ANALYSIS OF LOAD INTENSITY DURING THE WALK ON THE PATH OF HEALTH IN INDIVIDUALS WITH MYOCARDIAL INFARCT

Saša Pantelić*, Ratomir Durašković*, Milena Mikalački**, and Nebojša Čokorilo**

* The Faculty of Sport and Physical Education of Niš, Serbia
** The Faculty of Sport and Physical Education of Novi Sad, Serbia

Introduction

Based on data from various studies in industrially developed countries, heart and blood vessels diseases are one third to one half of all deaths: 33% in France, 39% in Japan, 48% in England and Wales and up to 52% in Finland (Ostojic, et all, 2002). Among them, myocardial infarct is a leading disease of cardiovascular system. Reality of the need to rehabilitate individuals with myocardial infarct urges not only from its frequency and increased number of diseases, but also from the very course of the disease which in time significantly reduces work abilities and leads to invalidity (Balady, et all, 2000).

Regularly prescribed and monitored physical activity as a part of a comprehensive rehabilitation program is a well recognized standard for care and rehabilitation of individuals with cardiovascular diseases, especially those after acute myocardial infarct. Long term programs of physical education can improve myocardial function in individuals with heart diseases and there are also some evidence supporting the fact that physical activity is necessary in rehabilitation of individuals with myocardial infarct (Leopn et al., 1990).

Rehabilitation of individuals with myocardial infarct is carried out in three phases (Hadzi Pesic et al., 1992): intra-hospital, post-hospital and clinic. Post-hospital phase is carried out in specialized rehabilitation centers where physical activity programs are realized. An argument for this is the fact that specialized centers have diagnostic possibilities for full control and monitoring of realization of this phase (Hadzi-Pesic, Ilic, & Markovic, 1986). Before this phase begins, effort tolerance of every patient has to be determined and on the basis of that we can valuate everyday physical activity. At the end of this phase effects of physical exercise and work ability are assessed.

Exercises which are prescribed to individuals with myocardial infarct have changed from standard exercises for all patients to a special exercise treatment for every patient individually. This kind of treatment is determined on the basis of risk factors, age and functional condition of a patient. Physical activity program should be planned according to special, individual characteristics of every patient, since exercise provokes an instant increase of work of heart muscle (Bloss, 1991, as cited Vuckovic, 1996). It is necessary to arrange exercise program according to characteristics and momentary abilities of every individual in order to recognize safe and positive exercise effects.

The most important determinants of physical exercise are intensity, duration, frequency and type of physical load. When carrying out the program of physical activity it is necessary for an exercise to have dynamic work, such as walking, running, stairs climbing, cycling, swimming, etc. Load intensity should be higher than of everyday activities in order to provoke positive changes, but under the level that leads to clinical symptoms and pain. Also we have to be careful to keep exercise intensity above the lower threshold of intensity, because otherwise the exercise would not produce expected effects.

Programming and dosing load intensity during the program of physical activity can be done on the basis of external (physical) and internal (physiological) indicators. External indicators of load are activity duration, rest duration, number of repeated exercises, etc, and internal indicators of load are indicators of a response of some organ systems and organism as a whole to applied load: heart rate, breathing rate, artery blood pressure, etc (Mikalacki, 2005).
Heart rate is most frequently used as the most common internal indicator of load level during the exercise. This is an indicator that during the activity itself gives information on cardiovascular system load (Mikalacki, 2005). ACSM (American College of Sports Medicine, 2000) emphasizes the need to measure heart rate in order to determine appropriate level of effort for every individual. According to recommendations of ACSM exercise must not be measured only by crossed distance, number of repentances or spent time, but also the degree of physical load of organ systems must be controlled. Thank to its wide applicability and simplicity of its use this method (pulsemetry) is most frequently used method for assessment of load level during physical activity (Bell & Bassey, 1994; Gilmann, 1996).

During realization of physical activity in individuals with myocardial infarct it is necessary for exercise to be carried out in specified load zone. Various authors recommend certain zones of exercise intensity for individuals with myocardial infarct and according to these authors exercise intensity can be determined on the basis of percentage of maximal oxygen intake (VO2max) (Savage, Brochu, Poehlman & Ades, 2003; Dressendorfer, et all, 1995) or according to the heart rate achieved on the load test on ergometer (Grodzinski, Jette, Blumchen & Borer, 1987; Newton, Mutrie, & McCarthur, 1991; Hadzi-Pesic et al., 1992). Load for individuals who recovered from myocardial infarct is between 40% and 70% of VO2max according to these authors, or from 50% to 85% of maximum heart rate achieved on the load test.

Exercise should be dynamic, isotonic or aerobic type in order to provoke positive effects. It is also necessary to determine which load intensity is ideal for individuals of different age who had myocardial infarct.

Since we should approach very carefully to dosing and exercise realization in individuals with myocardial infarct, it is necessary to determine if the load during the physical exercise program has satisfactory intensity to make positive changes in human body. It is also necessary to determine if it has lower or higher intensity than recommended one, depending on age and condition of every individual at that moment. The aim of the research is to determine and analyze load intensity, monitored by heart rate, during the walk on the paths of health in individuals who recovered from myocardial infarct.

Applied Method

The research was conducted on the sample of men of chronological age from 50 to 60 (n=30), who were on rehabilitation with physical exercise on Institute for Rheumatic and Cardiovascular Diseases “Niska Banja” (Table 1). Exercise program consisted of shape exercise, walking on the paths of health and riding bicycle-ergometer. Analysis of load intensity was carried out by controlling the response of cardiovascular system to the load during the walk on the health path.

Table 1. The basic statistic parameters of the experimental group (n=30)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSTAR</td>
<td>56.7</td>
<td>50.0</td>
<td>60.0</td>
<td>10.0</td>
</tr>
<tr>
<td>AVIST</td>
<td>171.9</td>
<td>148.2</td>
<td>187.0</td>
<td>38.8</td>
</tr>
<tr>
<td>AMAST</td>
<td>80.6</td>
<td>51.8</td>
<td>102.8</td>
<td>51.0</td>
</tr>
<tr>
<td>BMI</td>
<td>27.2</td>
<td>21.7</td>
<td>32.8</td>
<td>11.13</td>
</tr>
</tbody>
</table>

Legend: Mean – means, Min – minimal value, Max – maximal value, Range – range, GSTAR - age, AVIST –body height, AMAST –body weight, BMI – Body mass index

Condition that subjects had to fulfill in order to participate in research is that they had to have myocardial infarct three to four months ago (chronical phase) and that on the basis of ergometer test they could handle load on track 2. All subject voluntarily accepted to participate in the research.

Pulsemeter PC-9 Sigma (made in Germany) was used for controlling the load intensity. On the basis of maximum heart rate (MHR) which is achieved during the ergometer test and determined by the Jovanovic’s formula (1999), value of hart rate for certain load zones was determined. Zones that were automatically obtained by putting basic data into pulsemeter were used as the load zones in the research. Three zones of load were used (according to the SIGMA Gmbh):
HZ (Health Zone) which has intensity from 55% to 70% of MHR. This zone generally has influence on health improvement and body mass reduction.

FZ (Fitness Zone) intensity of this load zone is between 70% to 80% of MHR. This zone generally has influence on improvement of muscular and skeleton fitness and condition.

PZ (Power Zone) whose load intensity is from 80% to 100% of MHR. This is load which is rarely applied in recreation and more frequently it is used in sport in order to achieve maximum sport results.

With the help of pulsemeter, time and percentage of heart rate in different load zones were determined. The following variables were measured: percentage (HZ%) and total time (HZ TIME) spent in the health zone, percentage (FZ%) and total time (FZ TIME) spent in fitness zone, percentage (FZ TIME FZ%) and total time (FZ TIME) spent in power zone. Besides these variables also total walking time (TOTAL TIME) (min.sec) and average heart rate (AVEHR) (b/min) were measured.

Measurement results were assessed with the help of statistical package for data assessment STATISTICA 6.0.

**Results**

Table 2 shows basic parameters of load intensity of measured variables for all subjects included in experiment. Analyzing results we can say that total walking time was 17.33 minutes (TOTAL TIME). Time spent in health zone (HZ TIME), which was recommended exercise zone, was 10.38 minutes, that is 61.9% (HZ).

Those results are in accordance with earlier studies, where various authors actually recommended this load intensity in realization of physical exercise program in individuals with myocardial infarct (Grodzinski, et all, 1987; Newton, et all, 1991; Hadzi Pesic et al., 1992).

<table>
<thead>
<tr>
<th>Variables</th>
<th>TOTAL TIME [min.sec]</th>
<th>HZ TIME [min.sec]</th>
<th>HZ [%]</th>
<th>FZ TIME [sec]</th>
<th>FZ [%]</th>
<th>PZ TIME [sec]</th>
<th>PZ [%]</th>
<th>AVE HR [b/min]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17.33</td>
<td>10.38</td>
<td>61.9</td>
<td>35</td>
<td>3.3</td>
<td>2</td>
<td>0.2</td>
<td>92</td>
</tr>
</tbody>
</table>

Lazovic (1992) suggests that exercise intensity should be about 70% of maximum heart rate achieved on load test, and that physical activity should engage large muscle groups. Author argues that walking, jogging, stairs climbing, riding a bicycle, swimming, using a treadmill or bicycle-ergometer are the most ideal physical activities which are applicable in those individual. Similar load has been suggested by Franklin (Franklin, 1998). Nedeljkovic, Kanjuh and Vukotic (2000) argues that exercise intensity should be determined according to heart rate achieved at the end of the load test and it should be from 65% to 85% of heart rate. Authors argues that program of cardio rehabilitation with physical exercises always starts with lower intensity which gradually increases during the program.

Time of 35 minutes averagely that subjects spent in fitness zone (FZ ZONE) suggests very short period of time that subject spent in this load zone. Since the primary goal of cardio rehabilitation with physical exercise was not to influence the improvement of muscular and skeleton system and fitness in these individuals, but to significantly improve myocardial function, exercise that was carried out proved that, which is in the accordance with researches of other authors (Leon et al., 1990)

It is necessary to pay attention on the fact that average values of heart rate in realization of physical activities (AVE HR) during walking program are within the limits of load that is recommended for this sample.
On the basis of data about time spent in some of the load zones, we can say that subjects included in experiment spent great part of that time in predicted zones of load intensity (if observed in terms of percentage). (Chart 1)

**Chart 1.** Values of total time spent in particular intensities zones.

Time that has left from total walking time and where predicted values of heart rate were not reported (about 6.5 minutes), suggests that load intensity in some of the phases of realization of walking program was somewhat lower than recommended values. Data obtained in this way were expected because during the walking program there were some pauses when breathing exercise were done as a part of this program.

**Discussion**

Walking as a natural form of moving has developed during last ten years into recreational activity of great number of people regardless of their health. In individuals with myocardial infarct walking represents a basic physical activity during the rehabilitation. Exercise programs that are appropriately dosed can significantly improve myocardial function and some researchers point out the significance of exercising during rehabilitation in individuals with myocardial diseases (Leon et al., 1990). When dosing the load we must have individual approach for every man and numerous modern instruments allow us to monitor certain parameters during physical activities. One of these instruments is heart rate monitors (pulemeters) which is used to monitor pulse, because the pulse is the most frequently used indicator for load of cardiovascular system.

The research that was carried out had the aim to determine and analyze load intensity, monitored with the help of heart rate, during the walk on the health paths in individuals who recovered from myocardial infarct. On the basis of obtained data, it was determined that average heart rate (AVE HR) was 92 b/min, which is recommended value for subjects of this experiment. It is necessary to say that during the walking program maximum heart rate was not measured (because of the characteristics of pulsemeter), but that on the basis of average values spent in some zones it was very low.

Expressed in percentage, high values of heart rate which are in the health zone (HZ%) of almost 62% show that dosing and controlling load intensity during the walk was performed very well, because the heart rate was within this zone for the most of the time.

Analyzing load intensity in subject engaged in this experiment shows the possibility to use heart rate monitor as a component in dosing and controlling of load intensity in individuals with myocardial infarct.
References


