Improvements in fitness and vitality after a short high intensity training

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Received Date: May 05, 2019 / Accepted Date: June 06, 2019 / Published Date: June 08, 2019

Abstract
This study explored the effects of a short intensive training program to enhance the vitality of middle-aged and elderly people. 32 participants were questioned by a standardized questionnaire, at the start and end of a three-month period, during which they participated in a short intensive training program. This study presents the results of the quality control scale, a fysiofitscan, physical activity and the Vita 16. In general, the perceived fitness of the participants improved significantly. According to the results of the Vita 16 the participants had more energy after the short-term lifestyle intervention.

Keywords: Fitness; Vitality; Health


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Introduction

In the Netherlands there is a growing interest in informing and providing knowledge about how to promote healthy physical activity for aging people. In 2015, Hildebrandt et al presented a trend report about exercise and health and stated the importance of regular movement stimulation for elderly [1]. Especially the benefits of participating in short intensive training programs was mentioned. A gap in knowledge exists, however, about the effects of short intensive training programs on the vitality of aging people.

Short intensive training trials have proven their effectiveness on physical and mental health. Back in 1995, Jakicic et al. already stated that within a 20 weeks exercise program (short bursts of activity adding up to 30 minutes a day) the experimental group presented more weight loss and an improvement of their overall fitness. In this study, the experimental group exercised 10 minutes per day, compared to a control-group that exercised 20-40 minutes per day [2]. Another example originates in 1998, wherein Murphy and Hardman presented results of a ten-week trial [3]. During this trial 47 women were randomly assigned to either short-bouts or long-bouts (30 minutes intensive exercise a day). Both groups significantly increased their VO2 max and decreased their body fat. Only the short-bout group, however, significantly decreased their BMI and waist circumference. These results indicate that a short-term program of 10 or 20 weeks, is proven to be effective when it comes to improving fitness and VO2 max.
max, and reducing body fat, weight and waist circumference [4].

Traditional forms of exercise have been most commonly described as a moderate-to-vigorous intensive 20-60-minute workout. Nevertheless, Geasser and Angadi [5], claimed that thirty minutes of vigorous exercise per week improved glucose control and markers of skeletal muscle metabolism in patients with diabetes type 2. During two weeks of high intensity interval training (HIIT), which included interval sessions, the average 24 hours glucose was reduced by 13% and the postprandial blood glucose by 30%. HIIT has also been reported to be more effective than continuous, steady exercise training for encouraging fat loss in men and women, despite significantly less energy outlay required during training sessions [5].

Several studies show high-intensity interval training (HIIT) appears to induce improvements in aerobic flexibility, cardiorespiratory and metabolic health. Recent studies also underline the potential for other HIIT-based programs, e.g. low-volume HIIT models and high-volume endurance-type training, which may be more feasible but are still time-efficient. As little as three HIIT sessions per week, involving ≤10 min of intensive exercise within a time commitment of ≤30 min per session, including warm-up, recovery between intervals and cool down, has been shown to improve aerobic capacity, skeletal muscle oxidative capacity, exercise tolerance and markers of disease risk after only a few weeks in both healthy individuals and people with cardio metabolic disorders [6]. We think, however, that the decision on the intensity of the exercise prescription should be individualized and based on outcomes different from fat or weight loss, such as vitality. There are several descriptions of vitality, focusing on mental, as well as physical variables. Strijk et al [7], described vitality in three dimensions: energy, motivation and resilience. Hereby, energy is characterized by the feeling of having energy to perform daily tasks. Motivation has to do with setting goals in life and putting effort in achieving them. Resilience is the ability to deal with everyday problems and challenges in life. To counter the existing gap in knowledge, the aim of this study was to explore the effects of short intensive training programs on the vitality of aging people.

**Methods**

During the study, participants took part in a three-month lifestyle intervention led by a physiotherapist and employees of a fitness centre. In the lifestyle intervention, participants exercised twice a week with the help of the program of the Milon Cirkel [8], which is offered as a regular exercising opportunity in fitness centres in The Netherlands. The Milon Cirkel aims to improve overall fitness, increase the physical condition, improve and preserve the functioning musculoskeletal system, as well as the optimization of the biological age. Besides the Milon Cirkel, the participants had the opportunity to exercise with a new exercise method, the FIVE concept. This exercise program is focused specifically on complaints to back, neck, shoulders and hips [5]. The participants used the FIVE concept every time after they trained with the Milon Cirkel. By using the FIVE concepts, the researchers could measure the flexibility of the participants before and after the research.

43 persons voluntarily participated in the study and were quantitatively questioned before and after the lifestyle intervention, in a period of three months’ time. A structured questionnaire was used to gather information and results about the participant’s wellbeing, health and physical fitness. The people who participated in this study paid to get access to the fitness centre and nutritional advice. Some of the participants didn’t want to fill in the entire questionnaire. Therefore, the number of participants during the study dropped from 43 to 32 people. Every time participants visited the fitness centre, they received a signature with date on their member.
card, which provided the researchers with a check if participants fulfilled the conditions of exercising two times a week, which all 32 participants did. All participants were numbered to ensure anonymity for all participants at all times during the research. Participants were informed about the time and date of the measurement via a newsletter and by the employees of the fitness centre so that they were able to fit all important meetings into their schedules.

Several tests and a questionnaire were used to collect data regarding exercise behaviour and goals. The questionnaire consisted of the items of the Quality Control Scale (QCS), the Fysiofitscan (FFS), perceived fitness and vitality. The QCS measures BMI, muscle mass, fat percentage and weight. The FFS contains several indicators which have an influence on heart rate, agility, ability to perform push-ups and belly circumference. The physical activity of the participants was measured with the help of the questionnaire. At the beginning of the intervention, participants were asked to rate their fitness on a 10-point scale. The Vita 16 is an instrument which measures three core dimensions of vitality: energy, resilience and motivation. The score is on a 7-point scale, with 1 being the minimum and seven the maximum score. As with the fitness score, this method reveals a subjective measure of vitality as it was perceived by the respondents [7]. We used paired samples t-test to determine general effects of the intervention and to detect whether the mean difference between pre- and post-test mean scores on the quality control scale, fysiofitscan, perceived fitness and the Vita 16.

**Results**

All 32 participants have the Dutch nationality, 22 were female and the other 10 were male. The participants included individuals who were already used to doing physical activities in the fitness centre as well as non-members who only participated in the research. The youngest participant was 18 years old and the oldest participant 75 years old.

Table 1 presents the pre- and post-results on the quality control scale. This scale measured the BMI, muscle mass, fat percentage and weight. The results show a significant change in the BMI, the Muscle mass and the weight score after the intervention. A difference in fat percentage was observed, however this indicator proved to be insignificant.

Table 2 presents the Pre and post results of fysiofitscan and perceived fitness. This scan contains several indicators which have an influence on heart rate, agility, ability to perform push-ups and belly circumference. The results indicate that the participants on average are significantly more mobile in their movements, which can be seen from the results of the agility and push-up tests, as well as that participants consider themselves fitter after than before the intervention.

| Table 1: Pre and post result Results of quality control scale. |
|------------------------|------------------|-----------------|----------|
| Indicator              | Pre intervention Mean score | Post intervention mean score | p         |
| Body mass index        | 29.8             | 28.7            | <0.001   |
| Muscle mass %          | 51.5             | 52.4 %          | 0.007    |
| Fat %                  | 40.0             | 37.0            | 0.931    |
| Weight in kg.          | 87.5             | 86.1            | <0.001   |
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Table 2: Pre and post results of fysiofitscan and perceived fitness.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Pre intervention Mean score</th>
<th>Post intervention mean score</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate in rest</td>
<td>74</td>
<td>71</td>
<td>0.075</td>
</tr>
<tr>
<td>Agility test in cm.</td>
<td>6.77</td>
<td>4.38</td>
<td>0.009</td>
</tr>
<tr>
<td>Push up test</td>
<td>2.31</td>
<td>5.25</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Belly circumference in cm.</td>
<td>99.4</td>
<td>98.5</td>
<td>0.170</td>
</tr>
<tr>
<td>Perceived Fitness</td>
<td>5.81</td>
<td>7.28</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 3 presents the pre- and post-intervention results of Vita 16 and shows improvements in each of the dimensions. The reported level of energy - having the feeling that you are energetic-shows a significant change before and after the intervention. A significant difference is also observed in respondents’ motivation, a dimension measured in attitude towards targets in life. The participants on average felt more motivated for the future after the intervention. However, there is not a significant change in the level of resilience-the way you deal with misfortune or difficult situations in life - which could indicate that a fitness intervention does not change your psychological perspective on life or how you deal with issues in life.

Table 3: Pre and post intervention results of Vita 16.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Pre intervention Mean score</th>
<th>Post intervention mean score</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vita 16 Total</td>
<td>4.8</td>
<td>5.4</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>Vita 16 Energy</td>
<td>4.4</td>
<td>4.6</td>
<td>0.018</td>
</tr>
<tr>
<td>Vita 16 Motivation</td>
<td>5.0</td>
<td>5.4</td>
<td>0.003</td>
</tr>
<tr>
<td>Vita 16 Resilience</td>
<td>4.9</td>
<td>5.0</td>
<td>0.234</td>
</tr>
</tbody>
</table>

Discussion

This study shows the general effects of a three-month lifestyle intervention program. We detected significant positive differences in motivation, perceived fitness, strength (agility and push-up test), Body mass index, muscle mass and weight. These results replicate the individual differences, whereby we did not analyse size effects differences per gender or age. Our results are in line with the study of Dunn, Andersen, & Jakicic [4], who showed that a short-term program of 10 or 20 weeks led to an improvement in fitness, reduction in body fat, weight and waist circumference. The current research has led to similar results. The average score in perceived fitness before the research was 5.8 and the perceived fitness of the participants after the trial was 7.2 on average score. Besides that, the average score for fat percentage changed significantly. It was reduced by 3% after the three-month trial. Weight also changed slightly, it reduced with 1.4 kg on average. In addition, the waist circumference reduced from 99,3 cm. to 98.5 cm on the average score after this trial. Several studies show that aerobic flexibility improves during training [6], however the current study did not show an improvement in the flexibility of the participants during the three-month trial. Possibly, this is due to experienced muscle discomfort as a result of the intervention. Also, it is not clear whether stretching was done before and after the training. Research has shown that physical exercise and training improve physical and psychological well-being and cognitive function in people. This is also shown in this study. Moreover, some studies indicate improvement [9] self-esteem [10] and a lower occurrence of depressive symptoms [11].

Whilst others [12], found that few psychological changes could be clearly attributed to a four-month programme of aerobic exercise training, they reported it did
improve mood and reduced depression scores for men and lowered anxiety scores for women [12]. In general, this study shows that the participants felt happier and one participant even felt a positive change in the current life situation. The ability of physical activity to energise and produce a positive mood is reported widely. Stephens showed that there is a clear association between physical activity and subjective well-being [13]. The current study also shows evidence of a shift in vitality of the participants. Another study [14], analysed a 21-week intervention on endurance and strength. With their validated instrument (HRQoL) they also observed a positive shift in vitality, which supports that vitality as a dimension of subjective well-being is related to physical activity.

**Conclusions**

In general, it could be stated that the perceived fitness of the participants improved significantly. In addition, this research also proved that the BMI, fat percentage and waist circumference was reduced. Despite the fact that the push up test showed that the strength of the participants increased substantially, the muscle mass did not increase as was expected at the outset, but declined by 1.8%. Research has shown that physical activity has an impact on the mood and subjective well-being of research participants [15-17]. The results in this study also showed evidence that the trial has an impact on personal well-being. The results of the Vita 16 show that the participants have more energy after this trial. More specifically, the results show that when pre-selected for the variable employment, energy levels are significantly raised for participants who are in employment, and motivation levels are increased significantly for participants who are not in employment.

The aim of the Milon Cirkel is to increase physical condition in the participants, and this research has shown a positive contribution to the participants’ physical condition resulting from this trial. The perceived fitness of the participants increased by 14%. This short lifestyle intervention has shown a positive effect in general because it led to weight loss, improvement of BMI, waist circumference and strength. Furthermore, the participants reported to have more energy and feel fitter after the intervention. However, some indicators did not change positively. The motivation of the participants declined from 5.9 to 5.8 in a score out of 7. Moreover, the average score for the muscle mass went down with almost 2 %. Finally, flexibility did not improve.

However, this study has some limitations. First of all, the validity of the data could be improved by including a larger sample and a control group in a future research project. In addition, the period of the trial was limited. Short term gains are obviously a positive outcome, however, to what extent the participants change their lifestyle and continue with this type of exercise is an interesting question that needs further investigation. However, our study provides evidence of the effect of a short intervention on vitality and well-being of the participants. It would also be interesting to develop a study with a specific target group, such as retired citizens (65+), to examine if they could benefit from such interventions. The results of this study indicate that this target group shows different patterns than for example people in employment. Why don’t you show the different results in the result section?.

**Reference**

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