradually leads to reduction of their self-dependence. Decreased physical activity results mainly from an improper attitude towards rest, and only rarely from organic or functional disorders. It is reasonable to assume, that promoting all forms of physical activities among aged people contributes to improving health and well-being and enhances the image and quality of old age. A correlation between health status and age-matched physical activity has been reported by many authors (7, 13, 14, 15, 16).

In order to promote healthy life style among sedentary people over 60 years old, a special Programme of Recreational Activity for Aged People (PRAAP) was created. An intense physical training is known to induce similar adaptive changes in aged subjects as in the young ones (1, 4, 5, 8, 11, 12, 14, 17, 18, 19), but whether low-intensity exertions included in the programme, not exceeding 50% individual HRmax, would produce discernable physiological effects in addition to improved well-being, remains unknown.

An improved adaptation to physical exercise, resulting from augmented physical activity, is reflected by increases physical fitness, i.e. higher oxygen uptake in maximal exercise, and decreased heart rate in submaximal exertions. Various conventional fitness tests are used to assess adaptation, e.g. on cycle ergometers or electric treadmills, but their application to people in advanced age requires a thorough medical control and is hardly possible to conduct beyond a laboratory, unless special equipment has been available. Therefore, the so-called walking test designed by Bassey et al. (2, 3), seems to be best suited to that age group. The test consists of three walks at various speeds (volitionally optimal, and lower or higher than optimal), heart rate being the parameter measured. Since the loads are self-applied and are not excessive, aged subjects can easily perform the test.

The aim of the study was to find out whether recommended programme induces measurable changes in physiological indicators of work capacity of aged people subjected to walking test.

Material and Methods

Fifteen women aged 65 – 75 years, in whom the physician found no contraindications to participate in PRAAP activities, participated in the study. Those women did not participate previously in any regular physical activities. Basic data concerning the subjects are presented in Table 1.

According to WHO criteria based on body mass index (BMI), 5 women had normal body mass, 6 were overweight, and 4 were obese. However, when employing criteria proposed by Ewans and Rotenberg (6) (BMI up to 27.3 is considered normal for women above 60 years of age, and up to 27.8 above 70 years), 6 women had normal body mass, 8 were overweight, and only one was obese.

All subjects participated in the Programme of Recreational Activity for Aged People (PRAAP), which lasted 6 months and consisted of 3 stages: I – introductory (qualification of subjects), II – practical course, and III –recovery tourism. Details of the programme have been reported elsewhere (9).

In Stages II and III, participants exercised at 30 – 50% of their capacities (individual HRmax), established from Karvonen's formula: HRtraining = (220 – age – HRrest) x % desired aerobic capacity + HRrest. Heart rate was self-recorded by wrist palpation for 15 s. Additionally, HR was monitored in two subjects throughout every session by using sport testers (Polar Electro Oy, Finland).

Weekly exercise protocol in Stage II of PRAAP included:

- Health gymnastics, two sessions weekly, one hour each, directed by an instructor. Mean exercise intensity ranged from 35 to 50% HRmax in the first and third phases, respectively;
- Individual walks, once weekly, intensity not exceeding 35% HRmax; walk duration 20 – 40 min, depending on the phase of Stage II, and on participant's willingness and capability.

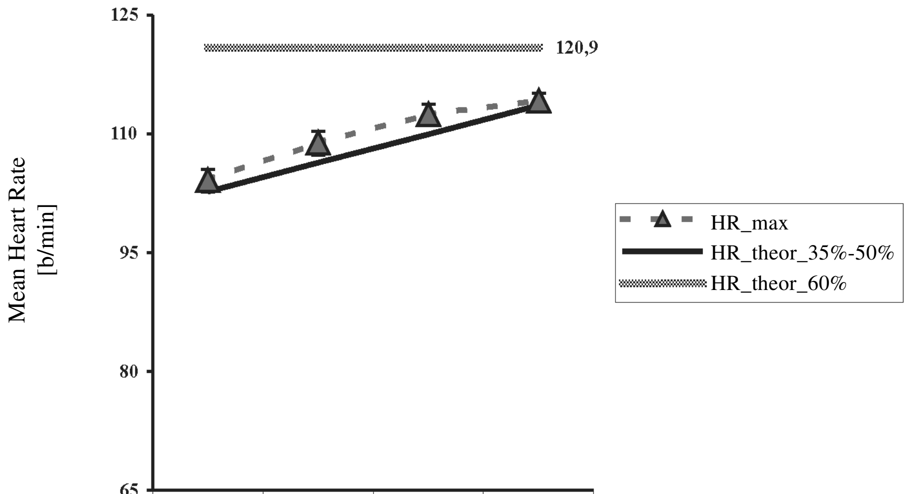
Various modes of exercises were performed in Stage II – aerobic, strength, flexibility and relaxation.

Stage III consisted of a two-week group stay in a spa. Scheduled physical activities included:

- Morning gymnastics, 20 min daily;
- Hiking – 9 excursions lasting about 2 h each;
- Health gymnastics, 6 sessions, one hour each, every other day;
- Recreational team games, two sessions, 2 h each;
- Dance, two sessions one hour each;

Table 1. *Mean values (±SD) and ranges of basic characteristics of aged women studied (n = 15)*

Age (years)	Body height (cm)	Body mass (kg)	BMI (kg/m^2)	Blood pressure at rest (mm Hg)	
				Systolic	Diastolic
70.0 ± 3.1 (60 – 75)	156±5 (146 – 165)	7.8 ± 6.9 (49 – 86)	28.0 ± 3.2 (23 – 36.4)	132.6 ± 12.4 (105 – 160)	80.7 ± 6.1 (65 – 90)



	Measurement 1	Measurement 2	Measurement 3	Measurement 4
HR_max	104.1	108.9	112.4	114.1
HR_theor_35%-50%	102.7	106.3	110.0	113.6
HR_theor_60%	120.9	120.9	120.9	120.9

Fig. 1. *Maximum heart rates attained by PRAAP participants during gymnastics in Stage II, and their heart rates predicted from programme assumptions*

– Relaxation, 3 sessions 30 min each.

Approximate energy expenditure, daily and weekly (for Stage II), was assessed from durations of training units and their energy costs (10).

All participants were subjected three times to walking test: before the beginning and at the end of Stage II (22 weeks later), and after termination of the programme. The test consisted of walking 3 times 200-m distance on tartan surface in a sport hall, each time at different speed (expressed in km•h^{-1}): individually (subjectively) optimal, slower than optimal, and faster than optimal, but not maximal; otherwise no requirements were imposed upon participants regarding the speed of walking. Each walk was followed by 5 min recovery period. Heart rates and walking times were recorded with sport testers.

In order to monitor the progress resulting from training, heart rates of every participant were recorded 4 times, at Sessions 8, 16, 24 and 42.

The relationship between heart rates and walking speeds proved curvilinear, but was linearised after converting heart rates to logarithms. Walking speed and log HR data were subjected to regression analysis and Student's t-test for paired data. From the regression equations, heart rates for the so-called standard speed equal to 4.8 km•h^{-1} were computed and named standard heart rates (HRst). The level of p=0.05 was considered significant.

Results

Highest heart rates recorded, i.e. immediately after having completed the programme of given session, are presented in Fig. 1. Those values increased from 104 ± 8 to 114 ± 3.4 bpm after Sessions 8 and 42, respectively, which is in good agreement with the prediction, that the exercise intensity would increase throughout the programme and amount to 35 – 50% of maximum expected capacity.

The intensity of exercises in Stage III was diversified and ranged from very light (below 35% HRmax) during recreational team games or morning gymnastics, thro-

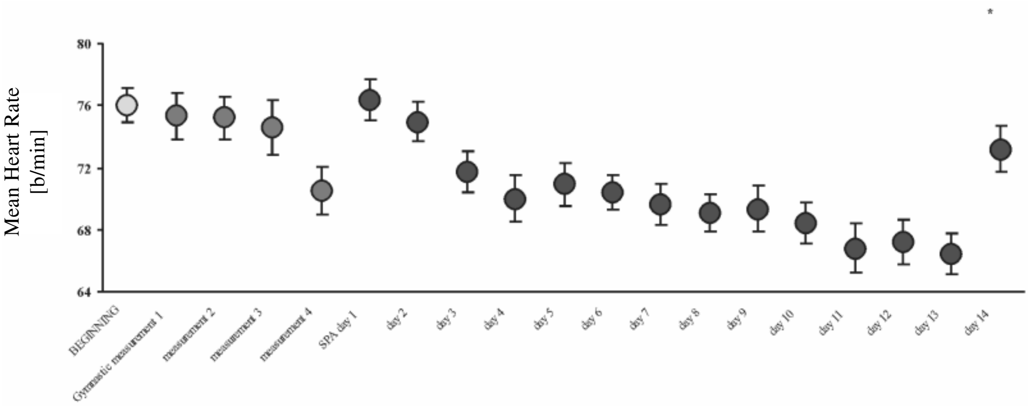


Fig. 2. *Mean resting heart rate during the programme.*

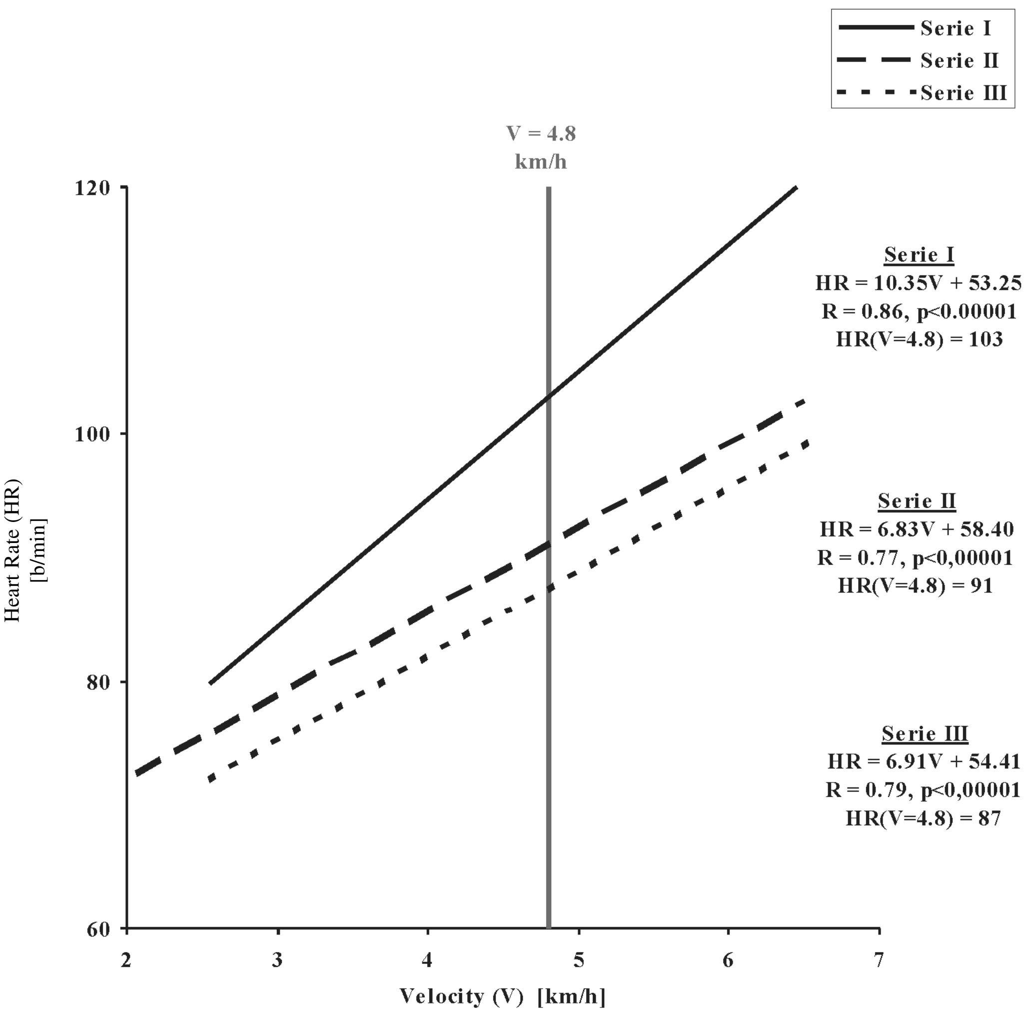


Fig. 3. *The relationship between heart rate (HR) and velocity of walking (V) before, after 22 weeks and after termination of programme. The differences between HRstand (4.8 km/h) in series I vs II and I vs III are statistically significant ($p<0.0001$). (R – Person's correlation coefficient)*

ugh moderate (about 35% HRmax) during hiking, up to high (up to 50% HRmax) during health gymnastics or dances. Individually undertaken exercises never exceeded 60% HRmax.

Mean values (±SD) of resting HR recorded during the programme are presented in Fig. 2, showing a significant ($p<0.001$), decreasing tendency, from 77.2 ± 4.6 bpm at the beginning, down to 66.4 ± 5.1 bpm at the end of Stage III.

Along with that, energy expenditure increased from about 600 kcal/week at the beginning of Stage II up to 1100 kcal/week at the end of that stage. During Stage III, energy expenditure ranged from 600 to 1000 kcal daily.

Participation in PRAAP improved work capacity of women as reflected by the results of walking test. As shown in Fig. 3, the regression of log HR on walking speed is significantly ($p<0.001$) steeper at the beginning than after Stages II or III. At the beginning, heart rate increases by nearly 11% with every km•h^{-1}, while after Stages II or III, increases by only 8% with walking speed increase by one km•h^{-1}. Thus, mean values of individual standard HR (at walking speed equal to 4.8 km•h^{-1}) at the beginning and after Stage II or III, amount to 101.5, 87.3, and 83.6 bpm, respectively. The initial value differs significantly ($p<0.001$) from the latter two.

Discussion

Regular physical activity is considered one of the principal factors of the so-called successful ageing (16), in which achieving certain level of work capacity enables attaining self-empowerment and self-dependence. The objective of PRAAP is to encourage aged people to undertake regular physical activities, and in order to achieve that, prospective participants are to be convinced of the necessity to be active and to change their life style. This would be rewarded by experiencing satisfaction from direct participation in training sessions, and from the results of training. Of course, those results would, to a high degree, depend on what given participant expected from his/her participation and work input. One such expectation, most frequently declared, is an improvement of the general condition, or physical fitness, and this may be fulfilled by regularly attending PRAAP, whose Stage II, lasting 22 weeks, offers health gymnastics, walks, and a 14-day vacation stay (Stage III) with its variety of activities.

The relationship between heart rate and exercise load (walking speed) is a simple, yet efficient measure of cardiorespiratory adaptation to physical exercise.

The here applied workloads are lower than those usually recommended for assessing work capacity and safe for aged people. The test does not require any special equipment and may thus be conducted everywhere. Moreover, Ziemba and Kozłowski (21) demonstrated that test results serve as a good indicator of adaptation to exercise, and the same followed from this study. Namely, sedentary women who participated in PRAAP exhibited a decreased relationship between heart rate and walking speed, compared with the pre-training state, as well as a decrease in standard heart rate. In other words, cardiovascular system of those who completed Stage II of PRAAP was less stressed than at the beginning of the programme. Standard HR was further decreased following the last 14 days (Stage III) of active recovery, and the same was true for resting heart rate. It can be concluded that workloads applied during Stage III of PRAAP constituted an additional stimulus, which enhanced the beneficial results achieved through participation in 22-week programme by subjects, who then could be classified as physically active.

Summarizing: exercise intensity applied in PRAAP, even as low as 30 – 50% of individual HRmax, brings about improved cardiovascular function, as reflected by decreased heart rate at standard load (walking speed equal to 4.8 km•h^{-1}). It is to be emphasised, that energy expenditure at the end of Stage II amounted to about 1000 kcal weekly, while in Stage III about the same amount of energy was spent daily.

High attendance at programme sessions, amounting to 98.3% at group trainings and 80% at individual activities, significantly contributed to achieving satisfactory results. Another positive effect of attending PRAAP was continuation of regular motor activities by participants after the programme has been terminated.

However slight the improvement in physiological indices might appear, a significant change in the life style of PRAAP participants is a tremendous achievement, as it meant changing attitudes towards prevention, instead of remaining sedentary with all its negative consequences.

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