



Strategic Promotion of Ageing Research Capacity

Taking a Walk? physical activity and the health of older people

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Taking a Walk?

physical activity and the health of older people

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There are many benefits of exercise in later life, but the direct benefits of exercise on the biological ageing process are not fully understood. An experiment involving two groups of older people was carried out to investigate the effects of exercise on oxidative stress in older adults. Oxidative stress is something which can happen if reactive “free radicals” outbalance good “anti-oxidants” in our bodies. It is often thought that oxidative stress becomes more common as we grow older. Volunteers, aged between 65 and 75 were split into two groups. The members of one group exercised as normal without changing their usual routines, and the others followed a modest walking regime of three 30 minute walks a week for 8 weeks. The volunteers assigned to the exercise group, lost weight over the 8 week period whilst those in the control group did not. As weight loss is associated with health benefits such as reduced risk of heart disease, the results suggest that regular walking is beneficial to healthy older adults. The exercise carried out in this study did not appear to increase oxidative stress. Some of the biological markers of oxidative stress which were measured were altered over the course of the study, but these changes were seen in both the control and the exercise groups. Oxidative stress in general is considered a risk factor for the development of diseases such as heart disease, arthritis, and some dementias. The results therefore suggest that exercise at this intensity and duration is not harmful to the health of older people.

Key Findings

- Lipoproteins are tiny spherical particles in our blood which contain cholesterol, fat and protein. Our bodies need them in order to function properly, but too much in the wrong form can cause health problems. For example, lipoprotein oxidation (which occurs when free radicals react with the lipoprotein) can be associated with the development of atherosclerosis. Oxidised lipoproteins are known to contribute to a condition known as oxidative stress, which happens when the balance of oxidative molecules and antioxidants in the blood becomes altered. Exercise can alter this balance. This study investigated the effects of exercise on lipoprotein oxidation in order to identify any changes which are due to physical activity.
- Volunteers who undertook low-intensity exercise lost weight during the study. Volunteers who did not do this exercise regime did not lose weight. As weight loss is associated with health benefits such as reduced risk for heart disease, the results suggest that regular low-intensity walking would improve health in healthy older adults.
- The exercise undertaken in this study did not appear to increase markers of oxidative stress in the volunteers. Some markers of oxidative stress were altered over the course of the study, but these changes were seen in both groups. When normal physical activity was assessed in the volunteers the control group did not appear to be different to the exercise group. Any potentially beneficial effects of the exercise training may have been obscured by the normal physical activity undertaken by all the volunteers in their daily life.
- The findings from this research may help future studies which aim to investigate the effect of exercise on oxidative stress in a healthy older population.

Introduction

The Background

Lipoproteins are tiny spherical particles in our blood which contain cholesterol, fat and protein. **Low density lipoprotein (LDL)** is responsible for moving cholesterol from the liver to sites where it is used in other tissues. An increase in LDL levels in the blood usually indicates an increase in total cholesterol. Our bodies need cholesterol in order to function properly, but too much in the wrong form can cause health problems. For instance, although normal LDL in the blood is not oxidised, the development of a number of diseases associated with ageing such as cardiovascular disease, rheumatoid arthritis, diabetes and dementia have been linked with oxidised LDL.

Free radicals, known as **reactive oxygen species (ROS)** and **reactive nitrogen species (RNS)**, are highly reactive molecules which are naturally occurring by-products of normal processes within the body. When antioxidant levels are not high enough, or during some diseases, the amount of ROS and RNS can increase and may react with other molecules to cause damage. For example, they can both react with LDL, resulting in **LDL oxidation** (caused by ROS) and **LDL nitration** (caused by RNS).

The body's immune system responds to the oxidised LDL by sending specialised white blood cells (known as macrophages) to absorb the oxidised LDL. Unfortunately, these white blood cells are not able to process the oxidised LDL, and so burst open depositing the cholesterol onto the wall of the artery. The immune system also produces antibodies which stick to the oxidised LDL. The artery becomes inflamed and this, coupled with the cholesterol deposits, results in a narrowing of the artery, reducing the blood flow and increasing blood pressure. This process is associated with the development of atherosclerosis.

The Issues

Oxidised lipoproteins such as LDL are known to contribute to a state known as **oxidative stress**, which happens when the balance of oxidative molecules and antioxidants (which are thought to have a protective effect against ROS) in the blood becomes altered. Exercise can alter this balance. Although it was originally thought that exercise would increase the amount of oxidative molecules in the body, it has in fact been shown to increase levels of antioxidant enzymes. A number of studies have investigated the effect of different types of exercise on disease but few have specifically looked at the effect it has on lipoprotein (for example, LDL) oxidation. Research into exercise in older adults has also been very limited.

The Aims of the Study

The aim of this research was to investigate the effects of exercise on lipoprotein oxidation in older adults. This will help to identify any changes in lipoprotein oxidation which are due to physical activity and that may have an impact upon diseases associated with ageing.



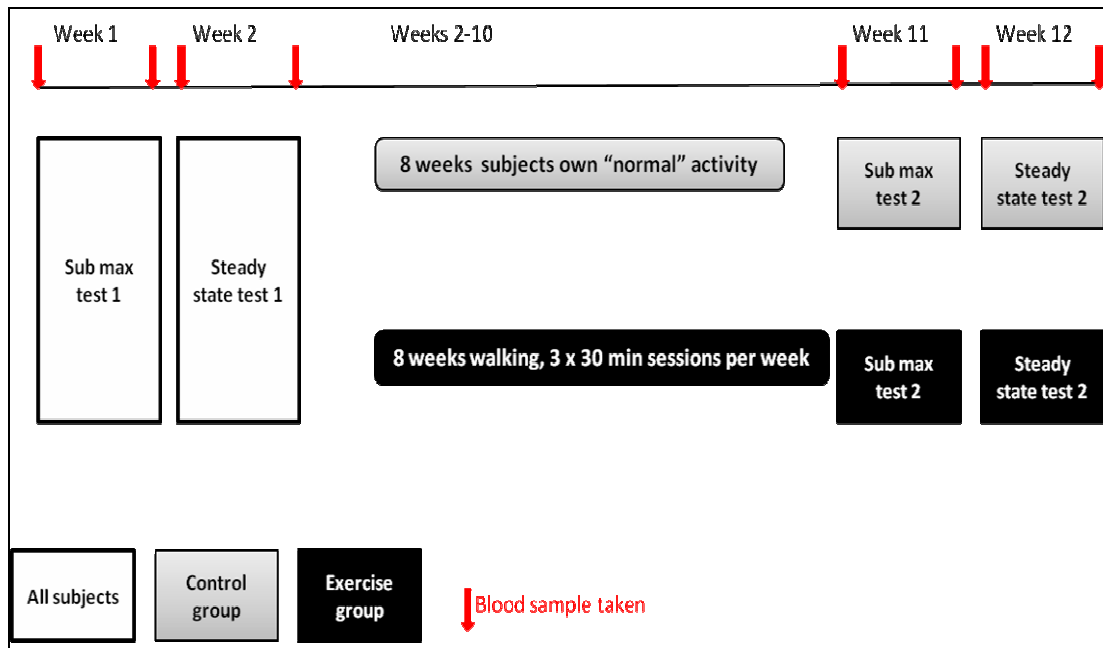
Undertaking the special exercise test

The Study

The study investigated **markers of oxidative stress** in the blood of individuals aged between 65 and 75 years involved in an exercise regime. 21 volunteers (12 Male and 9 Female) were involved in study. All volunteers were assessed using a special exercise test (known as a **graded sub maximal test**), to estimate the maximum level of exercise of which they were capable (maximal aerobic capacity). During a second visit the volunteers exercised for 30 minutes. Food was provided for the evening meal before this test in order to control dietary influences upon lipoproteins. Blood samples were taken from all volunteers before and after the exercise sessions.

The volunteers were then randomly assigned to either a control group or an exercise group. The volunteers in the control group were asked to continue their normal activity in the following 8 weeks. Those in the exercise group attended a 30 minute walking session three times a week for the following 8 weeks. After the 8 week period, all volunteers performed the graded sub maximal test and the 30 minute exercise test again before giving another blood sample.

Blood samples were analysed in order to gain an insight into mechanisms of lipoprotein oxidation and protection. This involved looking for markers of lipid oxidation and nitration.



The design of the study.

Findings

Main Findings

There were no significant changes in LDL oxidation or nitration following exercise. In the exercise group, participants lost weight but there was no change in their athletic fitness.

The normal levels of physical activity of the volunteers in both the exercise and control groups increased during the study, but this increase was not significant. This suggests that either the activity given to the exercise group was insufficient to increase their daily energy expenditure to a significant level, or that the exercise group adjusted their normal levels of physical activity to accommodate the training programme they were undertaking. For example, once someone in the exercise group had walked as part of the study they then rested rather than gardening or walking to the shop as they may usually have done. The physical activity levels in the control group also increased slightly through the time of the study so that the levels in the control and exercise group were not significantly different. This lack of difference in the amount of physical activity between the exercise and control groups during the study is interesting because it seems that by just being aware of the study, the people in the control group started to be a little more active.

The Impact of Exercise - Weight Loss

The volunteers in the exercise group lost weight significantly over the 8 week period. The volunteers in the control group did not have the same level of weight loss. Weight loss is associated with health benefits such as reduced risk of heart disease and improved lipoprotein profiles. Despite the weight loss, exercise group volunteers did not report a significant increase in daily physical activity during the study. As explained earlier, this would suggest that the exercise group accommodated the walking programme they were undertaking into their normal daily activity. This may have been by decreasing other activities they would have normally taken part in if they were not involved with the study.

The Impact of Exercise - Oxidative Stress

The exercise undertaken in this study did not appear to increase markers of oxidative stress in the volunteers. Throughout the study, changes in the levels of individual markers of LDL oxidation and nitration were measured. Most of the changes that were observed did not appear to be as a result of the exercise programme, but rather changed through the duration of the study. As previously suggested, these changes may have been due to altered physical activity by the volunteers, either due to knowledge about the study or seasonal activity changes. An interesting finding was that where LDL oxidation was high in some of the volunteers at the beginning of the study, it decreased significantly following the first exercise session. Oxidative stress in general is considered to be a risk factor for diseases such as heart disease, arthritis, and some dementias. Therefore the results provide evidence that exercise at this intensity and duration may be helpful and is certainly not harmful to older people's health.

The Impact of Exercise - The Effects of Normal Physical Activity

There were some changes in the levels of LDL oxidation and nitration in both the exercise and control groups. Normal physical activity was found to be the same in the control and exercise groups, despite the prescribed exercise training programme only being undertaken by the exercise group. This suggests that the control group may also have increased their normal physical activity. It is therefore a possibility that normal physical activity may have disguised any changes that might have otherwise been due to the exercise training undertaken by the exercise group.

Discussion and Implications

Weight Loss and Activity

The volunteers assigned to the exercise group, lost weight over the 8 week period whilst those in the control group did not. Despite this weight loss, exercise group volunteers did not report a significant increase in daily physical activity during the study. This would suggest that the exercise group incorporated their walking programme into their normal daily activity, by possibly decreasing other activities they may otherwise have undertaken, this is a common finding in walking studies. If this was the case then the substitution of walking may have been more beneficial than other physical activities, due to the regularity and low-intensity of the exercise.

As weight loss is associated with health benefits such as reduced risk of heart disease, the results suggest that regular walking improves health in healthy older adults.

Oxidative Stress and Activity

The exercise undertaken in this study did not appear to increase oxidative stress. Some markers of oxidative stress were altered over the course of the study, but these changes were seen in both the control and the exercise groups.

Oxidative stress in general is considered a risk factor for diseases such as heart disease, arthritis, and some dementias. Whilst previous studies have shown that exercise can alter the balance of oxidative and antioxidative molecules within the body, these beneficial influences were not found during this study. This is possibly because the study was relatively small and the exercise deliberately low-intensity. Equally though, there was no evidence of exercise having any damaging effects. The results therefore suggest that exercise at this intensity and duration is not harmful to health.

As there were some significant changes in markers of oxidative and nitrative stress in both exercise and control groups, factors such as normal physical activity and diet must be considered as playing a role. This again suggests that the control group may have also increased their normal physical activity levels during the time of testing. The effects of changes in normal physical activity may therefore have affected the results.

The study took place over the summer months and some of the effects that were seen in both groups may be due to a natural seasonal increase in physical activity. The study was focussed on the effects of low-intensity exercise. This was deliberate, as low-intensity exercise can be part of a routine that even quite frail people can take part in. Any changes which may have happened due to the introduction of the walking programme may require a larger study group undertaking exercise over the longer period of time to become apparent.

Future Studies

Any future studies of this nature need to use strict measures in order to control levels of normal physical activity in volunteers, and perhaps increase the exercise intensity for exercising groups. However, although it may be easier to detect changes when the level of exercise is greater, there is an important need to understand the benefits of low-intensity exercise, especially walking. Walking is the most acceptable and popular form of exercise that older people take part in. The notion of walking being beneficial to physical and mental health and wellbeing is well ingrained. There are numerous motivational factors which influence the desire to take a walk. The social and intergenerational benefits are considerable, and, as this study has shown, even low-intensity regular walking is beneficial to health.

The Research Team



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The Study

The study received financial support from SPARC of £29,148 and ran for 12 months ending in March 2008. Additional support was provided by the University of Birmingham.

More information about the study can be found on the SPARC website www.sparc.ac.uk and obtained directly from the investigators.

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A full bibliography is available on request from Dr Aldred.

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SPARC

SPARC is a unique initiative supported by EPSRC and BBSRC to encourage the greater involvement of researchers in the many issues faced by an ageing population and encountered by older people in their daily lives. SPARC is directed, managed and informed by the broader community of researchers, practitioners, policy makers and older people for the ultimate benefit of older people, their carers and those who provide services to older people.

SPARC pursues three main activities:

Workshops to bring together all stakeholders interested in improving the quality of life and independence of older people.

Advocacy of the challenges faced by older people and an ageing population and of the contribution of research to improving quality of life. SPARC is inclusive and warmly welcomes the involvement of everyone with a relevant interest.

Small Awards to newcomers to ageing research, across all areas of design, engineering and biology and at the interfaces relevant to an ageing population and older people. In 2005 and 2006 SPARC received 185 applications for support in response to two invitations for competitive proposals of which 34 were supported.

Executive Summaries

SPARC is supporting its award holders through funding, mentoring, a prestigious dissemination platform, professional editorial assistance, international activities and provision of contacts. Each of the projects has been small, yet the enthusiasm for discovery, and impatience to contribute to better quality of life for older people, has more than compensated for the very limited funding which was provided.

This executive summary is one of a series highlighting the main findings from a SPARC project. It is designed to stand-alone, although taken with summaries of other projects it contributes to a formidable combination of new knowledge and commitment by newcomers to ageing research, with a view to improve the lives of older people. This is a tangible contribution towards ensuring that older people receive full benefit from the best that research, science and technology can offer.