ADHERENCE TO PHYSICAL ACTIVITY IN PATIENTS WITH CORONARY ARTERY DISEASE

Veronika Drbošalová, Pavel Stejskal, Jan Bajorek*, Eliška Sovová*, Miloslav Klugar, Olga Hynková, Václav Krejčíř, Hana Cipryanová

Faculty of Physical Culture, Palacký Univerity, Olomouc, Czech Republic
**Faculty of Medicine and Dentistry, Palacký University, Olomouc, Czech Republic*

Submitted in January, 2011

OBJECTIVE: The aim of this study was to evaluate the adherence to a physical activity (PA) in an annual interventional programme of domiciliary rehabilitation designed for patients with coronary artery disease.

METHODS: The final group consisted of 20 patients (4 women and 16 men) from the 1st Internal Department – University Hospital of Olomouc. The mean age of patients was 61.95 ± 11.02 years. They were split into three groups in accordance with the method of monitoring PA. Group 1 (G1) used a pedometer, group 2 (G2) used a heart rate monitor and group 3 (G3) used both types of equipment simultaneously. Patients recorded the number of steps, the duration of the exercise (G1 and G3) or the average heart rate (G2 and G3), entering this information into the archive system. The checking of monitored indicators took place after 3, 6 and 12 months.

RESULTS: The adherence to the programme varied a lot (60–360 days). The results showed that the lowest one was in the case of patients from G1 and the highest one was in the third group of patients. Only 2 patients from group G3 managed to finish the programme (10% of the total number). We found no statistically significant difference between the groups in any of the quality indicators of a physical activity (number of steps, duration of the exercise, estimate of the weekly caloric output and total caloric output during exercise).

CONCLUSIONS: Using a pedometer has seemed to be an easy way to monitor the amount of a physical activity. Low adherence to the programme results from a fixation on a sedentary lifestyle, as well as from psychological and social causes.

Keywords: Aerobic exercise, pedometer, heart rate monitor, motivation.

INTRODUCTION

Cardiovascular disease is a major cause of disability and premature death throughout the world, and contributes substantially to the escalating costs of health care (WHO, 2007), though one of the most effective and least expensive therapies for cardiovascular disease is exercise (Schober & Knollmann, 2007). Regular physical activity using large muscle groups produces cardiovascular adaptations that increase exercise capacity, endurance, and skeletal muscle strength. Habitual physical activity also prevents the development of coronary artery disease and reduces symptoms in patients with established cardiovascular disease (Thomson et al., 2003).

Cardiovascular rehabilitation after myocardial infarction (MI) improves the prognosis of those affected. It leads to an improvement in tolerance towards exercise and is closely linked to a better prognosis. It has an influence on the reduction of risk factors and the most important effect is the undoubted improvement in the patients' quality of life. The treatment process relies upon the knowledge gained from basic research and the results of bigger studies. Regular employment of physical activity (PA) not only works as a significant factor in the prevention of cardiovascular diseases yet should also be a necessary part of complex therapy. Although this information is generally accepted, less than only a third of the patients in Europe go through complex rehabilitation (Chaloupka, 2004; Giannuzzi et al., 2003).

Aerobic (endurance) training is the base for PA in people having been affected by MI. The foundations of aerobic exercise involve regular and rhythmic exercises, which employ larger groups of muscles. The most common forms are walking, running, swimming, cycling or exercising on stationary machines (Chaloupka & Elbl, 2005; Thompson et al., 2003; AACPR, 2004; Leon, 2000; Fletcher et al., 2001).

Assessment of load intensity is the most important part of physical activity prescription. It should be from 60 to 80% VO_2max. The duration of physical activity should be 30–45 minutes (in long term hypokinetic people at first 20 minutes) and frequency on alternate days preferably (ACSM, 1995; Polock et al., 1984; Sharkey, 1991; Shephard & Balady, 1999; Thompson et al., 2003). According to the latest recommendations to promote and maintain health, all healthy adults aged 18 to

65 years need moderate intensity aerobic (endurance) PA(40–60% VO_2max) for a minimum of 30 min. on five days each week or vigorous intensity (> 60% VO_2max) aerobic PA for a minimum of 20 min on three days each week (Haskell et al., 2007).

In order for PA to be fully effective, it is important to follow the duration of the patient's PA exercise activities (adherence to the PA programme) (Stejskal et al., 2007). The area of adherence is very complicated due to the non-unified nature of times and methodology. Therefore, it is impossible to draw definite conclusions in this area. The following are examples of risk factors which lower adherence to PA: age, excess weight, smoking, a higher level of neuroticism and depression, and a lower awareness of one's abilities and self-management (Daďová et al., 2007).

The definite determination of causes of very poor long term adherence into the programme of physical activity is still confused. In order to bridge this gap in the literature, the aim of our work was: (a) to evaluate the use of the most frequent means (pedometer and heart rate monitor) for checking PA; (b) to find out the level of adherence to this PA in terms of the domiciliary rehabilitation programme; (c) to evaluate the effectiveness of the programme according to quality indicators of physical activity intervention in patients with coronary artery disease.

METHODS

Patients from the I. Internal Department – University Hospital of Olomouc with coronary artery disease (CAD) made up the subjects of this experiment. These patients still in the process of hospitalisation received instructions about the significance of a healthy lifestyle for patients with CAD, especially about regular PA. In case of interest in the yearly intervention programme (see below), they were to be invited to basic investigation three or four weeks after hospitalisation.

From November 2006 to January 2009, 57 patients signed up, having undergone the basic investigation. Forty of them got actively involved in the programme and were split into three groups on the basis of their level of interest: group G1 used a pedometer YAMAX Digi Walker SW 200 (Schneider et al., 2004), group G2 used a POLAR A3 heart rate monitor and group G3 used both instruments simultaneously.

The biggest focus was targeted at monitoring the PA through a pedometer; there were 20 patients in group G1 yet it was only possible to make records for 8 of them. There were 10 patients in group G2 and 7 of them were subject to the records. There were 10 patients in group G3 and records were made for 5 of the patients.

The final group thus consisted of 20 patients (4 women and 16 men) from 41 to 77 years, their mean age was 61.95 ± 11.02 years, their body weight was 83.35 ± 15.13 kg, their body height was 176.5 ± 10.80 cm, their BMI was 26.60 ± 3.16 kg/m^2 and the VO_2max was 23.30 ± 4.11 ml.kg^1.min^{-1} (TABLE 1).

The most common form of PA in groups G2 and G3 was walking (n = 8), cycling or using an exercise bike (n = 7), swimming (n = 3), Nordic walking (n = 2), downhill skiing (n = 1) and rowing (n = 1). Most patients combined these types of PA. The most common combination was walking with cycling or the exercise bike (n = 9).

TABLE 1
Characteristics of the group

Group n = 20					
	Age [years]	**Weight [kg]**	**Height [cm]**	**BMI [kg/m^2]**	**VO_2max [ml.kg^1.min^{-1}]**
M	61.95	83.35	176.50	26.60	23.30
SD	11.02	15.13	10.80	3.16	4.11
Max.	77.00	110.00	197.00	33.30	30.00
Min.	41.00	50.00	155.00	20.80	14.00

Legend: n – number of patients, *M* – arithmetic mean, *SD* – standard deviation, Min. – minimum value, Max. – maximum value

TABLE 2 presents the most common case history for patients according to individual groups.

The investigation involved a spiroergometric test (a ramp protocol with an extra load of 10–20 W/min. depending on weight) until exhaustion, and echocardiography.

Furthermore, the patients underwent basic anthropometric and blood pressure measurements and blood analysis was done. The patients then received a fortnight's worth of instruction about the specific conditions for their yearly intervention programme.

Cycling sports, speed walking, exercise biking, cycling, swimming and Nordic walking were chosen as activities depending on the interests of and possibilities available to individual patients; two patients chose downhill skiing and rowing. On the basis of the maximal spiroergometric test, an optimal level of intensity was chosen to be 60% with a maximum heart rate reserve of (MHRR) (± 5 beats/min.) for patients with a heart rate (HR) monitor. The recommended duration of exercise was 30 to 40 minutes and the frequency of exercise sessions was: every alternate day (i.e. 105 to 140 minutes per week) (ACSM, 1995; Shephard & Balady, 1999; Thompson et al., 2003; Haskell et al., 2007) for patients with a pedometer 8,000 steps per day were recommended, which were increased to 10,000 steps per day depending on the health and subjective feelings of the patient (Hatano, 1993; Tudor-Locke & Bassett, 2004).

The patients from all groups recorded their entire PA into record archives used for this programme. The pa-

tients should wear the pedometer all day and the heart rate monitor during the exercise. Checking of monitored indicators took place after 3, 6 and 12 months.

For patients with the heart rate monitor, we estimated their caloric output during exercise on the basis of the positive relationship between the known intensity of circulation (% MHRR) and the derivative metabolic intensity (% VO_2max). We started off from the Karvonen formula, % VO_2/kg max = (VO_2/kg max : 3,5) + 60 (Karvoven et al., 1957; ACSM, 1980) and subsequently we have assessed exercise HR: $HR_{exercise}$ = [(% VO_2/kg max : 100). (HR_{max} – $HR_{resting}$)] + $HR_{resting}$ (Astrand & Rodahl, 1977). The caloric output was subsequently calculated from the measured laboratory values VO_2max, % MHRR, the caloric equivalent (4.8 kcal) and the duration of the exercise for either one week or for the whole time of the experiment. A resultant value was relatived to 1 kg of weight.

The software Statistica 6.0 was used for data analysis. The basic characteristics of the study group are presented as means, standard deviations and maximal and minimal values. Differentials between groups were evaluated by means ofthe Mann-Whitney U test. In all analyses the differences were considered significant at $p \leq 0.05$. Cohen's coefficient d (Cohen, 1988) was calculated for the determination of effect size between two variables. The values of 0.2, 0.5 and 0.8 were interpreted according to the small, medium and large ranges of Cohen's standard.

The study was approved by the Ethical Committee of the Faculty of Physical Culture at Palacký University in Olomouc.

TABLE 2
The most common case history in groups

	NSTEMI	STEMI	IM	AP	APs	APns
G1 (n = 8)	4	3	1	0	0	0
G2 (n = 7)	2	2	0	1	1	1
G3 (n = 5)	1	2	0	1	0	1

Legend: G1 – group 1, G2 – group 2, G3 – group 3, NSTEMI – myocardial infarction without elevation of the ST area, STEMI – myocardial infarction with elevation of the ST area, IM – myocardial infarction, AP – angina pectoris, APs – stable angina pectoris, APns – non-stable angina pectoris

RESULTS

Adherence was evaluated in terms of records from the archives (ending recording = dropping of the programme).The level of adherence to the programme amongst the patients was low and fluctuated a lot (60–360 days). We recorded the lowest level of adherence in group G2 and the highest was in group G3 (TABLE 3). The PA records showed that the 12 month programme was completed by a mere 10% of patients (2 patients, both from group G3), whereas the others dropped out prematurely (TABLE 4). Certain patients claimed that they took part in the exercise programme yet merely failed to record such events. This was not to be trusted. We evaluated this situation as a decision of these patients to finish the programme.

TABLE 3
Duration of the programme in days for individual groups

	G1	G2	G3
M	123.75	111.43	216.00
SD	58.78	64.14	136.46
Min.	60.00	60.00	90.00
Max.	240.00	210.00	360.00

Legend: G1 – group 1, G2 – group 2, G3 – group 3, *M* – arithmetic mean, *SD* – standard deviation, Min. – minimum value, Max. – maximum value

TABLE 4
Finishing the programme in particular groups

Month of finishing the programme	n				%	
	G1	G2	G3	Total	Month	Total
1.	0	1	0	1	5	5
2.	1	1	0	2	10	15
3.	3	2	2	7	35	50
4.	2	1	0	3	15	65
5.	0	0	0	0	0	65
6.	1	1	1	3	15	80
7.	0	1	0	1	5	85
8.	1	0	0	1	5	90
9.	0	0	0	0	0	90
10.	0	0	0	0	0	90
11.	0	0	0	0	0	90
12.	0	0	2	2	10	100

Legend: G1 – group 1, G2 – group 2, G3 – group 3

PA evaluation for individual patients according to the groups

The number of steps for groups G1 and G3 is given in TABLE 5. The average amount of steps per day in group G1 was 9,964 ± 4,324, while in group G3 it was 7,711 ± 4,639. The average amount of steps per day in group G1 did adhere to the recommendations, yet proved to be lower in group G3. Five patients belonging to group G1 either fulfilled or exceeded the recom-

mended amount of steps, whereas three did not achieve the recommended level. In group G3 just one patient exceeded the recommended number of steps, whereas the remaining four did not fulfil the required amount. The patients who managed to complete the whole programme achieved the highest average, yet also the highest total number of steps in both groups. We did not find any statistically significant differences between groups G1 and G3 in terms of the average daily amount of steps (p = 0,107, d = 0,51).

The total period and average period per week of exercise are given in TABLE 6. The average period per week of exercise in group 2 was 340.63 ± 279.94 minutes, in group 3 was 255.82 ± 180.10 minutes. Six patients either fulfilled or exceeded the recommendations in group G2, as four patients did the same in group G3. Even these parameters did not give us any statistically significant differences between groups G2 and G3 (p = 0.291, d = 0.25), (p = 0.685, d = 0.35).

TABLE 7 presents the average HR during exercise and % maximum heart rate reserve for patients of groups 2 and 3. The average value of $HR_{exercise}$ in group G2 was 93.00 ± 10.74 and in group G3 it was 96.21 ± 10.21. We did not find any statistically significant differences between groups G2 and G3 in these indicators (p = 0.309, d = 0.50). We have calculated circulation intensity – % MHRR, in group G2 the average value was 48.50 ± 16.84 and in group G3 it was valued at 45.50 ± 4.04. Even these parameters did not give us any statistically significant differences between groups G2 and G3 (p = 1.000, d = 0.18). Only two patients from group G2 fulfilled the recommendations.

TABLE 8 presents the weekly caloric output during exercise for groups G2 and G3. Two patients from group G2 did not fulfil the recommendations, whereas the remaining five either managed to do so or even exceeded them. Two patients from group G3 had a level of caloric output during exercise, which was significantly lower than the recommended one, whereas the remaining two managed to fulfil recommendations. We did not record a statistically significant difference between groups G1 and G2 (TABLE 8).

We estimated the total caloric output for patients from groups G2 and G3, which allowed us to compare the patients. There were massive differences among individual probands, with the highest value in both groups being around 121 Mcal and the lowest in group G2 being around 3 Mcal, and 2 Mcal in group G3. We did not record any statistically significant difference between groups G2 and G3 (TABLE 8).

DISCUSSION

The aim of our work was to evaluate the use of the most frequent means for checking PA and adherence to this PA in terms of the domiciliary rehabilitation programme for patients with coronary artery disease.

There is a host of materials devoted to the positive influence of PA as a form of prevention of cardiovascular disease (Leon et al., 2005; Dunn et al., 1997; European Heart Failure Training Group, 1998; EUROASPIRE II Study Group, 2001; Myers, 2003; Rockhill et al., 2001). For example as early as in 1988 Oldridge et al. made a meta-analysis of 10 selected trials of rehabilitation following myocardial infarction. The results indicated a significant reduction of 24% for all causes of death and 25% for cardiovascular mortality in 2,202 patients allocated to comprehensive cardiac rehabilitation when compared with 2,145 control subjects. The results of these studies are generally accepted yet the motivation to an adequate level of physical activity will remain a major challenge to researchers in the context of cardiovascular prevention. There will be a growing interest in evaluating alternative approaches to treatment (Shepard & Balady, 1999).

Although exercise is considered to be the easiest type of rehabilitation for patients with coronary heart disease, their maintenance in exercise programs is difficult most of the time. Approximately 20–25% of patients drop out of exercise programs within the first three months and about 40–50% within 6 to 12 months (Song et al., 2000; Oldridge, 1982). People, who devote themselves to PA for a minimum of 6 months generally gain the psychological and biological ability to minimalise situation barriers, which come hand in hand with the exercise (Dishman, 1984).

King et al. (2009) discovered that adherence to a healthy lifestyle pattern has decreased over the last 18 years. These findings have broad implications for the future risk of cardiovascular disease in adults. Adherence to a healthy lifestyle has dropped in the last 18 years. Furthermore, individuals with a history of hypertension, diabetes or cardiovascular disease were no more likely to be adherent to a healthy lifestyle than people without these conditions. On the other hand, Macchi et al. (2009) discovered in their study that 65% of the elderly patients who have attended post acute inpatient cardiac rehabilitation after cardiac surgery are still capable of recovering or even increasing their regular physical activity and of maintaining these favourable lifestyle changes at least for 1 year. Perri et al. (2002) stated that prescribing a higher frequency increased the accumulation of exercise without a decline in adherence, whereas prescribing a higher intensity decreased adherence and resulted in the completion of less exercise.

TABLE 5
Number of steps for groups 1 and 3

	G1		G3		AG1 : AG3		BG1 : BG3	
	A	**B**	**A**	**B**	***p***	***d***	***p***	***d***
M	1,183,591	9,964	1,569,303	7,711	0.770	0.36	0.112	0.51
SD	856,699	4,324	1,383,216	4,639				
Min.	428,979	690	387,105	154				
Max.	2,820,460	25,881	3,738,546	28,173				

Legend: G1 – group 1, G3 – group 3, *M* – arithmetic mean, *SD* – standard deviation, Min. – minimum value, Max. – maximum value, A – total number of steps/patient, B – average amount of steps per day/patient, *p* – level of statistical significance (Mann-Whitney U test), *d* – effect size (Cohen's coefficient)

TABLE 6
Duration of exercise for patients from groups 2 and 3

	G2		G3		G2A : G3A		G2B : G3B	
	A	**B**	**A**	**B**	***p***	***d***	***p***	***d***
M	5,781.29	340.63	7,379.00	255.82	0.291	0.25	0.685	0.35
SD	7,249.39	279.94	5,215.19	180.10				
Min.	495.00	57.70	479.00	37.26				
Max.	21,615.00	840.58	15,119.00	506.72				

Legend: G2 – group 2, G3 – group 3, *M* – arithmetic mean, *SD* – standard deviation, Min. – minimum value, Max. – maximum value, A – total duration of exercise in minutes/patient, B – total duration of exercise in minutes for a week/patient, *p* – level of statistical significance (Mann-Whitney U test), *d* – effect size (Cohen's coefficient)

TABLE 7
Exercise heart rate and maximum heart rate reserve for patients of groups 2 and 3

	G2		G3		G2 : G3 HR		G2 : G3 % MHRR	
	$HR_{exercise}$	**% MHRR**	**HR**	**% MHRR**	***p***	***d***	***p***	***d***
M	93.00	48.50	96.21	45.50	0.309	0.50	1.000	0.18
SD	10.74	16.84	10.21	4.04				
Min.	80	21	80	40				
Max.	125	74	127	49				

Legend: G2 – group 2, G3 – group 3, M – arithmetic mean, *SD* – standard deviation, Min. – minimum value, Max. – maximum value, $HR_{exercise}$ – heart rate during exercise, % MHRR – maximum heart rate reserve, *p* – level of statistical significance (Mann-Whitney U test), *d* – effect size (Cohen's coefficient)

TABLE 8
Estimate of the weekly and total caloric output during exercise for patients of groups 2 and 3

	G2		G3		G2B : G3B		G2A : G3A	
	B	**A**	**B**	**A**	***p***	***d***	***p***	***d***
M	20.14	33.01	13.57	47.56	0.345	0.42	0.705	0.43
SD	17.79	10.86	11.55	52.39				
Min.	4.99	2.95	2.60	2.34				
Max.	54.50	120.52	25.70	121.60				

Legend: G2 – group 2, G3 – group 3, M – arithmetic mean, *SD* – standard deviation, Min. – minimum value, Max. – maximum value, B – total caloric output in kcal/kg during exercise for a week/patient, A – estimate of the total caloric output in Mcal during exercise/patient, *p* – level of statistical significance (Mann-Whitney U test), *d* – effect size (Cohen's coefficient)

Only two patients managed to complete our 12 month programme. This statistic does indeed adhere to the often quoted 10% of adherence and it is possible to expect that the amount would drop further with time. Of our patients, 50% dropped out even during the first three months and 25% of the patients quit the programme between the sixth and twelfth month.

One of the parameters for the effectiveness of PA is its caloric demand. The recommendation for the caloric output during exercise is 10–25 kcal/kg per week (Stejskal, 2004). Our results suggest that the average value of the estimated caloric output per week and throughout the whole time of monitoring individual patients oscillated quite a bit. Where a small amount of probands are concerned it is impossible to statistically evaluate these differences. Despite this, it seems that using a combined system for following PA (monitoring heart rate + monitoring number of steps) did not affect these parameters.

Explaining the reasons for a very low level of adherence which does not only limit the effectiveness of the PA programme yet also the levels of mutual judgement and support, is very difficult. The reason is in the variations surrounding the problems, the breadth and variability of their influences upon individuals, which influence the possibilities for outer intervention in a negative manner. Moreover, there is the important and certain role of genetic predisposition linked to the realisation of physical regimes and their effectiveness. Whereas the given PA programme is very quickly effective for certain people, the same programme turns out to be ineffective for others.

Apart from certain physical dispositions in terms of exercising for a long time (state of health, age, capacity parameters limiting systems, etc.) psychological factors also play a very important role, which influence motivation and adherence (Štěrbová et al., 2008). The level of motivation in an individual's life is often judged in relationship to performance. If the individual is considered to be successful in activities, which he/she carries out, then he/she is strongly motivated and finds it easier to achieve the specified targets. However, these targets must be realistic and the opposite case sees them lowering motivation (Roberts, 2001). Annesi (2004) states that clearly defined targets become the main cause, which determines the level of allegiance to regular PA and simultaneously increases endurance and immunity. Personal factors also play a significant role (the ability to use strength, determination, work rate, tendency to stick to tasks and fulfil them), especially in situations where there is a lack of outer strength. The main target of our patients is, above all, their health and returning to a normal life. Even this seems insufficiently strong as a motive towards long term adherence. Getting used to a long-term lazy lifestyle wins against short-term positive motivation for most patients. Self-Determination Theory (SDT) distinguishes between amotivation (lacking any intention to engage in a behaviour), extrinsic motivation (where the behaviour is engaged in order to achieve outcomes that are separable from the behaviour itself) and intrinsic motivation (where the behaviour is engaged in for the enjoyment and satisfaction inherent in taking part) (Ryan & Deci, 2000). According to SDT's basic tenets, the successful maintenance of weight reduction would occur when people chose eating and exercise behaviours because they personally value weight loss maintenance and its health benefits accordingly, successful weight loss and long term maintenance would not be achieved if reasons for it were mostly controlling (e.g., because the doctor insisted or based on a strong desire to be thin, according to social norms). Being autonomous in one's relevant actions, that is, having an internal perceived locus of causality, is the crucial predictor of maintained behaviour change (Rose et al., 2005). In a recent study on the psychosocial predictors of weight management, an increase in intrinsic motivation for physical activity was the strongest predictor of long term weight change, even after adjusting for initial weight loss (Teixeira et al., 2006). SDT could be used to make the dynamics of motivation during lifestyle changes clear.

The quality of the prescription, which must take the abilities and possibilities of the individual into account, plays a very important role. Therefore, it is very important for the prescribed PA to have optimal intensity, duration, frequency and volume in order for it to adhere to the interests and possibilities of the individual. It is erroneous to prescribe one type of exercise and to insist upon it. A similar mistake is to not specify the type of exercise required or to put too much stress on checking it. The social environment may also play a significant role. Matouš et al. (2000) prefer group training to individual training for improved levels of adherence.

Taking these circumstances into account, it is very difficult to prescribe a PA programme as it is necessary to take a number of factors into consideration, including correctly estimating the weak and strong points of the patient (client or proband), correctly predicting the development of adherence and concentrating on the risk periods for future training.

Our work has shown that patients prefer a simple method of monitoring PA. Using a pedometer may be a very simple and effective way of motivating people to do PA and to measure their achievements (Tudor-Lock et al., 2004). The average daily value for the number of steps in group G1 adhered to the recommended 10,000 steps, yet G3 was around 25% under the recommended amount. Araiza et al. (2006) carried out a study with the aim of finding out whether the recommended 10,000 steps has an influence on reducing cardiovascular risks in patients with DM II. type or not. The PA of

patients increased by 69% during the 6 week intervention programme, the resting caloric output increased, the HDL: cholesterol level increased and the level of inhibitor activators of tissue plasminogens was positively influenced. Butler et al. (2009) discovered in their study that the pedometer based intervention was successful in increasing PA in cardiac patients after a 6 month cardiac rehabilitation programme. This programme also led to a greater adherence to PA.

CONCLUSION

Our study has shown that it is necessary to be devoted to the problematic area of adherence to PA. In order for the intervention programme to reach its aims, thus positively influencing the health of individuals, it must have a quality prescription and must be adhered to. The pedometer turned out to be the best of the devices used for monitoring the volume of PA. The patients with decades of a sedentary lifestyle behind them, which has social and psychological effects, turned out to show the lowest level of adherence. Despite the fact that these patients were aware of the risks to health resulting from a lack of PA, they still lacked the wilpower to complete the programme.

The limiting factors of our study include (a) the enormously low number of patients who finished the 12 month programme; (b) potential inaccuracies in the record archives; (c) insufficient surveillance during the programme. On the basis of these limits the follow up research should focus on eliminating inaccuracies in the records with more frequent checkups during the monitoring period by the means of mail service or internet mail service. It is necessary to increase the number of patients who start with the programme of physical activity by means of good motivation programme.

ACKNOWLEDGEMENT

The study has been supported by the research grant from the Ministry of Education, Youth and Sports of the Czech Republic (No. MSM 6198959221) "Physical Activity and Inactivity of the Inhabitants of the Czech Republic in the Context of Behavioral Changes".

REFERENCES

American College of Sports Medicine. (1980). *Exercise testing and exercise prescription* (2nd ed.). Philadelphia: Lea & Febiger.

American College of Sports Medicine. (1995). *Guidelines for exercise testing and prescription* (5th ed.). Baltimore: Williams & Wilkins.

American Association of Cardiovascular and Pulmonary Rehabilitation. (2004). *Guidelines for cardiac rehabilitation and secondary prevention programs.* Champaign, IL: Human Kinetics.

Annesi, J. J. (2004). Relationship of perceived health and appearance improvement, and self motivation, with adherence to exercise in previously sedentary women. *European Journal of Sport Science, 4*(2), 1–13.

Araiza, P., Hewes, H., Gashetewa, C., Vella, C. A., & Burge, M. R. (2006). Efficacy of a pedometer based physical activity program on parameters of diabetes control in type 2 diabetes mellitus [Abstract]. *Metabolism, 55*(10), 1382–1387.

Astrand, P. O., & Rodahl, K. (1977). *Textbook of work physiology.* New York: Mc Graw-Hill Book Company.

Butler, L., Furber, S., Phongsavan, P., Mark, A., & Bauman, A. (2009). Effects of a pedometer based intervention on physical activity levels after cardiac rehabilitation: A randomized controlled trial. *Journal of Cardiopulmonary Rehabilitation and Prevention, 29*(2), 105–14.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Elia, M. (2001). Obesity in the elderly. *Obesity Research, 9*(4), 244–248.

Daďová, K., Hyťhová, P., Pelíšková, P., Slabý, K., & Hošková, B. (2007). Adherence k pohybovým aktivitám. *Medicina Sportiva Bohemica et Slovaca, 16*(4), 170–177.

Dishman, R. K. (1984). Motivation and exercise adherence. *Psychological Foundations of Sport, 111,* 420–434.

Dunn, A. L., Marcus, B. H., Kampert, J. B., Melisa, E., Garcia, M. P. H., Kohl, H. W., & Blair, S. N. (1997). Reduction in cardiovascular disease risk factors: 6 months results from project active. *Preventive Medicine, 26,* 883–892.

European Heart Failure Training Group. (1998). Experience from controlled trials of physical training in chronic heart failure. Protocol and patients factors in effectiveness in the improvement in exercise tolerance. *European Heart Journal, 19,* 466–475.

EUROASPIRE II Study Group. (2001). EUROASPIRE II.: Lifestyle and risk factor management and use of drug therapies in coronary patients from 15 countries. *European Heart Journal, 22,* 554–572.

Fletcher, G. F., Balady, G., Amsterdam, E. A., Chaitman, B., Eckel, R., Fleg, J., Froelicher, V. F., Leon, A. S., Pina, I. L., Rodney, R., Simons-Morton, D. A., Williams, M. A., & Bazzarre, T. (2001). Exercise standards for testing and training: A statement for healthcare professionals from the American Heart Association. *Circulation, 104*, 1694–1740.

Giannuzzi, P., Saner, H., Björnstad, H., Fioretti, P., Mendes, M., et al. (2003). Secondary prevention

through cardiac rehabilitation. *European Heart Journal, 24*(13), 1273–1278.

Haskell, W. L., Lee, I. M., Pate, R. R., Powell, K. E., Blair, S. N., Franklin, B. A., Macera, C. A., Heath, G. W., Thompson, P. D., & Bauman, A. (2007). Physical activity and public health: Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports and Exercise, 39*(8), 1423–1434.

Hatano, Y. (1993). Use of the pedometer for promoting daily walking exercise. *International council for Health, Physical Education, and Recreation, 29,* 4–8.

Chaloupka, V. (2004). Rehabilitace nemocných po infarktu myokardu. *Medicína pro praxi. 2,* 65–68.

Chaloupka, V., & Elbl, L. (2005). Rehabilitace po infarktu myokardu (II): způsoby zátěže. *Kardiol. Rev., 7*(2),73–76.

Karvonen, M. J., Kentala, E., & Mustala, O. (1957). The effects of training on heart rate: A longitudinal study. *Ann. Med. Exp. Biol. Fenn., 35,* 307–315.

King, D. E., Mainous, A. G., Carnemolla, M., & Everett, C. J. (2009). Adherence to healthy lifestyle habits in US adults, 1988–2006. *The American Journal of Medicine, 122*(6), 528–534.

Leon, A. S. (2000). Exercise following myocardial infarction: current recommendations. *Sports Med., 29,* 301–311.

Leon, A. S., Franklin, B. A., Costa, F., Balady, G. J., Berra, K. A., Stewart, K. J., Thompson, P. D., Williams, M. A., & Lauer, M. S. (2005). Cardiac rehabilitation and secondary prevention of coronary heart disease. *Circulation, 111*, 369–376.

Macchi, C., Polcaro, P., Cecch, F., Zipoli, R., Sofi, F., Romanelli, A., Pepi, L., Sibilio, M., Lipoma, M., Petrilli, M., & Molino-Lova, R. (2009). One year adherence to exercise in elderly patients receiving postacute inpatient rehabilitation after cardiac surgery. *American Journal of Physical Medicine & Rehabilitation/Association of Academic Physiatrists Links, 88*(9), 727–734.

Matouš, M., Radvanský, J., Zajacová, R., & Mocková, K. (2000). Výsledky intervenčního programu u pacientů s projevy nebo rizikem ischemické choroby srdeční (ICHS). *Medicina Sportiva Bohemica et Slovaca, 9*(2), 69–73.

Myers, J. (2003). Exercise and cardiovascular health. *Circulation, 107*(1), 20–26.

Oldridge, N. B. (1982). Compliance and exercise in primary and secondary prevention of coronary heart disease: A review. *Preventing Medicine, 11,* 56–70.

Oldridge, N. B., Guyatt, G. H., Fischer, M. E., & Rimm, A. A. (1988). Cardiac rehabilitation after myocardial infarction. Combined experience of randomized clinical trials. *Journal of the American Medical Association, 260*(7), 945–950.

Perri, M. G., Anton, S. D, Durning, P. E., Ketterson, T. U., Sydeman, S. J., Berlant, N. E., Kanasky, W. F., Newton, R. L., Limacher, M. C., & Martin, A. D. (2002). Adherence to exercise prescriptions: Effects of prescribing moderate versus higher levels of intensity and frequency. *Health Psychology, 21*(5), 452–458.

Pollock, M. L., Wilmore, J. H., & Fox, S. M. (1984). *Exercise in health and disease.* Philadelphia: W. B. Saundres Company.

Roberts, G. C. (2001). *Advances in motivation in sport and exercise.* Champaign, IL: Human Kinetics.

Rockhill, B., Willet, W. C., & Manson, J. E. (2001). Physical activity and mortality: A prospective study among women. *American Journal of Public Health, 91*(4), 578–583.

Rose, E., & Parfitt, G. G. W. (2005). Exercise causality orientations, behavioral regulation for exercise and stage of change for exercise: exploring their relationships. *Psychology Sport Exercise, 6,* 399–414.

Ryan, R. M., & Deci, E. L. (2000). Self determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78.

Schneider, P. L., Crouter, S. E., & Bassett, D. R. (2004). Pedometer measurements of free living physical activity: Comparison of 13 models. *Med. Sci. Sports Exercise, 36*(2), 331–335.

Schober, T., & Knollmann, B. (2007). Exercise after myocardial infarction improves contractility and decreases myofilament Ca 2+ sensitivity. *Circulation, 100*(7), 937–939.

Sharkey, B. J. (1991). *Next dimensions in aerobic fitness.* Champaign, IL: Human Kinetics.

Shepard, R. J., & Balady, G. J. (1999). Exercise as cardiovascular therapy. *Circulation, 99,* 963–972.

Song, R., & Lee, H. (2001). Effects of a 12 week cardiac rehabilitation exercise program on motivation and health promoting lifestyle. *Heart and Lung, 3*(3), 200–209.

Stejskal, P. (1993). Preskripce trvání tréninku, jeho energetického výdeje a týdenní frekvence v rámci aerobní části programu tělesné aktivity. *Medicina Sportiva Bohemica et Slovaca, 2,* 93–98.

Stejskal, P. (2004). *Proč a jak se zdravě hýbat.* Břeclav: Presstempus.

Stejskal, P., Jakubec, A., Kováčová, L., Elfmark, M., Řehová, I., Petr, M., & Cipryan, L. (2007). Vliv rozdílné adherence k půlročnímu programu aerobiku na aerobní zdatnost. *Medicina Sportiva Bohemica et Slovaca, 16*(1), 14–25.

Štěrbová, D., Hrubá, R., Harvanová, J., Elfmark, M., & Otipková, D. (2008). Faktory adherence k pohybové aktivitě žen ve věku 40–65 let. *Československá psychologie, 52*(4), 378–387.

Teixeira, P. J., Going, S. B., Houtkooper, L. B., Cussler, E. C., Metcalfe, L. L., Blew, R. M., Sardinha, L. B., & Lohman, T. G. (2006). Exercise motivation, eating, and body image variables as predictors of weight control. *Medicine and Science in Sports and Exercise, 38,* 179–188.

Thompson, P. D., Buchner, D., Piña, I. L., Balady, G. J., Williams, M. A., et al. (2003). Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease. *Circulation, 107,* 3109–3116.

Tudor-Locke, C., & Bassett, D. R. Jr. (2004). How many steps/day are enough? Preliminary pedometer indices for public health. *Sports Medicine, 34*(1), 1–8.

WHO. (2007). *Prevention of cardiovascular disease: Guideline for assessment and management of cardiovascular risk.* Retrieved 2. 11. 2010 from the World Wide Web: http://www.who.int/cardiovascular_diseases/guidelines/Full%20text.pdf

ADHERENCE K POHYBOVÉ AKTIVITĚ U PACIENTŮ S KARDIOVASKULÁRNÍM ONEMOCNĚNÍM

(Souhrn agnlického textu)

CÍLE: Cílem studie bylo zhodnotit adherenci k pohybové aktivitě (PA) v rámci ročního intervenčního programu domácí rehabilitace u pacientů po infarktu myokardu.

METODIKA: Konečný soubor tvořilo 20 pacientů (4 ženy a 16 mužů) preventivní kardiologie Fakultní nemocnice Olomouc s koronarograficky prokázanou ischemickou chorobou srdeční ve věku 61,95 ± 11,02 let. Podle metodiky kontroly PA byli pacienti rozděleni do tří skupin. Skupina 1 (G1) používala krokoměr, skupina 2 (G2) monitor srdeční frekvence a skupina 3 (G3) oba přístroje současně. Pacienti zapisovali počet kroků, trvání cvičení (G1 a G3) nebo průměrnou srdeční frekvenci (G2 a G3) do záznamových archů. Kontrola sledovaných laboratorních a klinických ukazatelů probíhala po 3, 6 a 12 měsících.

VÝSLEDKY: Adherence k programu byla velmi variabilní (60–360 dní), nejnižší byla u pacientů skupiny G2 a nejvyšší ve skupině G3. Program dokončili pouze dva pacienti ze skupiny G3 (10 % z celkového počtu intervenovaných pacientů). Mezi jednotlivými skupinami jsme nezaznamenali statisticky významný rozdíl v žádném ze sledovaných ukazatelů kvality pohybové intervence (počet kroků, doba cvičení, odhad energetické spotřeby při cvičení).

ZÁVĚRY: Jako nejvíce akceptovaný prostředek ke kontrole objemu PA se jevil krokoměr. Velmi nízká adherence vyplývá z pevné fixace většinou několik desítek let trvajícího sedavého životního stylu a často má psychologické a sociální příčiny.

Klíčová slova: aerobní cvičení, krokoměr, monitor srdeční frekvence, motivace.

Mgr. Veronika Drbošalová

Palacký University
Faculty of Physical Culture
tř. Míru 115
771 11 Olomouc
Czech Republic

Education and previous work experience

2001–2007 – Faculty of Physical Culture, Palacký University in Olomouc – Recreology – Mgr.;
2007 – Ph.D. student in Kinanthropology at Palacký University in Olomouc, Faculty of Physical Culture;
2010 – work as wellness consultant.

Scientific orientation

Health nutrition, obesity, exercise physiology.

First-line publication

Drbošalová, V., Stejskal, P., Klimešová, I., Klugar, M., Krejčíř, V., & Hynková (Bartáková), O. (2010). Změny aktivity autonomního nervového systému a antropometrických ukazatelů u dvou typů redukčních programů. *Medicina Sportiva Bohemica et Slovaca, 19*(3), 144–151.

Drbošalová, V., Stejskal, P., Klugar, M., Krejčíř, V., & Hynková, O. (2010). Charakteristika klientů komerčního sportovního centra dle vybraných funkčních a antropometrických ukazatelů. *Medicina Sportiva Bohemica et Slovaca, 19*(4), 196–200.

Drbošalová, V., Cipryanová, H., Stejskal, P., Klugar, M., Hynková, O., Krejčíř, V., et al. (2010). Adherence to physical activity in patients with coronary artery disease. *Acta Universitatis Palackianae Olomucensis. Gymnica, 40*(4), 53–61.

Drbošalová, V., Stejskal, P., Klimešová, I., Šlachta, R., Bartáková, O., Jakubec, A., et al. (2008). Vliv komplexního půlročního redukčního programu na vybrané laboratorní ukazatele. In *Národný kongres telovýchovného lekárstva Aktuálne problémy telovýchovného lekárstva: abstrakty* (p. 10).

Drbošalová, V., Stejskal, P., Klugar, M., Hynková (Bartáková), O., Krejčíř, V., Bajorek, J., et al. (2009). Adherence k domácímu rehabilitačnímu programu pohybové aktivity u pacientů po infarktu myokardu. In *Dny sportovní medicíny: sborník abstrakt* (p. 16).