Psychological and physiological effects on Swedish worker’s health when using a health promotion intervention including mechanical massage and mental training - a pilot study.

Jasmin Muller
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Abstract

Introduction:

Work-related stress is one of the most challenging issues on workplaces. Reduced ability to relax and recover has been proposed as a key factor behind the increase of stress-related illness among workers. Massage and mental training are two commonly used techniques which may have positive effects on the ability to recover. One technique to help workers recover is a “recovery chair” which include both mechanical massage and mental training programs. However, it has not been scientifically evaluated yet whether using the techniques included in the “recovery chair”, both separately and in combination, as a health promotion tool.

Aim:

The overall aim of this thesis was to explore the psychological and physiological effects of the mechanical massage and mental training programs included in the “recovery chair”, both separately and in combination, as a health promotion tool for Swedish workers.

Methods:

In this study workers were randomly assigned to one of the following groups: i) Mechanical massage combined with mental training (n=19), ii) Mechanical massage (n=19), iii) Mental training (n=19), iv) Pause (15 min break in the armchair, n=19), v) and a Control group (n=17). Psychological effects were measured by the ”Swedish Scale of Personality” (SSP) and physiological effects were measured by heart rate, blood pressure and fingertip temperature, immediately before the randomization, after four weeks and after eight weeks (end-of-study).

Results:

Psychological effects: The results showed that receiving mechanical massage was associated with a significant decrease in “Somatic Trait Anxiety”. The participants in the mental training group showed a tendency to decrease in
“Somatic Trait Anxiety”. The participants who received both mechanical massage and mental training showed a significant decrease in “Stress Susceptibility” between four and eight weeks. The results also showed a significant decrease in “Somatic Trait Anxiety” and a significant increase in “Detachment” for the pause group.

**Physiological effects:** As compared to pre-intervention assessments, participants in the massage group condition showed significantly reductions in their resting heart rate, systolic and diastolic blood pressure and an increase in their fingertip temperature directly after the intervention (post-intervention). The mechanical massage and mental training group showed a significant increase in diastolic blood pressure during the last four weeks of the study.

The participants in the mental training group showed a significant decrease in their heart rate, when compared the start of the study to week four. The pause group tended to have lower systolic blood pressure at post-intervention assessment when compared to the pre-intervention assessment. The participants in the control group showed significantly decrease in heart rate and their systolic blood pressure.

**Conclusion:**

The workers’ who used the “recovery chair” with mechanical massage or mental training programs, either separately or in combination, for eight weeks during working hours reported a positive impact on their levels of anxiety and stress sensitivity. The results also showed positive effects on the workers' blood pressure, pulse and fingertip temperature. The effect was particularly strong for workers’ who received only mechanical massage. This indicate that stress management interventions as work place health promotion activities clearly have a potential to provide significant benefit for health and wellbeing for workers.

**Keywords:**

Alternative, Anxiety, Blood pressure, Complementary, Heart rate, Intervention, Massage, Physical Health, Psychosocial health, Randomized controlled study, Salutogenic theory, Stress, Temperature, Working place.
Original papers

The thesis is based on the following original papers, which are referred to by their Roman numerals in the text:

Paper I


Paper II


The contribution of Jasmin Muller to papers I and II included in this thesis was as follows:

Responsible of planning, performing and executing the project following the ethical principles according to the Helsingfors Declaration and the Belmont Report jointly with the supervisors.

- Main responsible for executing the data collection and analyses.
- Analyzed and wrote all manuscripts together with the supervisors.
- Presented the results for the companies and in scientific journals.
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<th>Description</th>
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<tr>
<td>D</td>
<td>Detachment</td>
</tr>
<tr>
<td>DBP</td>
<td>Diastolic blood pressure</td>
</tr>
<tr>
<td>ENWHP</td>
<td>European Network for Workplace Health Promotion</td>
</tr>
<tr>
<td>FHI</td>
<td>Folkhälsomyndigheten</td>
</tr>
<tr>
<td>KSP</td>
<td>Karolinska Scale of Personality</td>
</tr>
<tr>
<td>PSTA</td>
<td>Psychic Trait Anxiety</td>
</tr>
<tr>
<td>SBP</td>
<td>Systolic blood pressure</td>
</tr>
<tr>
<td>SD</td>
<td>Social desirability</td>
</tr>
<tr>
<td>SS</td>
<td>Stress Susceptibility</td>
</tr>
<tr>
<td>SSP</td>
<td>Swedish Scale of Personality</td>
</tr>
<tr>
<td>SSPS</td>
<td>Statistical Package for the Social Sciences</td>
</tr>
<tr>
<td>STA</td>
<td>Somatic Trait Anxiety</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<td>WMA</td>
<td>World Medicine Association</td>
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Preface

My interest for health on workplaces with a focus on workers developed when I worked as a registered nurse. The situation in my workplace was characterized by an increasing workload and worsened working conditions for nurses as expressed in, for instance, a constant decrease in registered nurses and hence, more patients per nurse to take care of, lack of time to do tasks adequately, and many stressful moments. These working conditions resulted in sickness and absence. Some other colleagues decided to retire or to change workplace. The few who were left waited and hoped for support from the hospital management but help never came. I saw that as a very disrespectful gesture towards us which made me angry and sad. Workers deserve more support and also, they have to be the focus of the management, which instead had their focus on the patient or the product only. I felt that workers have the right to receive a good, that is, a healthy and supportive, working situation and that workers have to stay healthy in order to be able to do a properly job. My wish was and still is to reach a sustainable health among workers, in order to be able to perform their daily work assignments and to change the workplace to a better and positive one.

I began to deepen my interest for the workers’ situation at any workplace and the wish arose to help workers, but I didn’t know how. Therefore, it was so important for me to be part of a research project, which focused on health promotive interventions for workers. It was also important to be part of a research team, in which I had the great opportunity to learn from my research colleagues and to contribute with my own knowledge. The dream became true when I became a PhD student. The project in this thesis was my first one and For me, I hope that this is just the beginning of many more projects focusing on health promotion interventions with workers in focus.
Introduction

In Sweden, as in many Western countries, there is an increasing problem with negative stress. Stress on workplaces arises as a consequence of different factors such as high workload or imbalance between demands and resources, which has characterized the employment situation. Lack of recovery has been proposed as a key factor relating to the increasing stress-related health problems on workplaces. Research has shown that workers can stay healthy if they get enough time to recover. Nevertheless, if workers lose or decline in their ability to recover, they can become more sensitive to stress. It is therefore important to create a good working environment with the goal to promote health among workers in order to help them cope with work-related stress. Due to this there is a need to develop evidence-based interventions for recovery from work strain and stress and for health promotion interventions in order to strengthen the workers to stay healthy. This idea is in line with Aaron Antonovsky’s Salutogenesis, which asks the question what creates health? Health promotion interventions, such as mechanical massage and mental training programs, included in a recovery chair, used during working hours, could be beneficial in creating health for workers. However, it has not been scientifically tested nor evaluated whether using these techniques either separately or together is beneficial for workplace health promotion.
Background

Health and Health Promotion

The definition of health is broad and can embody a large range of meanings and uses in different contexts (Naidoo & Wills, 2004; Pellmer, Wramner & Wramner, 2012). Pellmer et al. (2012) describe how the approach has shifted from the traditional biomedical way of looking at health and ill-health into a more humanistic approach, in which health embodies experiences of meaningfulness and well-being (Pellmer et al., 2012). The origin of the word “health” is derived from the old English word “heal” or “hael” which means “whole” or “wholeness” and refers to health as concerning the whole person with all- embracing physical, social, spiritual and psychological elements (Morrison & Bennet, 2006; Naidoo & Wills, 2004). The probably most well-known and current definition of health is the World Health Organizations’ (WHO) definition of health from 1948: “A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, int).

Like the term “health”, also “health promotion” has a broad perspective (Naidoo & Wills, 2004). In the Ottawa Charter for Health promotion in 1986, health promotion is defined as “… the process of enabling people to increase control over, and to improve their health”. This perspective enables people to learn, throughout life, to prepare themselves for all of life´s stages, obstacles or events. Health promotion actively provides information, education and enhances life skills, which are important for reaching a better status of physical, mental and social health (WHO, 1986).

In this thesis, health and health promotion follows the salutogenic framework that was created by Aaron Antonovsky in 1979 (Eriksson & Lindström, 2008). According to the salutogenic perspective, health and health promotion are not seen as a pathogenic (which focus on knowledge of factors that makes people ill) but instead focus on health and dynamic conceptions emphasizing social and personal resources, as well as physical capacities.
The workplace as a key setting for health promotion

Working adults spend about 60% of their waking hours at work, which makes the workplace a significant arena not only for affecting people’s health, but also as a context to promote health. Thus, the workplace is one of the priority settings for health promotion because it influences the workers physical, mental, economic and social health (Naidoo & Wills, 2004).

WHO stated that every citizen has the right to a healthy and safe job and work environment that enables them to live a socially and economically productive life (WHO, 1995). Indeed, according to the WHO, health promotion is not just the responsibility of the healthcare sector, but also for all workplaces where employers have responsibility for their workers (WHO, 2009). The Swedish government clarifies that it is the employer’s responsibility to have a good working environment, including appropriate resources to create a sustainable work setting (Regeringen skrivelse 2015/16:80). An increased number of employers has started to work with health promotion interventions to help their employees stay healthy and become less stressed. Indeed, stress management interventions or workplace health promotions activities clearly have a potential to provide significant benefit for health and wellbeing on workplaces (Morrison & Bennett, 2006) and may strengthen workers’ own resources to reduce their stress levels and stay healthy (Ejlertsson, Hejbel, Ejlertsson & Andersson, 2014).

Stress and its effects on illness and sick leave

Like “health”, the concept of “stress” is used very widely and with several meanings (Morrison & Bennett, 2006) and has been defined in various ways by theorists and researchers (Smith, 1993). Although the term “stress” is generally claimed as something negative, it is also a positive driver. In order to perform well, a certain degree of positive stress (called arousal) is needed. Positive stress can be experienced when someone is focused on a specific task, motivated, feeling confident and also excited about a result one is hoping to achieve. However negative effects of stress often result from a mismatch between demands and pressures on a person and the resources of knowledge and ability to handle or cope with a stressful situation (Smith, 1993; Morrison & Bennett, 2006).
Another type of stress is long-term stress (chronic stress) that can exist for weeks, months or even years and can challenge the health and performance of individuals (Leka, Griffith & Cox, 2005). Previous research shows that long term stress is a contributing factor for psychological problems such as anxiety, social desirability and further stress (Ulf Lundberg, 2005; Leka, Griffiths & Cox, 2005). In addition, long term stress is also a contributing factor for physiological problems such as high blood pressure, cardiovascular disorders, type 2 diabetes and reduced immune function (Kang, Koh, Cha, Park, Woo & Chang, 2005; Mino, Babazono, Tsuda & Yasuda, 2006).

In Sweden, as in many western countries, stress-related illnesses, are an increasing problem (Försäkringskassan, 2015). In 2016, the Swedish Work Environment Authority reported that the most common causes of health problems, for both women and men, were stress and mental illness. During 2014, 26,000 Swedish workers were unable to work due to stress. This was an increase of 75% as compared to 2012 and represented 14% of all sick-leaves in Sweden (Arbetsmiljöverket, 2016). The increased numbers of sick leave will affect workers but in turn also insurance companies and society negatively, because high stress levels may increase the prevalence of sick leave and decrease workers’ productivity, resulting in negative profit for companies (Forbes, 2013). According to the European Agency for Safety and Health at work (EU-OSHA) the financial costs of work-related stress and psychosocial risks in Europe were €617 billion annually (osha.europa.eu, 2014).

Thus, there is a need to create sustainable workplaces, and more specifically, there is a need to implement health promotion interventions at workplaces in order to strengthen workers own resources to tackle stressful situations on their workplace (Lindberg, Vingård, Josephson, Alfredsson, 2005).

Ability to recover and its importance for health among workers

One of the most important factors affecting workers health is to what extent they are able to recover from work and stress (Jansen, Kant, van den Brandt, 2002; Geurts & Sonnentag, 2006). Recovery is needed to replenish with new
energy in order to be ready for a new working day with new challenges (Jansen, Kant, van Amelsvoort, Nijhuis & van den Brandt, 2003). Lack of recovery has been proposed as a key factor relating to the increasing levels of stress-related health problems among working women and men in industrialized countries (Dhand & Sohal, 2006; Geurts & Sonnentag, 2006; Hayashi, Watanabe, & Hori, 1999; Lundberg, 2005; Lundberg et al., 1999).

For achieving recovery only, a short respite from work is needed. It has previously been shown that a brief nap taken after lunchtime can positively affect wakefulness, performance, learning ability and subsequent alertness (Dhand & Sohal, 2006; Hayashi et al., 1999; Takahashi, Fukuda, & Arito, 1998). Short breaks of about 10 minutes can improve performance at work and such breaks may be an effective way to control accumulation of risk during industrial shift-work (Tucker, Folkard, & Macdonald, 2003).

In order to recover from negative stress on workplace, it is necessary to reduce both muscular and mental tension. When tension and stress are reduced, recovery and increased well-being may follow (Risberg & Risberg, 2016). Reduction of tension and stress may even lead to an enhanced ability to learn and to work more efficiently (Lundberg et al., 1999; Uneståhl & Bundzen, 1996). Among the most frequently used health related activities in order to increase the ability to recover and to lower stress levels (Ruotsalainen, Verbeek, Mariné & Serra, 2015) are massage (Field, 2002, 2014) and mental training (Uneståhl-Hellertz, 2001; Uneståhl & Bundzen, 1996; Uneståhl, Bundzen, Gavrilova & Isakov, 2004).

**Massage**

Stimulation of sensory nerves in the skin, can induce anti-stress effects, such as increased cardiovascular health, increased energy, better mood, decreased tiredness or better sleep (Uvnäs-Moberg, Handlin & Petersson, 2015). Traditional massage has both psychological and physiological stress reducing effects such as decreased levels of anxiety, increased perception of wellbeing, and lowering of both blood pressure and cortisol levels. Repeated massage treatments are associated with long-term expression of all these effects (Field, 2002; 2014).
Back massage applied by a mechanical massage chair has been shown to produce a general muscle relaxation. This type of artificial massage seems to be especially useful for people who dislike being touched by other people (Zullino, Krenz, Fresard, Cancela, & Khazaal, 2005).

Mental training

Active mental training makes it possible for a person to develop techniques that help to achieve a relaxed mental state that can reduce stress and tension and increase potential for recovery and health. Mental training techniques give rise to effects (patterns) that are similar to those induced by massage (Uneståhl et al., 2004). Even a single session of mental training or slow breathing can result in a temporary decrease of blood pressure. In addition, mental training has also been shown to increase creativity and problem-solving skills, and to increase satisfaction and a sense of well-being. Finally, it has been related to better problem-solving skills in relation to negative stress situations (Kaushik, Kaushik, Mahajan, & Rajesh, 2006).
Conceptual Framework

The salutogenic theory

The salutogenic theory was developed by Aaron Antonovsky, born 1923 in Brooklyn, USA. He was a professor of medical sociology, whose work concerned the relationship between stress, health and well-being, which he termed Salutogenesis in 1979 (Antonovsky, 1987; Eriksson & Lindström, 2008). Unlike the biomedical model of health the salutogenic theory focuses on the origin of health and on the resources that sustain and improve the development of health. Antonovskys’ aim was to reject the traditional medical-model dichotomy separating health and illness and focus on the relationship between a total positive health at one side and total absence of health at the other side (Antonovsky, 1987; Eriksson & Lindström, 2008; Tones & Green, 2010).

The salutogenic perspective at workplace

It has been a change from a patological view of workplace health to a more salutogenic view. Ejlertsson et al (2014) stated that work environment studies have a traditional pathogenic approach, i.e. focuses on symptoms, risk factors or illness among workers which successively have changed with the formulation of the Ottawa Charter from 1986 towards a salutogenic perspective within work environment research. The Ottawa Charter implicates that there is a need for health promotion using a salutogenic perspective that takes a focus on health and dynamic conceptions that emphasize social and personal resources, as well as physical capacities to guarantee that workers do not become ill but remain healthy (Eriksson & Lindström, 2008).
Rationale

Work-related stress is one of the most challenging issues on workplaces. The most common reason for sick leave among Swedish workers is negative stress, often work-related. The numbers of sick leave continue to increase, and the prognosis indicates that stress-related illness in the workplace will continue to increase. Reduced ability to relax and recover has been proposed as a key factor behind the increase of stress-related illness among workers. In order to be able to reverse the negative trend of increasing prevalence of stress-related illness there is a need for more evidence on the effectiveness of interventions to promote health. This is in line with the intention of the World Health Organization (“... the process of enabling people to increase control over, and to improve their health”) and also with the salutogenic perspective (people’s abilities and skills to recover from negative stress), since it can be used to enable people to increase control over and improve their health.

Massage and mental training are two commonly used techniques which may have a positively psychological and physical effects on the ability to recover. One technique to help workers to become less stressed is a “recovery chair” which included both mechanical massage and mental training programs. However, it has not been scientifically evaluated yet whether using the techniques included in the “recovery chair”, both separately and in combination, as a health promotion tool.
Aims

The overall aim of this thesis was to explore the psychological and physiological effects of the mechanical massage and mental training programs included in the “recovery chair”, both separately and in combination, as a health promotion tool for Swedish workers.

The specific aims were:

- To evaluate possible effects on employees’ experience of levels of “Anxiety”, “Stress Susceptibility”, “Detachment” and “Social Desirability” when using mechanical massage and mental training programs, both separately and in combination, during working hours (paper I).

- To investigate possible effects on the employees’ heart rate, blood pressure and fingertip temperature when using mechanical massage and mental training programs, both separately and in combination, during working hours (paper II).
Materials and methods

Study design

For planning and conducting the studies and analyzing the data needed for the two papers a quantitative approach was used (LoBiondo-Wood & Haber, 1998; Polit & Beck, 2017).

Based on the overall aim of this thesis, a randomized controlled intervention study (RCT) was used. According to Polit & Beck (2017), RCTs are very well suited for drawing conclusions about the effects of health care interventions (Polit & Beck, 2017) and are appropriate when testing a new treatment (Billhult & Gunnarsson, 2012).

Both papers included in this thesis were based on the same study and followed the Consort recommendations, by registration in the Australian New Zealand Clinical Trials Registry (ANZCTR), trial registration: ACTRN12615000020583. Thus the study was conducted with the same participants at the same time, using the same design. For an overview of the study see Table 1 and for a more detailed description of design, sample, data collection and data analysis, see paper I and II.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Design</th>
<th>Sample</th>
<th>Data collection</th>
<th>Data analysis</th>
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<tr>
<td>I</td>
<td>Prospective RCT Explorative approach</td>
<td>93 workers from four different workplaces in south–west Sweden</td>
<td>Repeated questionnaire (SSP) at three times: at start, after 4 and after 8 weeks</td>
<td>Descriptive statistics. Cronbachs alpha Kruskal Wallis Test Mann-Whitney Test Friedman’s Two-way Analysis of Variance Wilcoxon Signed-Rank-Test</td>
</tr>
<tr>
<td>II</td>
<td></td>
<td>Blood pressure, heart rate and fingertip temperature at three times: at start, after 4 and after 8 weeks</td>
<td>Descriptive statistics. Kruskal Wallis Test Mann-Whitney Test Friedman’s Two-way Analysis of Variance Wilcoxon Signed-Rank-Test</td>
<td></td>
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</table>
Setting

Paper I and II were performed in the south-west part of Sweden between spring and winter 2013. To get a workplace variation, four different workplaces were selected based on their geographical location and working areas. The workplaces were in both the private sector; the automotive and construction industry, and in the public sector; the school and health-care sector.

*Information about the study given to the employers and workers*

The responsible manager at the selected workplaces was contacted and informed about the study's purpose and meaning. After a positive contact had been made, the researchers visited each interested workplace and met the workers during a regular staff meeting and explained the study to them. During this meeting all the attending workers were given the opportunity to ask questions about the study and their possible participation. Those workers who were not able to attend the meeting still had the opportunity to participate in the study. All workers who chose to participate in the study signed written consent.

Participants

A voluntary sample of 93 workers (69 women, 74.2%, and 24 men, 25.8%) from the four different workplaces mentioned above agreed to participate in the study. The workers who participated in the study varied between 25 to 64 years of age and worked between 75% and 100% within their own organizations and had different types of positions, responsibilities and experiences (Table 2). In the study, the focus was on healthy workers, which were defined as workers able to perform their daily work assignments and who had not reported any serious or chronic illness.
Table 2. Overview of the four workplaces, type of positions, responsibilities and the participation of female and male workers.

<table>
<thead>
<tr>
<th>Workplace</th>
<th>Type of workplace</th>
<th>Type of positions and responsibilities</th>
<th>Female (n)</th>
<th>Male (n)</th>
<th>Total (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School sector</td>
<td>School, Preschool</td>
<td>Teachers, Preschool teachers</td>
<td>24 80%</td>
<td>6 20%</td>
<td>30 100%</td>
</tr>
<tr>
<td>Health-care sector</td>
<td>Primary health-care center</td>
<td>Registered nurses</td>
<td>18 94.7%</td>
<td>1 5.3%</td>
<td>19 100%</td>
</tr>
<tr>
<td>Automotive industry</td>
<td>Manufacturer of heavy trucks</td>
<td>Councils, Economists, Clerks</td>
<td>12 75%</td>
<td>4 25%</td>
<td>16 100%</td>
</tr>
<tr>
<td>Construction industry</td>
<td>Manufacturer of insulation solutions</td>
<td>Manager, Administrative staff</td>
<td>15 53.6%</td>
<td>13 46.4%</td>
<td>28 100%</td>
</tr>
<tr>
<td></td>
<td>Total: n=69</td>
<td>Total: n=24</td>
<td>Total: n=93</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Inclusion criteria

Healthy workers i.e., without self-reported serious and/or chronic (physical or mental) illnesses and able to perform their work assignment with no previous experience of using mechanical chair massage and/or the mental training programs.

Exclusion criteria

Workers who were pregnant, or who were at the time suffering from influenza, colds, fever or had a skin or kidney disease were excluded from the study due to health risks.

The intervention

The intervention used in the present study was the “recovery chair” included in the “Concept of Recovery ™”, provided by Promas AB. The chair is equipped with the ability to give massage for the neck, shoulders, back and calves. While the user gets a massage, he/she may simultaneously listen to a mental training program (developed and produced by Lars-Eric Uneståhl at
Scandinavian International University). The mental training programs include soft music combined with verbal instructions and is designed to help achieve a relaxing mental state. It is possible to use either the massage program or the mental training program separately.

Randomization and study groups

Each participant was randomly assigned to one of the following five study groups: i) Sitting in the armchair and using the massage program while listening to a mental training program (n=19), ii) Sitting in the armchair and using the massage program only (n=19), iii) Sitting in the armchair and listening to a mental training program only (n=19), iv) Sitting in the armchair but not using either the massage program nor listening to a mental training program (pause group) (n=19), v) Not sitting in the armchair at all (control group) (n=17).

The study lasted for a total of eight weeks. During these weeks the participants in groups i-iv took a break from their regular work and sat in the chair for 15 minutes three times each week, preferably between 1pm and 4pm. In three of the workplaces the participants choose themselves when to use the chair. In the fourth workplace (health care sector), due to a hectic schedule, the participants were assigned specific time points when to use the chair.

The participants who used the massage program (i.e., groups i and ii) all used the same massage program but were able to make individual adjustments regarding the strength of massage. The participants who listened to the mental training programs (i.e., groups i and iii) listened to different programs in the following order: week one - "Recovery", week two - “Mindfulness - learn to live in the present”, week three - "The way to a better and deeper sleep”, week four - “Reduce the negative stress”, week five - "Learn to think positively”, week six - "Increase your mental strength”, week seven - “How to get a greater enjoyment of life” and week eight - "Recovery”. The participants in group iv took a break from their regular work and sat in the chair for 15 minutes three times each week, however they did not use either the massage program nor listen to the mental training programs. Group v served as a control group and continued their work as usual.
The chair was placed in rooms where the door could be shut, separated from a disturbing environment. An overview of participant recruitment is shown in Fig. 1.

Fig. 1: Flow chart of numbers of workers randomized to either Massage and Mental training, Massage, Mental training, Pause or Control group, including participation over time: Start, four and eight weeks.

Data collection

*Paper I*

On three different occasions during the study period, the participants filled in questionnaires regarding their self-rated psychological and physical health through a web-based software program for research projects named EvaSys (EvaSys.sco.uk). The first occasion was at the start of the study, immediately before the randomization, so that the baseline assessment of the participants was not influenced by knowing to which intervention group participants would belong to. The second measurement was taken after four weeks and the third measurement was taken after eight weeks (end-of-study). Participants filled in the questionnaire after an individual meeting with the researchers at
the workplace during regular working hours. When completing the questionnaire, the participants were alone in a secluded room.

The statements included in the questionnaire are part of the larger questionnaire, the “Swedish Scale of Personality” (SSP) measuring psychological effects. SSP is a revised form of the previous “Karolinska Scale of Personality” (KSP) which has been used both on healthy participants and on patients with various psychiatric and psychomatic disorders (Zuckerman, Kulman & Camac, 1988; Zuckerman, Kuhlman, Thornquist & Kiers, 1991), and also on healthy mothers in relation to childbirth (Jonas, Nissen, Ransjö-Arvidson, Matthiesen & Uvnäs-Moberg, 2008; Nissen, Gustavsson, Widström & Uvnäs-Moberg, 1998; Ryding, Wirfelt, Wängsborn, Sjögren & Edman, 2007; Wiklund, Norman, Uvnäs-Moberg, Ransjö-Arvidson & Andolf, 2009). In the updated form the scales in SSP have been shortened, modernized and psychometrically evaluated. The SSP has been evaluated in more than 3,000 individuals including more than 1,000 patients. SSP contains 13 subscales, of which each subscale has seven statements with a four-point response format, ranging from “does not apply at all” to “applies completely” (Gustavsson et al., 2000). In the present study the following five subscales, and corresponding items, were included: “Somatic Trait Anxiety” (includes somatic related anxiety such as sweating, teeth clenching or not getting enough air to breathe), “Psychic Trait Anxiety” (includes psychic related anxiety such as an expression of not having much self-confidence, to be worried about things or about being a person who is excessively sensitive and easily hurt), “Stress Susceptibility” (includes aspects of having less energy or feeling more hurried and stressed than most other people, feeling pressure when told to speed up work or having less energy than most other people), “Detachment” (contains social dimensions such as keeping people at a certain distance or being reserved and cold rather than warm and kind) and “Social Desirability” (contains claims such as always being polite and self-controlled, always being a good listener or being willing to admit a mistake) (Gustavsson et al., 2000).

**Paper II**

The participants’ blood pressure, heart rate and fingertip temperature were measured at the same three time-points as described for paper I. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) and heart rate were
measured by using an automatic manometer that have been clinically validated and approved in accordance with the protocols of the International Society of Hypertension (Omron M6 Comfort, Omron Healthcare, Hoofddorp, the Netherlands). The manometer was attached on the participants’ left arm and placed in line with the heart. Fingertip temperature was measured by a laser thermometer (Digital-Laser Thermometer, Esska.de GmbH, Hamburg, Germany). The participants were in a seated resting position during all measurements.

**Statistical analysis**

Statistical calculations were performed by using the Statistical Package for the Social Sciences (SPSS, version 22.0). Background data are presented as means and standard deviations to describe the study sample. Since the number of participants in each group was relatively small and a normal distribution was not reached, non-parametric statistical tests were used to analyze the data. To check the internal consistency of the SSP, Cronbach’s alpha was calculated for each subscale. The Kruskal Wallis Test for independent samples, as well as the Mann-Whitney Test for independent samples, was used to test for the differences between groups on separate occasions (start, four weeks and eight weeks). Friedman’s Two-way Analysis of Variance by Rank was used to test for differences within each study group during the entire study period. Wilcoxon Signed-Rank Test was used to test for differences between two occasions within each study group. Changes between start and four weeks, between four and eight weeks, as well as between start and eight weeks were analyzed. p-values ≤ 0.05 were considered significant and p-values ≤ 0.1 were interpreted as a tendency (Pallant, 2013; Polit & Beck, 2017). Calculation of estimated number of participants was performed based on the results of previous studies using KSP (Jonas, Nissen, Ransjö-Arvidson, Matthiesen, & Uvnas-Moberg, 2008; Nissen, Gustavsson, Widström, & Uvnas-Moberg, 1998).
Ethical considerations

The study was based on the World Medical Association Declaration of Helsinki, (WMA) describing ethical guidelines for human research (WMA.net, 2018). The Helsinki declaration emphasizes respect for the individual and requires that research involves a prior informed consent (Helgesson, 2006; Sandman & Kjellström, 2013). Due to respect of autonomy all participants were informed about the aim of the study, the course of action and their voluntary participation, which means that they could end the study at any time without giving any reason. They were also informed that their workload would not be affected by their participation. To respect the non-maleficence principle, the risks associated with this type of study, is considered as minimal. The use of the “recovery chair” is not known to cause any physical or mental pain or discomfort. The participants in this study had the opportunity to report any side effect and could cancel their participation at any time. All collected data were treated confidentially and was only be available to the researchers. All materials that could be linked to an individual were encoded.

The control group was not allowed to use the “recovery chair” during the study period. But regarding to the justice principle and beneficence principle the control group had the opportunity to use the same “recovery chair” with the massage and/or mental training programs for eight weeks after the study had ended. The study was approved by the Local Ethics Committee in Gothenburg, Sweden (980-12).
Results

Baseline data for the participants (workers) is shown in table 3.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Massage and mental training (n=19)</th>
<th>Massage (n=19)</th>
<th>Mental training (n=19)</th>
<th>Pause (n=19)</th>
<th>Control (n=17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs.), Mean (SD)</td>
<td>50.4 (8.37)</td>
<td>46.5 (12.1)</td>
<td>49.3 (14.1)</td>
<td>47.9 (9.24)</td>
<td>46.6 (10.5)</td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female,</td>
<td>16 (84.2)</td>
<td>15 (78.9)</td>
<td>13 (68.4)</td>
<td>13 (68.4)</td>
<td>12 (70.6)</td>
</tr>
<tr>
<td>Male</td>
<td>3 (15.8)</td>
<td>4 (21.1)</td>
<td>6 (31.6)</td>
<td>6 (31.6)</td>
<td>5 (29.4)</td>
</tr>
<tr>
<td>Education, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compulsory school</td>
<td>1 (5.3)</td>
<td>1 (5.3)</td>
<td>1 (5.3)</td>
<td>0</td>
<td>1 (5.9)</td>
</tr>
<tr>
<td>High school</td>
<td>5 (26.3)</td>
<td>3 (15.8)</td>
<td>2 (10.5)</td>
<td>4 (21.1)</td>
<td>2 (11.8)</td>
</tr>
<tr>
<td>Higher education</td>
<td>2 (10.5)</td>
<td>3 (15.8)</td>
<td>2 (10.5)</td>
<td>3 (15.8)</td>
<td>1 (5.9)</td>
</tr>
<tr>
<td>University</td>
<td>11 (57.9)</td>
<td>12 (63.2)</td>
<td>14 (73.7)</td>
<td>12 (63.2)</td>
<td>13 (76.5)</td>
</tr>
<tr>
<td>Civil status, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>3 (15.8)</td>
<td>3 (15.8)</td>
<td>2 (10.5)</td>
<td>2 (10.5)</td>
<td>2 (11.8)</td>
</tr>
<tr>
<td>Partner/married</td>
<td>15 (83.3)</td>
<td>16 (84.2)</td>
<td>17 (89.5)</td>
<td>17 (89.5)</td>
<td>14 (82.4)</td>
</tr>
<tr>
<td>Not living together</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 (5.9)</td>
</tr>
</tbody>
</table>

Paper I

Below follows a presentation of the psychological effects measured by the SSP subscales “Somatic Trait Anxiety”, “Psychic Trait Anxiety”, “Stress Susceptibility”, “Detachment” and “Social Desirability”.

**Somatic Trait Anxiety (STA)**

The massage group showed a significant decrease in the STA subscale (p=0.032) during the entire study period. This decrease was also detected when analyzing changes between start and week four (p=0.094) and start and week eight (p=0.050). The mental training group showed tendencies to decrease in the STA subscale during the entire study (p=0.061) and also between week four and week eight (p=0.060). Also, the pause group showed a significant decrease between start and week eight (p=0.040) and between week four and week eight in the STA subscale (p=0.049). Even the control group showed significant changes between the week four and week eight
(p=0.014). This group showed a tendency to decrease during the entire study (p=0.076). No significant differences could be found in the massage and mental training group. Cronbach’s alpha for was STA 0.94 (Table 4).

**Psychic Trait Anxiety (PSTA)**

No significant differences could be found in in any of the groups. Cronbach’s alpha for PTSA was 0.95 (Table 4).

**Stress Susceptibility (SS)**

The SS subscale tended to decrease in the massage and mental training group during the entire study period (p=0.088), but showed a significant decrease between week four and week eight (p=0.022). No significant differences could be found in the other groups. Cronbach’s alpha for SS was 0.93 (Table 4).

**Detachment (D)**

A significant increase in the D subscale was shown in the pause group during the entire study (p=0.044). No significant differences could be found in any of the other groups. Cronbach’s alpha for D was 0.95 (Table 4).
The results regarding the psychological effects showed that receiving mechanical massage was associated with a significant decrease in “Somatic Trait Anxiety”. The participants in the mental training group showed a tendency to decrease in “Somatic Trait Anxiety”. The participants who received both mechanical massage and mental training showed a significant decrease in “Stress Susceptibility” between week four and week eight. The results also showed a significant decrease in “Somatic Trait Anxiety” and a significant increase in “Detachment” for the pause group.

Summarizing psychological effects – results from paper I

Table 4. The participant’s answers (mean values (m), corresponding standard deviations (SD) and Cronbach’s alpha to the Swedish Scale of Personality (SSP) subscales

<table>
<thead>
<tr>
<th>Design</th>
<th>Massage and mental training (n=19)</th>
<th>Massage (n=19)</th>
<th>Mental training (n=19)</th>
<th>Pause (n=19)</th>
<th>Control (n=17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week</td>
<td>Start 4 8</td>
<td>Start 4 8</td>
<td>Start 4 8</td>
<td>Start 4 8</td>
<td>Start 4 8</td>
</tr>
<tr>
<td>n</td>
<td>19 16 18</td>
<td>19 17 18</td>
<td>17 15 16</td>
<td>18 17 13</td>
<td>13 17 17</td>
</tr>
<tr>
<td>STA, m (SD) CA=0.94</td>
<td>1.79 (0.6) 1.79 (0.6) 1.74 (0.6) 2.12 a (0.7) 2.0 a,b,d (0.7) 1.92 a,d (0.7) 1.85 b (0.6) 1.88 b (0.5) 1.68 a,d (0.5)</td>
<td>1.80 (0.6) 1.85 (0.8) 1.72 (0.6) 1.71 b (0.5) 1.76 b (0.5) 1.61 b (0.5)</td>
<td>1.79 (0.5) 1.79 (0.5) 1.76 (0.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSTA, m (SD) CA=0.95</td>
<td>2.01 (0.6) 2.06 (0.7) 2.01 (0.7) 1.88 (0.7) 1.91 (0.6) 1.90 (0.7) 1.82 (0.5) 1.82 (0.5) 1.64 (0.5)</td>
<td>1.84 (0.5) 1.90 (0.4) 1.78 (0.4) 1.79 (0.5) 1.79 (0.6) 1.76 (0.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SS, m (SD) CA=0.93</td>
<td>2.05 (0.6) 2.14 b (0.7) 1.93 b,c (0.5) 2.23 (0.6) 2.32 (0.7) 2.28 (0.7) 1.97 (0.5) 2.05 (0.5) 1.96 (0.5)</td>
<td>2.15 (0.5) 2.08 (0.6) 2.04 (0.4) 1.88 (0.5) 1.94 (0.5) 1.84 (0.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD, m (SD) CA=0.93</td>
<td>3.16 (0.4) 3.15 (0.4) 3.18 (0.4) 3.13 (0.3) 3.00 (0.3) 3.08 (0.4) 2.92 (0.5) 2.92 (0.4) 2.88 (0.3)</td>
<td>3.10 (0.3) 2.91 (0.4) 2.98 (0.4) 3.04 (0.4) 3.03 (0.3) 2.98 (0.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D, m (SD) CA=0.95</td>
<td>1.84 (0.6) 1.91 (0.6) 1.87 (0.6) 1.70 (0.5) 1.70 (0.4) 1.86 (0.5) 1.95 (0.6) 1.95 (0.5) 1.92 (0.5)</td>
<td>1.95 (0.6) 1.97 a (0.5) 2.04 a (0.5) 2.04 a (0.5) 2.04 a (0.5) 2.04 a (0.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Swedish Scale of Personality (SSP) subscales: “Somatic Trait Anxiety” (STA), “Psychic Trait Anxiety” (PSTA), “Stress Susceptibility” (SS), “Soci desirability” (SD) and “Detachment” (D). Each subscale has seven statements with a four-point response format, ranging from “does not apply at all” to “applies

Cronbach’s alpha (CA)

a= Significant change over the entire study period (p<0.05)
b= Tendency to change over the entire study period (p=0.1)
c= Significant change compared to 4 weeks (p<0.05)
d= Tendency to change when compared to start (p<0.1)
e= Tendency to change when compared to 4 weeks (p<0.1)
Paper II

Below follows a presentation of the physiological effects on heart rate, blood pressure and fingertip temperature.

Heart rate

When comparing the groups, the massage group (p=0.026), the mental training group (p=0.007) and the control group (p=0.006) had significantly lower heart rate after four weeks compared to the pause group. After eight weeks, both the massage group (p=0.024) and the control group (p=0.008) showed significantly lower heart rate compared to the massage and mental training group. When analyzing each group separately, the massage group showed a significant decrease in their heart rate from the start to week four (p=0.039). The decrease remained for this group and was significant when comparing the start of the study with the end of the study (p=0.038). Also, the mental training group showed a significantly decrease of the heart rate from the start to week four (p=0.036). The results of heart rate are shown in figure 2.

![Heart rate](image)

Figure 2: Heart rate (median levels) for the five study groups. Massage and mental training group (n=19), Massage group (n=19), Mental training group (n=19), Pause group (n=19) and Control group (n=17).
**Systolic blood pressure (SBP)**

In the massage group, SBP decreased significantly during the entire study period (p=0.019). This decrease was particularly strong during the first four weeks (p=0.002). In the pause group, SBP tended to decrease when comparing the start of the study with the end of the study (p=0.051). The control group had a significant decrease in SBP during the first four weeks of the study (p=0.038). No significant differences could be found in the other groups. The results for SBP are shown in figure 3.

![Figure 3 Systolic blood pressure (mmHg) (median levels) for the five groups. Massage and mental training group (n=19), Massage group (n=19), Mental training group (n=19), Pause group (n=19) and Control group (n=17).](image)

**Diastolic blood pressure (DBP)**

The massage group showed a significant decrease in DBP between the start and week four (p=0.031) as well as between the start and week eight (p=0.026). The massage and mental training group showed a significant increase in DBP during the last four weeks of the study (p=0.028). No significant differences could be found in the other groups. The results for DBP are shown in figure 4.
Figure 4: Diastolic blood pressure (mmHg) (median levels) for the five groups. Massage and mental training group (n=19), Massage group (n=19), Mental training group (n=19), Pause group (n=19), and Control group (n=17).

**Fingertip temperature**

For the massage group there was a significant change over time (p=0.003) with a significant decrease during the first four weeks (p=0.001) followed by a significant increase during the next four weeks (p=0.035). The combined massage and mental training group showed a significant decrease in fingertip temperature when comparing start with end of study (p=0.031). No significant differences could be found in the other groups. The results for fingertip temperature are shown in figure 5.
Figure 5: Fingertip temperature (°C) (median levels) for the five groups. Massage and mental training group (n=19), Massage group (n=19), Mental training group (n=19), Pause group (n=19), and Control group (n=17).

**Summarizing physiological effects - results from paper II**

As compared to pre-intervention assessments, participants in the massage group conditions showed significantly reductions in their resting heart rate, systolic and diastolic blood pressure and an increase in their fingertip temperature directly after the intervention (post-intervention). The mechanical massage and mental training group showed a significant increase in diastolic blood pressure during the last four weeks of the study.

The participants in the mental training group showed a significant decrease in their heart rate, when compared the start of the study to week four. The pause group tended to have lower systolic blood pressure at post-intervention assessment when compared to the pre-intervention assessment. The participants in the control group showed significantly decrease in heart rate and their systolic blood pressure.
DISCUSSION

Methodical considerations paper I and II

**Study design and triangulation**

Based on the overall aim of this thesis, a randomized controlled intervention study (RCT) was used. According to Polit & Beck, RCTs are very well suited for drawing conclusions about the effects of health care interventions (Polit & Beck, 2017) and are appropriate when testing a new treatment (Billhult & Gunnarsson, 2012). Thus, this type of experimental study design seems to be highly relevant when the effect of an intervention is to be tested. The design is helpful in understanding if a specific cause (here work-related stress) can be manipulated by the intervention to yield a specific effect on the expected outcome (here less stress-related health symptoms) (Polit & Beck, 2017). In the present study the participants were randomly assigned into one of five different study groups (including the control group) after baseline data were collected. In this way the participants answers in the baseline data collection, were not influenced by knowing which intervention group they would belong to.

The term triangulation has become increasingly common in research. The term refers to the use of different methods by collecting and interpreting data about a phenomenon from different perspectives in order to converge their different perception of reality and, the collaboration between a multidisciplinary research group as a team (Polit & Beck, 2017). This study used triangulation, which can be seen as a strength. Different methods were used for the data collection including questionnaires measuring psychological effects of the intervention. In addition physiological measurements such as blood pressure, fingertip temperature and heart rate were made. Moreover, the research team in this study consisted of different professions within varied disciplines such as nursing, public health, biomedicine and mathematics, i.e. researcher triangulation (Taft Marcus & Liehr, 1998).
When the goal is to implement health promotion in workplaces it is necessary to understand that workplaces as a setting can be very diverse. Workplaces differ in size, their purpose, structure, culture and in general working hours (Hodgins, 2012). The study population in the current study can be defined as a heterogeneous population since the participants came from four different workplaces, with different kinds of work assignments, variation in perceived workload and different levels of required education. The purpose was to include a variety of workplaces with heterogeneous groups of workers with various age and professions and various kinds of responsibilities within the organizations. This can be considered as a strength because we got a relatively broad overview and the findings are therefore not restricted to a single, homogenous population. However, the relative small sample size, can also be seen as a weakness (Polit & Beck, 2017) which will be discussed below.

Another issue that could affect the outcomes of the study is the environment in which the “recovery chair” was placed. Ideal, the “recovery chair” should be separated from any disturbing environment and placed in rooms where the door could be shut. In three of the workplaces it was possible to place the “recovery chair” away from the regularly workplace environment. In one workplace (the school), due to lack of space, the “recovery chair” was placed in a very tiny room next-door with a classroom used for practice musical instruments such as trumpet or saxophone.

**Sample size and gender balance**

Calculation of estimated number of participants was performed based on the results of previous studies using KSP (Jonas, Nissen, Ransjö-Arvidson, Matthiesen, & Uvnäs-Moberg, 2008; Nissen, Gustavsson, Widström, & Uvnäs-Moberg, 1998).

Of all included participants (N=93), the majority (91%) completed the study and the low drop outs must be seen as a strength. The population in each group was relatively small, between 17 and 19 participants. Researchers must pay attention to a sample size in order to have enough power to find statistically relevant and significant results (Polit & Beck, 2017). Indeed, a larger study population can increase the possibility to find statistically significant differences. Thus, the current study was probably underpowered to detect
significant small between-group differences. Therefore, this study must be seen as a pilot study and the results should be seen as a first step towards a larger randomized study within the study area.

There are several reasons to explain why the current study had a small size in each group. First, it was more difficult than expected to get workplaces interested in the study and even at the included workplaces, there was a substantial number of workers, also more than expected, who declined participation in the study. An already too stressful working situation was the main reason for declining participation. Second, due to financial and time-related limitations, it was not possible to include additional workplaces and extend the data collection period any further (Handlin, Muller & Ekström, 2017). The chosen workplaces were relatively small and it is likely that the participants had verbal contact with each other and talked about their experiences about the study. Therefore a spill-over effect might have occurred within each workplace.

In total 69 females (74.2%) and 24 males (25.8%) participated in this study where women were overrepresented in all workplaces. It can be noticed that the highest frequency of female workers was in the school sector (female: n=24, 80%, male n=6, 20%) and in the health care sector (female: n=18, 97.4%, male: n=1, 5.3%). These workplaces are known to have a higher rate of female workers as they are still regarded as typical female professions (Hausmann & Kleinert, 2014). Another reason for the overrepresentation of female participants in this study could be that the intervention used belongs to the complementary and alternative medicine (CAM) category. The interest in CAM has increased during the past decade and the attitude of the general public is mainly positive (Andersson, Tornkvist & Wandell, 2009) but the most frequent users tend to be female (Frass, Strassl, Friehs, Mullner, Kundi & Kaye, 2012; Hanssen, Grimsgaard, Launso, Fonno, Falkenberg & Rasmussen, 2005; Nilsson, Trehn & Asplund, 2001; Pettigrew, King, McGee & Rudolph, 2004).
Psychological effects measured by the Swedish Scale of Personality

The statements included in the questionnaire are part of the larger questionnaire, the “Swedish Scale of Personality” (SSP). SSP is a revised form of the previous “Karolinska Scale of Personality” (KSP), which has previously been used to measure health promotion effects both on healthy participants and on patients with various psychiatric and psychomatic disorders (Zuckerman et al., 1988; Zuckerman et al., 1991) and also on healthy mothers in relation to childbirth (Jonas, et. al., 2008; Nissen, et. al., 1998; Ryding, et. al., 2007; Wiklund, et. al., 2009;) Furthermore, KSP has been correlated with biological variables such as blood pressure (Ortet, Ignacio, Llerena & Torrubia, 2002). In the updated SSP the scales have been shortened, modernized and psychometrically evaluated. Both KSP and SSP are well validated instruments measuring self-experienced health (Gustavsson et al., 2000, Zuckerman et al., 1988; Zuckerman et al.,1991).

Cronbach’s alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is also considered to be a measure of scale reliability. Cronbach’s alpha in this study varied between 0.83-0.95 which indicate a high internal consistency (Pallant, 2013, Polit & Beck, 2017).

In this study a web-based software program (EvaSys.sco.uk), for research projects were used for all collection of SSP data, minimizing the risk of bias during manual transformation data from paper questionnaires. Furthermore, all data collection was carried out by the author of this thesis, with the intention of reducing the risk of changing procedure (Heale & Twycross, 2015).
Physiological effects measured by blood pressure, fingertip temperature and heart rate

Physiological data were collected by measuring the participant’s blood pressure, heart rate and fingertip temperature. Regarding these measures three trustworthy forms of measurements were used for the data collection. The blood pressure manometer, used in current study, was clinically validated and approved (Omron M6 Comfort, Omron Healthcare, Hoofddorp, the Netherlands). The researcher who performed the data collection, is an educated and registered nurse who had appropriate knowledge in which way the chosen instruments in the study had to be used. Most of the data collection was performed during the autumn when outdoor temperatures were decreasing. Seasonal decrease in outdoor temperature might therefore have been a contributing factor for the decrease in fingertip temperature seen in some groups.
Reflections of results

The overall aim of this thesis was to explore the psychological and physiological effects of the mechanical massage and mental training programs included in the “recovery chair”, both separately and in combination, as a health promotion tool for Swedish workers. The presented results showed that there were both psychological and physiological effects for Swedish workers’ when using mechanical massage and mental training programs, both separately and in combination, during working hours. The result will be discussed based on the overall aim.

Effects of mechanical massage

Workers’ who received mechanical massage only had a significant decrease in their “Somatic Trait Anxiety”. They also had significantly lower heart rate compared to both those who received mechanical massage combined with mental training, i.e. the combination group, and the pause group after four and eight weeks. In addition, they displayed significant decreases in their heart rate, systolic and diastolic blood pressure. These workers also showed a significant increase in fingertip temperature during the last four weeks of the study. During stress, the increased sympathetic activity leads to increased vasoconstriction, especially in the peripheral body parts, resulting in decreased temperature in fingers and toes. In contrast, the opposite occurs during a relaxed state and the circulation out to fingers (and toes) increases, as does the temperature (Berridge & Waterhouse, 2003). This shift from a stressed to a more relaxed state is the most likely explanation for the temperature change observed in the workers who received mechanical massage since they displayed increasing fingertip temperature during the last four weeks of the study.

The results presented in this thesis are in line with previous studies on traditional massage, which shows anti-stress effects such as increased energy, better mood, decreased tiredness and better sleep (Uvnäs-Moberg, 2009). It has also been shown to induce sedative effects and calmness and increase social competence (Uvnäs-Moberg, 1998) and increase perception of wellbeing and decrease perception of pain (Field, 2014). Manual massage/massage therapy has also been shown to decrease blood pressure (Field, 2002; 2014).
Taken together, the results showed that massage can be an efficient technique for generating both psychological and physiological anti-stress effects, regardless of whether it is administered by another human being, as during traditional massage and massage therapy, or in a mechanical way, as in the present study. This indicates that mechanical massage can be seen as a potential health promotion activity among workers. Mechanical massage can also be especially important for people who dislike being touched (Zullino et al., 2005). The present study included both mechanical massage and mental training. However, the mechanical massage seems to be the most effective in terms of generating stress-reducing effects.

**Effects of mental training**

The workers who received mental training showed a tendency to decrease in “Somatic Trait Anxiety”. The participants in the mental training group also showed a significant decrease in their heart rate, when compared to the start of the study to week four. Previous studies have shown that techniques for mental training can help a person to achieve a relaxed mental state i.e. a reduction of stress and tension and an increased potential for recovery and health (Uneståhl-Hellertz, 2001; Uneståhl & Bundzen, 1996; Uneståhl et al., 2004). Mental training has also been shown to increase problem solving skills in relation to negative stress situations (Kaushik et al., 2006) and help decrease heart rate and blood pressure (Kaushik et al., 2006).

**Effects of mechanical massage and mental training when used in combination**

Workers’ who received a combination of mechanical massage and mental training showed a significant decrease in “Stress Susceptibility” between four and eight weeks. They also displayed a significant increase in their diastolic blood pressure during the last four weeks of the study. In addition, they displayed significantly lower heart rate after four weeks which tended to differ also after eight weeks. There was also a significant decrease in fingertip temperature when comparing start with end of study for these workers.
The mechanisms behind the effects generated when mechanical massage and mental training was used in combination is most likely the same as those discussed above for the individual interventions. However, since most of the effects were not generated until the last four weeks of the study a longer period than eight weeks might be needed to generate more sustained effects when both activities are used in combination.

**Control conditions**

This study included two control conditions, the workers who took a pause for 15 minutes, i.e. the pause group, and those who continued working as usual, i.e. the control group.

The pause group, had a significant decrease in “Somatic Trait Anxiety” and tended to have lower systolic blood pressure at post- intervention assessment when compared to the pre-intervention assessment. These results could indicate that short breaks during working hours without any treatment apparently may contribute to worsen social dimensions in form of that they became less social or less inclined to help others. Here, probably the pause group had difficult to relax or calm down due to self-perceived high workload. It has previously been shown that a brief nap taken after lunchtime can positively affect wakefulness, performance, learning ability and furthermore enhances subsequent alertness (Dhand & Sohal, 2006; Hayashi et al., 1999; Takahashi et al., 1998).

The workers in the control group continued with their work as usual and did not use any functions of the armchair or take a break in the armchair during working hours. However, they still displayed several positive changes during the study period, such as a significant decrease in heart rate and in systolic blood pressure. These findings could indicate that the control group were positive affected by being part in this study or that they got improved experiences through conversations with their colleagues. A possible explanation for this might be the “Hawthorne Effect”, i.e., the tendency to modify an aspect of a person’s behavior in response to their awareness of being observed. For example, work harder and perform better even if they are not included in an intervention. (McCambridge, Witton, & Elbourne, 2014). It is further known that positive social interactions can be related to health-
promotion effects (Uvnäs-Moberg, 1998) and this can also be the case in this study, where a large part of the workforce belonged to the treatment groups that experienced less stress and/or anxiety.

**Effects on health promotion**

Earlier research shows that one of the most important factors affecting workers health is the extent the workers are able to recover from stress and fatigue at workplaces (Jansen, Kant & van den Brandt, 2002). Lack of recovery has been proposed as a key factor relating to the increasing levels of stress-related health problems (Dhand & Sohal, 2006; Geurts & Sonnentag, 2006; Hayashi, Watanabe, & Hori, 1999; Lundberg, 2005; Lundberg et al., 1999). Research also shows that to achieve recovery only a short respite from work is needed (Dhand & Sohal, 2006; Hayashi et al., 1999; Takahashi, Fukuda, & Arito, 1998). The results from this study indicate that the interventions tested, and especially the mechanical massage, can help workers develop health promotion tools, which are important for reaching a better status of physical, mental and social health, just as stated in the Ottawa Charter for Health promotion as “… the process of enabling people to increase control over, and to improve their health” (WHO, 2009).

The results presented in this thesis are in line with other research (Morrison & Bennett, 2009) that indicate that stress management interventions or workplace health promotions activities clearly have a potential to provide significant benefit for health and wellbeing on workplaces. Nilsson, Andersson, Ejlertsson & Troein stated that workplace health promotions activities strengthen workers’ own resources to reduce their stress levels (Nilsson et al., 2012).

As previously stated, health is a broad concept which can embody many meanings and is thus multifactorial (Naidoo & Wills, 2004). That means, that a research problem can be addressed from different perspectives in order to get a more comprehensive understanding of the research question (Sohlberg & Sohlberg, 2006). There is a need of a multidisciplinary research in order to tackle complex research issues such as health promotion (Antonovsky, 1987).
When studying health promotion interventions for workers it’s important to keep in mind that the aim is to support workers to remain healthy and recover, not to treat workers who have become ill and unable to work (Eriksson & Lindström, 2008).
Comprehensive Understanding

Work-related stress is one of the most challenging issues on workplaces. Reduced ability to relax and recover has been proposed as a key factor behind the increase of stress-related illness among workers. The most common reason for sick leave among Swedish workers is negative stress, often work-related, and therefore there is a need for more evidence on the effectiveness of health promotion interventions. This is in line with the intention of the World Health Organization, stated as “… the process of enabling people to increase control over, and to improve their health” and also with the salutogenic perspective (people’s abilities and skills to recover from negative stress), since it can be used to enable people to increase control over and improve their health.

Massage and mental training are two commonly used techniques which may have a positively psychological and physical effects on the ability to recover. One technique to help workers to become less stressed is a “recovery chair” which included both mechanical massage and mental training programs. This thesis, it is to our knowledge, the first study which has explored the psychological and physiological effects of the mechanical massage and mental training programs included in the “recovery chair”, both separately and in combination, as a health promotion tool for Swedish workers.

The workers’ who used mechanical massage or mental training programs, either separately or in combination, for eight weeks during working hours reported a positive impact on their levels of anxiety and stress sensitivity. The results also showed positive effects on the workers' blood pressure, pulse and fingertip temperature. The effect was particularly strong for workers' who received only mechanical massage. It seems that there is a time difference for different techniques to generate effects on different traits. It appears as if the single treatments alone, i.e., mechanical massage only or mental training only, generate effects faster than the combination of the two. This is shown by the fact that the effects in the massage group and mental training group were generated throughout the entire study period, whereas the effects in the massage and mental training group appeared first in the second part of the study. These results could indicate that the combination of the two techniques takes longer time to generate effects than the single treatments alone.
The results from this study are in line with other research that indicate that stress management interventions or workplace health promotions activities have a potential to provide significant benefit for health and wellbeing for workers.

Practical implications and further research

Receiving mechanical massage and mental training programs, either separately or in combination, included in a “recovery chair”, showed positive effects on workers’ self-experienced anxiety, their heart rate, blood pressure and on their fingertip temperature. The effects were especially strong for workers who received mechanical massage only. Based on these results, mechanical massage and mental training can be used as a health promotion tool to combat the increasing stress-related health problems at workplaces. However, further research is needed to investigate the long-term effects of using mechanical massage and mental training programs, and especially when combining the two.
Conclusions

The overall aim of this thesis was to explore the psychological and physiological effects of mechanical massage and mental training programs included in a “recovery chair”, both separately and in combination, as a health promotion tool for Swedish workers. The results showed that the workers’ who used mechanical massage or mental training programs, either separately or in combination, for eight weeks during working hours reported a positive impact on their levels of anxiety and stress sensitivity. The results also showed positive effects on the workers' blood pressure, pulse and fingertip temperature. The effect was particularly strong for workers' who received only mechanical massage. The results from this study are in line with other research that indicate that stress management interventions or workplace health promotion activities clearly have a potential to provide significant benefit for health and wellbeing for workers.
Svensk sammanfattning

Inledning:
Ökad stressrelaterad ohälsa bidrar till ökade sjukskrivningar. Minskade möjligheter att återhämta sig har setts som en orsak till denna ökning. En teknik, som använts för att möjliggöra återhämtning, är en återhämningsfåtölj med inbyggd mekanisk massage och mental träningssprogram, vilka kan användas både separat och tillsammans. Effekterna av återhämningsfåtöljen och dess mekanismer har dock inte studerats vetenskapligt tidigare.

Syfte:
Syftet med denna avhandling var därför att utvärdera psykologiska och fysiologiska effekter av mekanisk massage och mental träning, inbyggda i en återhämningsfåtölj, både separat och tillsammans.

Metod:

Datainsamlingen skedde tre gånger under studieperioden. Första datainsamlingen skedde innan randomiseringen, där deltagarna inte visste vilken grupp de skulle tillhöra. Andra datainsamlingen skedde efter fyra veckor och tredje datainsamlingen skedde efter åtta veckor, vid studiens slut. Vid varje tillfälle fyllde deltagarna i ett frågeformuläret som mätte psykologiska effekter av interventionen, till detta användes frågeformuläret Swedish Universities Scale of Personality (SSP). För att mäta fysiologiska effekter mättes arbetstagarnas blodtryck, hjärtfrekvens och fingertopptemperatur.

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Resultat:

Psykologiska effekter: Resultatet visade att de arbetstagare som fick mekanisk massage hade en signifikant sänkning av sin kroppsliga ångestbenägenhet. Även arbetstagare i den mentala träningsgruppen visade en signifikant tendens till en sänkning av sin kroppsliga ångestbenägenhet. Deltagarna som fick både mekanisk massage och mental träning visade en signifikant sänkning av sin stressmottaglighet de sista fyra och åtta veckorna av studien. Resultatet visade också en signifikant sänkning av stressmottaglighet och avståndstagsande för pausgruppen.

Fysiologiska effekter: Resultatet visade att mekanisk massage gav en signifikant minskning av hjärtfrekvens samt systoliskt och diastoliskt blodtryck. Dessutom resulterade mekanisk massage i en ökning av fingertopptemperaturen. Gruppen som enbart fick mental träning visade en signifikant minskning av fingertopptemperaturen och en signifikant minskning av hjärtfrekvensen, vid studiens slut jämfört med studiens start. Massage och mental träning tillsammans bidrog till en signifikant ökning av det diastoliska blodtrycket under de sista fyra veckorna av studien. Deltagarna i pausgruppen visade dessutom en högre hjärtfrekvens jämfört med andra grupper efter fyra veckor. Deltagarna i kontrollgruppen, gruppen som fortsatte jobba som vanligt, visade statistiskt signifikanta förbättringar i hjärtfrekvensen och det systoliska blodtrycket.

Slutsats:

Slutsatsen av studien är att arbetare som använde återhämtningsfåtöljen med mekanisk massage eller mentalt träningsprogram, antingen separat eller i kombination i åtta veckor, rapporterade en positiv inverkan på sin ångest- och stresskänslighet. Resultaten visade också positiva effekter på arbetstagarnas blodtryck, puls och fingertopptemperaturen. Effekten var särskild starka för de som endast fick mekanisk massage. Återhämtningsfåtöljen och dess mekanismer kan därför ses som ett hälsofrämjande verktyg på arbetsplatsen. Detta kan bidra till att minska arbetsrelaterad stress och antalet sjukskrivningar bland svenska arbetstagare. Resultatets slutsats kan dock inte dras till återhämtningsfåtöljens effekter under en längre period än åtta veckor och visar därför behov av randomiserade kontrollerade longitudinella interventionsstudier studier, som pågår en längre tid än åtta veckor.
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**Appendix**

**Explanation of variables in the questionnaire**

**STA= Somatic Trait Anxiety:**
STA 1= I rather often find myself clenching my teeth for no reason
STA 2= My body often feels stiff and tense
STA 3= Sometimes my heart pounds hard or irregularly for no apparent reason
STA 4= Sometimes I suddenly start sweating for no particular reasons
STA 5= An unexpected noise makes me jump
STA 6= I sometimes have a feeling that I don’t get enough air to breathe
STA 7= I worry far in advance when I’m going to get started on something

**SS=Stress susceptibility:**
SS 1= I get tired and hurried too easily
SS 2= I don’t mind being interrupted when I’m working with something
SS 3= In order to get something done I have to spend more energy than most others do
SS 4= I can usually concentrate on what I’m doing even if the environment is distracting
SS 5= I easily feel pressure when told to speed up my work
SS 6= I feel calm and secure even when I’m facing new tasks
SS 7= I think I have less energy than most people I know
D=Detachment:
D 1= It is easy for me to get close to people
D 2= I avoid people who are interested in my personal life
D 3= I feel uncomfortable when people take me into their confidence
D 4= I feel best when I keep people at a certain distance
D 5= I prefer not to get involved in other people`s problems
D 6= I´m probably reserved and a little cold rather than kind and warm
D 7= People often come to me with their troubles

SD=Social Desirability:
SD 1= I´m always polite and self-controlled, regardless of whom I talk to
SD 2= I´m always a good listener, regardless of whom I talk to
SD 3= I always help out when somebody needs me
SD 4= I never mind if people ask me a favor
SD 5= If I have made a mistake I´m always willing to admit it
SD 6= I´m always polite, even to unpleasant people
SD 7= I have been known to lie to get out of something I did not want to do

PSTA=Psychic Trait Anxiety:
PSTA 1= I don´t have much self-confidence
PSTA 2= I´m probably the kind of person who is excessively sensitive and easily hurt
PSTA 3= I seldom dare to express myself in a discussion because I have the feeling that people think my views are not worth anything
PSTA 4= It probably takes me an usually long time to get over unpleasant events
PSTA 5= I often feel uneasy when I meet people I don´t know too well
PSTA 6= I often worry about things that other people look upon as trifles.