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Optimization of Exercise Capacity in Sedentary Adults through Kinetic Programs

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Abstract

According to World Health Organization statistics, 60 to 85% of the world population has a sedentary lifestyle. This paper aims to examine whether there is any evidence to support the use of kinetic programs as an effective approach for the optimization of exercise capacity in sedentary adults. The study was conducted at a wellness center in Bucharest and was limited to a group of 5 subjects aged 35 to 45 years. Our training strategy, based on personal experience and on results of previous research, led to an improvement of the functional parameters of the research group.

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Keywords: exercise capacity, sedentariness, kinetic programs, quality of life, adults;

1. Introduction

According to World Health Organization statistics, 60 to 85% of the global population, both from the developed and the developing countries, has a sedentary lifestyle (WHO, 2013) This is one of the most severe and yet insufficiently approached issues nowadays. Lack of physical exercise may have severe implications on health. According to the World Health Organization, around 2 million of the annual deaths are caused by sedentariness, which places this factor among the top ten leading death and disability causes worldwide.

It is well known that physical exercise contributes to a healthy lifestyle. We have developed a series of kinetic programs which may be performed with ease by the subjects and which contribute to the improvement of their functional parameters. We noticed that our results were more efficient as compared to other training strategies and the subjects’ ability to perform their daily tasks was enhanced; therefore this pilot research aims to determine whether our observations may be objectified.

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2. Research methodology

2.1. Scope

Through this research we intend to develop a series of training programs which can lead to an improvement of the exercise capacity of sedentary people, offering them the opportunity of performing simple physical exercises which enhance their motivation and desire to work out.

2.2. Hypothesis

The use of our specific, individualized kinetic programs leads to the improvement of the sedentary adults’ peak oxygen consumption.

2.3. Subjects

The study was conducted from May to November 2012 in the wellness club “Le Club” in Bucharest on a group of 5 subjects aged 35 to 45 years old. The kinetic programs were individualized and applied for 8 weeks.

The inclusion criteria were:

- Gender: males/females;
- Age: 35 to 45 years old;
- Physical inactivity/insufficient physical activity (< 3 times per week);
- No diagnosis of chronic illnesses;
- Subjects’ written agreement to participate in the research study.

2.4. Methods and materials

To validate the hypothesis we have used the following research methods: bibliographic research, the observation method, the case study method as well as various specific tests for the assessment of functional parameters and QOLS scale for the self appreciation of one’s quality of life.

The subjects recruited for the research study were initially assessed to collect data for correct exercise prescription. The assessment consisted in various functional tests and anthropometric measurements and took place between 9-11 am. Specific assessment tools were used: metric tape measure, tonometer, bicycle ergometer, pulse oximeter, quality of life questionnaire.

The objectives of the kinetic program were:

- Improvement of the subjects’ exercise heart rate.
- Improvement of maximal oxygen uptake.
- Weight loss (when necessary).
- Improvement of the subjects' quality of life.

Kinetic programs are one of the most efficient and simple training methods at present. They are actually physical training programs that do not require the use of specialized equipment and may be practiced by any individual, whatever their age and fitness level. Kinetic programs are used both in physical therapy and fitness training programs for professional athletes. They consist of different strength, coordination and balance training exercises which contribute to the improvement of daily/sports activities performance and to accident prevention. Benefits reside in their contribution to the enhancement of the body’s natural capacity to move in all dimensions by using complex movements.
Kinetic programs are not a new or revolutionary concept, but rather a present-day reinterpretation of traditional training methods. Motivating people to be physically active will have long term positive implications over their quality of life.

The kinetic programs we used consisted in performing simple bodyweight exercises or exercises that required different types of equipment, such as dumbbells, stability balls, wobble boards, foam rollers, bands, medicine balls and stability discs. The workouts took an integrated approach to improving the coordination, flexibility, strength and overall conditioning of the subjects (Boyle, 2004). The physical exercises were adapted to the specificity of each subject’s daily activity and were designed according to their interests. They were organized as tasks with a well determined end purpose, thus requiring the subjects’ permanent attention and ability to solve the tasks through the most efficient ways.

Dragnea and Teodorescu (2002, cited by Ţerbănoiu and Virgil, 2007) have developed a complete approach to exercise parameters, which include the following: exercise duration, frequency, intensity and type.

We applied the same parameters in the description of the exercises our subjects have been submitted to as part of our research:

- Duration – 60 minutes; for each training session we used a maximum of 6-8 exercises, in 3-4 sets of 10-15 repetitions each. Resting time between sets varied from 30 to 90 seconds.
- Frequency – 4 times a week;
- Intensity – submaximal exertion;
- Type – aerobic exercise; specific strength, coordination and conditioning training.

30 days after the beginning of the training, the subjects were submitted to an interim assessment. We adjusted the workouts according to their functional responses. The final assessment was conducted at the end of the 8 weeks of training.

3. Results

The data collected from the initial assessment were summarized in Table 1. We used the submaximal Astrand and Rhyming Cycle Ergometer Test to determine maximal oxygen uptake. Assessment methodology consisted in constant pedalling at 150 Watts for 6 minutes (men) and at 100 Watts (women). Heart rate was measured at the end of minute 6 when subjects should have achieved a stable heart rate between 120-170 beats per minute. Maximal aerobic capacity was estimated using the Astrand-Rhyming nomogram.

\[
\text{VO}_2 \text{ max} \text{ may be estimated according to the age and gender of the subjects using the following formulas (M. Cordun, 2009):}
\]

- MEN: \(\text{VO}_2 \text{ max} \ (\text{ml/min/kg}) = 55 - (0.39 \times \text{age})\),
- WOMEN: \(\text{VO}_2 \text{ max} \ (\text{ml/min/kg}) = 41 - (0.39 \times \text{age})\).
Table 1. Initial assessment results

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Subject 1</th>
<th>Subject 2</th>
<th>Subject 3</th>
<th>Subject 4</th>
<th>Subject 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initials</td>
<td>C.D.</td>
<td>V.S.</td>
<td>A.M.</td>
<td>G.M.</td>
<td>L.M.</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
<td>Female</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td>Age (years old)</td>
<td>43</td>
<td>36</td>
<td>35</td>
<td>41</td>
<td>42</td>
</tr>
<tr>
<td>Chronic illnesses</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>175</td>
<td>172</td>
<td>165</td>
<td>176</td>
<td>181</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>79.5</td>
<td>57.6</td>
<td>58</td>
<td>88</td>
<td>90</td>
</tr>
<tr>
<td>Chest wall elasticity (cm)</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>2.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Abdominal perimeter (cm)</td>
<td>91</td>
<td>77</td>
<td>78.5</td>
<td>120.5</td>
<td>97.5</td>
</tr>
<tr>
<td>Body Mass Index (kg/cm²)</td>
<td>25.95</td>
<td>19.46</td>
<td>21.3</td>
<td>28.4</td>
<td>27.47</td>
</tr>
<tr>
<td>Blood pressure (mmHg)</td>
<td>135/80</td>
<td>120/80</td>
<td>120/70</td>
<td>140/90</td>
<td>130/80</td>
</tr>
<tr>
<td>Resting Heart Rate (BPM)</td>
<td>75</td>
<td>68</td>
<td>78</td>
<td>72</td>
<td>80</td>
</tr>
<tr>
<td>Exercise Heart Rate (BPM)</td>
<td>157</td>
<td>152</td>
<td>144</td>
<td>169</td>
<td>165</td>
</tr>
<tr>
<td>VO₂max (L/min) – formula</td>
<td>3.04</td>
<td>1.56</td>
<td>1.58</td>
<td>3.43</td>
<td>3.48</td>
</tr>
<tr>
<td>VO₂max (L/min) – Astrand–Rhyming nomogram</td>
<td>2.7</td>
<td>2.6</td>
<td>2.9</td>
<td>2.4</td>
<td>2.5</td>
</tr>
<tr>
<td>QOLS score</td>
<td>83</td>
<td>78</td>
<td>81</td>
<td>84</td>
<td>75</td>
</tr>
</tbody>
</table>

The following conclusions may be drawn based on the analysis of the anthropometric measurements shown in the table above:

- Body Mass Index (BMI) is between 19.5 kg/cm² and 28.4 kg/cm². Therefore, subjects 2 and 3 have normal weight (BMI: 18.5-24.9 kg/cm²), while subjects 1, 4 and 5 are overweight (BMI: 25-29.9 kg/cm²);
- Chest wall elasticity is low in the case of overweight subjects (1.5-4 cm);
- Subject 4 has a high abdominal perimeter (>102 cm), which involves an increased cardiovascular risk.

Training at a moderate pace in the time slot when our assessment took place determines an exercise heart rate of around 138 beats per minute. Therefore, by analyzing the data above, one may notice that the subjects’ exercise heart rates exceeded the accepted limit. Between the ages of 18 to 25, peak oxygen consumption (VO₂ max) shows an ascending trend, from 25 to 30 it remains stable, while after that age it starts to slowly decrease. For people with a sedentary lifestyle it may decrease at a rate of 10-20% per decade due to physical inactivity (Cordun, 2009).

Analyzing the VO₂ max values in Table 1, one may notice that subjects 1, 4 and 5 have a reduced exercise capacity associated with a sedentary lifestyle and cardiovascular risks. These are major risk factors for disabling conditions. To assess the subjects’ own perception about their quality of life, we used the Quality of Life Scale (QOLS). The subjects were asked to choose a score of 1-7 for each of the 16 indicators of QOLS. We summarized the results in Table 1. The average score for the entire population is 90 points (Burckhardt & Anderson, 2003), therefore, at the initial assessment, all 5 subjects scored values below average.

4. Discussion

During the first 3 weeks, subject 4 was unable to follow the workout schedule. He participated in only 2, 3 and one training sessions, respectively. The situation eventually changed. In all, the research subjects adapted really well to the kinetic programs. Table 2 reflects the improvements in each subject’s functional and anthropometric
parameters as well as their final QOLS scores. Over time, their perception about their quality of life improved. They considered themselves to be fitter, more sociable and creative, more physically active even in their leisure time and above all healthier.

Table 2. Final assessment results

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Subject 1</th>
<th>Subject 2</th>
<th>Subject 3</th>
<th>Subject 4</th>
<th>Subject 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>76</td>
<td>56</td>
<td>58.5</td>
<td>83</td>
<td>83.7</td>
</tr>
<tr>
<td>Chest wall elasticity (cm)</td>
<td>5</td>
<td>6.3</td>
<td>6.5</td>
<td>3.2</td>
<td>2</td>
</tr>
<tr>
<td>Abdominal perimeter (cm)</td>
<td>88</td>
<td>75</td>
<td>78</td>
<td>108.5</td>
<td>94</td>
</tr>
<tr>
<td>Body Mass Index (kg/cm²)</td>
<td>24.81</td>
<td>18.92</td>
<td>21.48</td>
<td>26.79</td>
<td>25.54</td>
</tr>
<tr>
<td>Exercise Heart Rate (BPM)</td>
<td>152</td>
<td>136</td>
<td>128</td>
<td>163</td>
<td>150</td>
</tr>
<tr>
<td>VO₂ max (L/min)</td>
<td>2.9</td>
<td>3.6</td>
<td>3.7</td>
<td>2.5</td>
<td>2.8</td>
</tr>
<tr>
<td>QOLS score</td>
<td>92</td>
<td>85</td>
<td>89</td>
<td>92</td>
<td>82</td>
</tr>
</tbody>
</table>

Fig. 1. Maximum aerobic capacity over the 8 weeks of training

The above chart reflects the improvement in each subject’s exercise capacity over the entire research period.

At the end of the 8 week training schedule, subject 1 reached an exercise heart rate of 152 bpm. Therefore, by the time of the final assessment, it improved by 2% (interim assessment) and 3%, respectively. He also achieved an improvement of the QOLS score, reaching 92 points, and a 4.4% weight loss (76 kg). According to the BMI International Classification he is considered to be normal weight (BMI: 24.81 kg/cm²). Furthermore, subject 1’s chest wall elasticity improved by 1 cm and his peak oxygen consumption increased to 2.9 L/min.

At the interim and final assessments, subject 2 had a 6% and 11% improvement of his exercise heart rate, reaching 136 bpm. VO₂ max increased to 3.6 L/min, while his appreciation of his quality of life improved by 9%. After the first 30 days of training, subject 3 achieved a 4% improvement of his exercise heart rate. The final
assessment resulted in a 7% decrease of this parameter, therefore reaching 134 bpm. QOLS score was 89 points and VO2 max increased to 3.7 L/min.

In spite of the difficulties in complying with the training schedule, subject 4 did achieve progress. The final assessment revealed that his exercise heart rate improved by 3% (164 bpm). Interim assessment results were not relevant. By the end of the 8 weeks of training, his maximum aerobic capacity increased to 2.5 L/min and his perception about the quality of his life was better. His QOLS score exceeded the average (92 points). Furthermore, his body weight decreased with 5 kg, his abdominal perimeter diminished by 10% (108.5 cm) and his chest wall elasticity increased by 0.7 cm (3.2 cm).

The interim and final assessments also revealed an improvement of subject 5’s exercise heart rate by 3 and 6%, respectively. Its final value was 155 bpm. As a result, subject 5’s maximum aerobic capacity grew to 2.8 L/min. His opinion about his quality of life improved, reaching 82 points on the QOLS scale. His chest wall elasticity increased from 1.5 to 2 cm and his body weight diminished by 7% (83.7 kg).

5. Conclusions

As a result of the experimental pilot research, our hypothesis was confirmed. Therefore, we determined that individualized kinetic programs contribute to the improvement of sedentary adults’ exercise capacity.

Although the research was conducted on a small number of subjects, our training methodology induced an improvement of their functional parameters. The positive results have convinced us to extend the research to larger groups of subjects.

References

Serbanoiu, S., Tudor, V. (2007). Teoria și metodica educației fizice și sportului (pp. 125, 126), Bucharest: ANEFS.