Stress and physical activity during a 1-year counseling intervention

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ABSTRACT

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Physical inactivity has been identified as the fourth leading risk factor for global mortality causing an estimated 3.2 million deaths globally. At the same time perceived stress of individuals has increased. Many studies suggest that increasing physical activity can decrease perceived stress. The purpose of this study was to investigate whether the amount of physical activity and inactivity are associated with perceived and measured stress. In a year-long intervention a group receiving counseling to reduce physical inactivity and a control group were followed.

123 adults completed the study of which 42 to 90 have been used in statistical analyses (depending on valid data available on different variables). Intervention group (IG) included 25 males aged 39 ± 5years and 40 females aged 36 ± 4 years and control group (CG) 26 males aged 41 ± 5 years and 32 females aged 40 ± 5 years. Perceived stress, work ability index, physical activity and sitting time were assessed with questionnaires. Heart rate (HR) and heart rate variability (HRV) were measured for examining autonomic modulation.

Intervention decreased self-reported sitting time at work (p=0,017) and lowered self-reported stress (p=0,019) compared to the control group. During the first 6 months perceived stress decreased in IG from 67 ± 10 to 65 ± 9, and increased in CG from 67 ± 9 to 69 ± 9, (p=0,019 between groups). Sitting time during work decreased in IG from 85 ± 12% to 79 ± 15% and on CG from 77 ± 14% to 76 ± 15% (p=0,017 between groups). Changes in HRV variables occurred in orthostatic test but the results were inconsistent with those from the questionnaires. The effect of intervention on perceived stress, self-reported sitting time and HRV lasted only the reinforced counseling period (first 6 months) and the effect disappeared during the maintenance period (last 6 months).

Results of the study suggest that tailored counseling can reduce sitting time at work and perceived stress. Controversial results between HRV method and stress questionnaire leaves some open questions. It may be that avoiding inactivity is not a sufficient stimulus to affect autonomic modulation. It is also notable that in general all differences between the groups were seen after the first 6 months and not maintained after 12 months. Therefore, it is likely that long term effects require reinforcement of counseling to maintain the positive changes.

Key words: stress, HR, HRV, inactivity, questionnaire

TIIVISTELMÄ

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Liikkumattomuus on luokiteltu maailman neljänneksi suurimmaksi kuolinsyyksi ja arviolta 3,2 miljoonaa ihmista kuolee vuosittain liikkumattomuudesta seuraaviin sairauksiin. Samaan aikaan ihmisten kokema stressi on lisääntynyt. Monissa aiemmissa tutkimuksissa fyysisen aktiivisuuden lisääminen on helpottanut stressiä. Tämän tutkimuksen tarkoitus oli selvittää, ovatko fyysinen aktiivisuus ja inaktiivisuus yhteydessä koettuun ja sykevälivaihtelun avulla mitattuun stressiin. Tutkimuksessa seurattiin vuoden ajan interventio-ryhmää (IR), joka sai neuvoja inaktiivisuuden vähentämiseksi. IR:n rinnalla seurattiin kontrolliryhmää KR.

123 aikuista oli tutkimuksessa mukana koko vuoden. Mittauksesta ja muuttujasta riippuen lopullisissa tilastollisissa analyyseissä oli mukana 42-90:n koehenkilön tulokset. IR koostui 25 miehestä (ikä 39 ± vuotta) ja 40 naisesta (ikä 36 ± 4 vuotta), KR koostui 26 miehestä (ikä 41 ± 5 vuotta) ja 32 naisesta (ikä 40 ± 5 vuotta). Koettua stressiä, työkykyä, fyysistä aktiivisuutta ja istuma-aikaa mitattiin kyselyillä. Sykettä ja sykevälivaihtelua mitattiin autonomisen hermoston toiminnan tutkimiseksi.

Verrattuna KR:iin, IR:n itse raportoima istuma-aika työajalla ja koettu stressi laskivat ensimmäisen kuuden kuukauden aikana tilastollisesti merkitsevästi (istuma-aika $p=0,017$; ja itse raportoitu stressi $p=0,019$). Tuona aikana IR:n istuma-aika työajalla laski 85 ± 12%:sta 79 ± 15%:iin ja koettu stressi 67 ± 10:stä 65 ± 9:een. Sykevälivaihtelussa muutoksia havaittiin ortostaattisessa testissä, mutta tulokset olivat ristiriidassa kyselytulosten kanssa. Eroja ryhmien välillä havaittiin vain ensimmäisen kuuden kuukauden eli tehostetun seurannan aikana ja seuraavan kuuden kuukauden ylläpitojakson jälkeen eroja ei enää ryhmien välillä havaittu.

Tutkimuksen tulokset osoittavat, että neuvonnan avulla voidaan vähentää koettua stressiä sekä istumista työajalla. Ristiriitaiset tulokset sykevälivaihtelumittausten ja kyselyiden välillä herättävät kysymyksiä. Voi olla, että inaktiivisuuden välttäminen ei riitä vaikuttamaan autonomiseen säätelyyn. On myös huomionarvoista, että tilastollisesti merkitseviä eroja ryhmien välillä havaittiin vain tehostetun seurannan eli ensimmäisen kuuden kuukauden aikana. Ihmisiä olisi siis jatkuvasti muistutettava neuvonnasta, jotta sen vaikutukset säilyivät.

Avainsanat: stressi, syke, sykevälivaihtelu, inaktiivisuus, kysely

CONTENTS:

1 INTRODUCTION

Physical inactivity has been identified as the fourth leading risk factor for global mortality causing an estimated 3.2 million deaths globally (WHO). Inactivity during everyday life has been rising since the beginning of industrial revolution as mentioned in Finni et al. 2011. At the same time stress levels of individuals have raised constantly (Cox et al. 2000).

Elevated stress is related to actions that break the normal phase of an individual. Stress can be positive or negative depending on the occasion. Stress turns to negative when it is chronic and the reasons why stress occurs are not that positive either. Stress occurs when individual resources do not meet the demands. The higher the level of commitment, the higher the stress can be. (Lazarus & Folkmann 1984, Cox et al. 2000.) Main stressors related to the present study are work related stress and family related stress and their combination.

Work related stress is increasing all the time while demands and time constraints are also increasing. At work it seems that the psychological demands have increased while the physical demands have decreased. Work is nowadays done by computers, and even though workers are not all the time at work, they need to be on call all the time. (Rahkonen et al. 2011, Rantanen & Mauno 2010, Kinnunen et al. 2005). It is difficult to evaluate the effects of work related stress, but some educated guesses have been made. Some idea of the scale of the problem can be seen from statistics: The European Foundation's 1996 Working Conditions in the European Union revealed that 29% of the workers believed the work to affect their health. 28% of those were related to stress. From the responders 23% had been absent from work of those causes for four days. That means 600 million working days lost per year in EU. (Cox ym. 2000.) In families with small children, parents meet many stressors. With family the commitment is usually on the highest level so the risk of chronic stress in families is raised. (Figley 1989, Cox 2000, Lazarus & Folkman 1984, Crnick & Greenberg 1990.)

Perceived stress can be measured with questionnaires. Another way to evaluate stress is to observe modulation of autonomic nervous system, which is related to stress. Higher sympathetic activity of autonomic nervous system is related to higher stress while higher vagal tonus is related to relaxation. Autonomic nervous system activity can be monitored via measurements of heart functioning. Changes in heart rate (HR) and especially heart rate variability (HRV) can reflect individuals stress levels. The results of HRV methods are not yet completely valid measurements because of the various things which can affect HR and HRV. Nevertheless when using HRV method together with the individuals own estimation it is useful method in detecting stress. (Hynynen 2011.)

Earlier studies have shown that increased physical activity and relaxation rehearsals can decrease perceived stress and stress measured by HRV. Usually stress related studies have been performed with people with stress symptoms and that is why the results have been so clear. Effects of avoiding sedentary behavior on stress have not been studied. In bigger picture it would be more important to find a way to avoid getting chronically stressed than just nurse the stress symptoms when they occur. That is why the topic of this study is so important. (Brandao et al. 2009, Levy et al. 1998, Iellamo et al. 2002, Sandercock et al, Bernardi et al. 1996, Jurca et al, 2004, Schuit et al. 1998, Bernardi 1996, Sneed et al. 2001.)

The purpose of this thesis was to study whether inactivity can be reduced by tailored counseling, and whether the reduction of inactivity affects perceived and measured (HR and HRV) stress. In addition, the association between perceived and measured stress was studied.

2 STRESS

The definition of stress is not an easy task. Stress as a phenomenon has been studied in many different areas of science. Usually the word stress has negative connotations and it is seen as a negative physiological state with cognitive and emotional components. (Cox et al. 2000) There is also a belief that certain type and certain amount of stress can be beneficial for health and maximal performance (Hynynen 2011.) Unfortunately different kind of views leads often to misunderstandings and malpractices. In the literature there are three different, overlapping approaches to define stress. (Cox et al. 2000.)

1. Engineering approach –"stress is aversive or noxious characteristics of the work environment, and treats it as an independent variable." =stress factors
2. Physiological approach –approaches stress as common physiological effects, and treats stress as a dependent variable. =stress reactions
3. Psychological approach –"dynamic interaction between the person and their (work) environment."

There are two criticisms against the two first approaches. They do not account the existing data and they ignore individual differences. However the third approach pays attention to the environmental and psychosocial factors. That is why variants of psychological approach dominate the contemporary stress theory. (Cox et al. 2000.) The difficulty in psychological stress models is that they are difficult to measure, and actually "the individual's subjective assessment is the only valid measurement of well-being available" (Levi 1992).

Lazarus and Folkman (1984) defined stress as interaction between individual and environment. Stress is due to disproportion of demands and individuals strength. (Lazarus & Folkmann 1984.) Actions which break the normal phase of a person are called stressors; they can be physical or psychological. Persons own health and social

skills are strongly related on the amount of perceived stress and handling of it. The level of commitment usually defines the amount of the psychological stress. Family and work are usually the most important things in individual's life, and that is why stressors related to those play such a big role in individual's own estimation of perceived stress. (Cox et al. 2000.) Work and family play a big role in this study and are therefore described in more detail in the next chapters.

2.1 Work related stress

During the last 60 years, demands of work life in Finland have changed. In general work has changed from physically demanding to mentally demanding, although different occupations have different demands.. (Rahkonen et al. 2011.)

One major problem in work related stress studies is that wellbeing in the work life is approached on negative angle. This means that if stress and exhaustion symptoms do not exist, it is interpreted as wellbeing. (Kinnunen ym. 2005 13.) It is also notable that different personalities experience stressful situations on different manner (Levi 1992).

In Finland work related stress has been studied since 1950's (Rantanen & Mauno 2010). Work related stress is rising while the demands of work life are rapidly changing. For example in Finland the hurry and demands of work have risen constantly since 1977. In 2003, 30 % of Finnish workers said that time constraints disturb their work, 51 % of them claimed that work demands are hard or pretty hard and 41 % of workers stated that they have constant fear of unexpected changes in work (such as restructurings). Insecurity in the workplace may lead to competition and back stabbing, which decreases the atmosphere in the work community. Stress levels have risen especially among white collar workers. (Kinnunen ym. 2005.) Since the 1970's Finnish workers have reported that due to limited time and insecurity, the line between work and free time has been blurred, which also causes stress (Lehto & Sutela 2008). During economic difficulty,

organizations are pushing their workers to the edge. People cannot be sure of their work places, and as more and more people are getting fired, uncertainty leads to anxiety even in apparently stable conditions. (Kinnunen ym. 2005 119-167.)

Despite these negatives, there are also some positive trends in Finnish work life. Relationships between bosses and employees have got better. Bosses are now listening to and trusting more in employees, which offers better chances for employees to influence the directions of their work. Education level has increased. Working conditions and general health have improved during the last 30 years. The psychosocial work environment is now the biggest problem. On a European level the positive changes in work life are concentrated to big corporations and long work relationships, while the negative issues are more related to small firms and insecure work relationships. At its best, work improves individual resources but at its worse can be a health risk. (Kinnunen ym. 2005 7-10, Cox 2000.)

2.2 Family related stress

Family related stress is also related to the same kind of disproportion of demands and strength that individuals face in everyday life. Hamilton et al. (1983), divide family stress to physical-, psychological-, and-, economical stress. Stress is always individual's cognitive experience and his own estimation on stress level is the best way to measure stress also in families. When family's strength is not enough to handle the responsibilities and demands of the family, stress occurs. Examples of stressors include: death of someone in a family or close of it, divorce, serious illness, money problems etc. (Figley 1989, Cox 2000.)

Parental stress occurs, when individual resources do not meet the parental needs. Every parent has their own wishes and expectations of being parent and what kind of parent he or she wants to be. If there are big differences between the wishes and expectations

compared to real life, parental stress may come up. Stress can be divided to bigger stress factors and daily hassles. Those bigger stressors occur so rarely, that daily hassles can be even more important for wellbeing (Lazarus & Folkman 1984).When you have to solve kids fights every day, in the long term stress accumulates (Crnick & Greenberg 1990). Rogers and White (1998) stated that some people interpret home works as stressor and others do not. Also different roles in the family may cause some stress. (Rogers and White 1998.)

When coping with family related stress, especially social support plays a big role. Relationship between parents is also one part of being stressed because it provides social support. Östberg et al. (1999) found that single mothers are more stressed than other parents, which is probably due to lesser social support. There are also differences between genders; mothers feel that the majority of home works belongs to them. It seems that women experience more stress than males. Also the education level and age of parents can have influence. Less educated mothers and older mothers experience more stress than more educated ones. (Östberg & Hagekull 2000).

There are also many stressors related to the child-parent relations. For example the temperament of the child can have an influence on parental stress, the harder the characteristics of the child, the higher the stress level of parents (Saisto et al. 2004). As children's behavioral problems cause stress, their wellbeing and health can also be a huge stressor for many parents. As well as children's behavior, parental behavior can be a reason for family stress. Strict rules and demanding parenting causes stress for kids, and then these stressed kids do not obey the rules. And when they do not obey the rules, parents are more stressed and they are stricter with their rules, creating a vicious circle. (Deater & Deckar 1998). The quality of parenting decreases when individual resources decrease. Happiness in the relationship decreases the stress level. (Belsky 1984.)

When joining work and family life, there will definitely be some conflicts. Spouses can get the feeling that they are doing more than they are able to do while the other spouse

is not doing his/her part of the family and economy management. If you always have the feeling that you are the only one making compromises, it is not a sustainable situation. At its best, work can support family management, as parents will get their own time and social networking, as well as feelings of success. Their psychosocial part gets satisfied through work. On the other hand work can decrease the resources of the individual and through that it makes family life harder. Family can either support work life or then make it harder (Kossek et al. 1999, Kinnunen ym. 2005 229-265.) In Figure 1 Kossek et al (1999) have compiled relations of self-management and work/family roles (Kossek et al. 1999).

Figure 1
Model of Antecedents and Outcomes Pertaining to Self-Management of Work/Family Roles

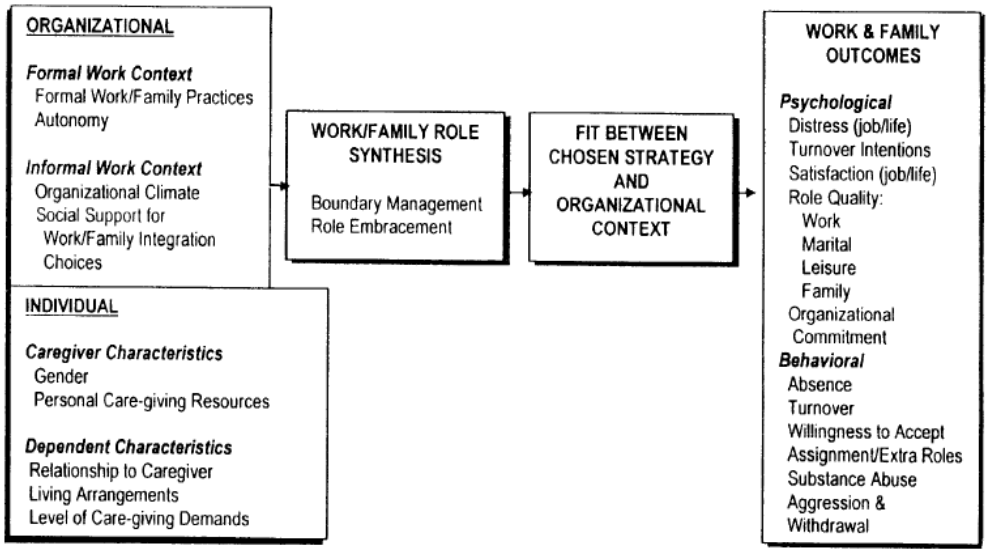

FIGURE 1. Model of antecedents and outcomes pertaining to self-management of work/family roles (Kossek ym. 1999).

2.3 Stress and physical activity

The World Health Organization (WHO) describes physical activity as “any bodily movement produced by skeletal muscles that requires energy expenditure”. Through the health benefits, physical activity is big part of people’s well-being. Well-being is

described as a dynamic state of mind characterized by reasonable harmony between a person's abilities, needs, and expectations, and environmental demands and opportunities (World Health Organization 1986.) The individual's subjective assessment is the only valid measure of well-being available (Levi 1992.)

The relationship between stress and physical well-being is acknowledged but the exact effects of exercise needs still further research (Gockel ym. 2004). Physical activity can decrease the physical and psychological symptoms of stress. It is still unclear whether stress decreases physical activity or whether decreased physical activity is the reason for higher stress. (Hirvensalo et al. 2011.) There are many ways-, in which physical activity can affect stress. Changes occur in anatomical, cellular, and molecular level as well as in endocrine system. Exercise and increased activity affects the brain by increasing its elasticity (adaptability) and improving its functioning. Changes occur in areas that influence learning, memory and cognitive function. By gene microarray analysis it has been found that physical activity activates over 130 genes in the brainstem. For example gene called BDNF (brain derived neurotropic factor) modulates synaptic plasticity and is used as a medicine to treat depression. Not only genes but also hormones, which are activated through physical activity, modulate basal neurogenesis. Corticosteroids are released from the adrenal gland as response to stressful events. They bind to glucocorticoid receptors, located especially in hippocampus, and modify gene expression. Prolonged stress increases the risk of hippocampal neurons to injury from neuronal insults, which can lead to depression. Increased levels of corticosteroids in hippocampus decrease BDNF mRNA and protein expression in hippocampus. Exercising increases BDNF levels, which improves hippocampal functioning and relieves stress. The research in that area is still only in the beginning and probably more exact knowledge will still be found in the future. (Mooren & Völker 2005 331-341.) In addition physical activity prevents diseases by improving immune system functioning, it also improves physical condition and work ability. Through that physical activity improves self-image and simplifies the management of everyday life. (Valkeinen et al. 2011).

Heikkinen & Ilmarinen (2001) reported based on a longitudinal study from 1992 to 2001 that physical activity during leisure time decreased the risk of work related stress. They took into account the level of education and demands of the work in the analysis. Individuals who were actively exercising in their leisure time had four times lower risk to come down with work-related stress than those who did not exercise in their leisure time. Also the effects of changes in physical activity on perceived stress were seen really clearly. When the level of physical activity was raising the level of stress decreased and vice versa. (Heikkinen & Ilmarinen 2001.)

Higher levels of physical activity during youth and childhood predict lower levels of work-related stress. This may be due to the characteristics which have led them to exercise in the first place. On the other hand exercising might have developed stress management abilities and coping. Sports and exercising can teach how to handle responsibilities and social networks which helps coping. (Valkeinen 2011.)

Physical activity can prevent or treat depression through changes in molecular level (Mooren & Völker 2005 s. 331) and through changes in social environment and self-picture. This especially with sedentary workers, but for example it has been seen also with nurses who are active in their work that leisure time activity decreases depression. (Hirvensalo ym. 2011.) Yang et al. (2010) investigated leisure-time physical activity and its connections to job strain and depressive symptoms. According to the study leisure-time physical activity was connected with lower job strain and depression and inactivity was connected to higher job strain and depression. Results were not dependent on the occupation, age, gender, body composition or educational level. (Yang 2007.)

Why does higher physical activity relieve stress symptoms? Effects of physical activity are related to the worker himself. How he or she experiences his resources, himself and his work capability and through those how he experiences his work. In physical activity there is physical, physiological and social side. Physical side is related to better condition, better work ability and lower fatigue. Many people also report that physical

activity is a good way to cope work-related stress. The demands of the work have changed and now physical activity needs to be done on leisure time. In coping and wellbeing the psychological and social effects of physical activity are even more important than physiological effects. Positive moods and satisfaction after physical activity are connected to wellbeing and mental health. Physical activity produces endorphins, activates brain and raises hormone levels. Through physical activity individuals learn to know their body better which is strongly related to self-picture. Together these factors can protect from work-related stress, fatigue and depression. Social part in physical activity is the connection to other people, doing together and being a part of a group. (Valkeinen et al. 2011, Hirvensalo et al. 2011, Hynynen 2011.)

2.4 Stress and its effects on individuals, body systems and HRV

Stress causes many symptoms such as emotional exhaustion, physical fatigue, and cognitive weariness. Accumulating evidence suggests that prolonged stress increases the risk of cardiovascular disease. (Melamed et al. 2006.) Depressed mood and psychological stress are independently associated with primary and secondary coronary events. (Nolan et al. 2005). There are several possible mechanisms linking stress symptoms to physical illnesses. Melamed et al. 2006 list those linkages as follows: "metabolic syndrome, dysregulation of the hypothalamic–pituitary–adrenal axis along with sympathetic nervous system activation, sleep disturbances, systemic inflammation, impaired immunity functions, blood coagulation and fibrinolysis, and poor health behaviors." (Melamed et al. 2006.) This thesis focuses on self-reported stress and HRV which are discussed in more detail.

Stress can be measured by questionnaires and by measuring body functions such as heart rate (HR), heart rate variability (HRV) and blood pressure (BP) (Hynynen 2011, Sandercock et al. 2005, Berntson & Cacioppo 2004). Stress is related to higher sympathetic activity and there-fore measuring variables that are related to autonomic nervous system can help evaluate stress levels. In Figure 2 the state of autonomic

nervous system during stress and recovery is presented. The more stressed the individual is, the higher the sympathetic modulation is, the more relaxed the individual is, the higher the vagal modulation is. (Hynynen 2011).

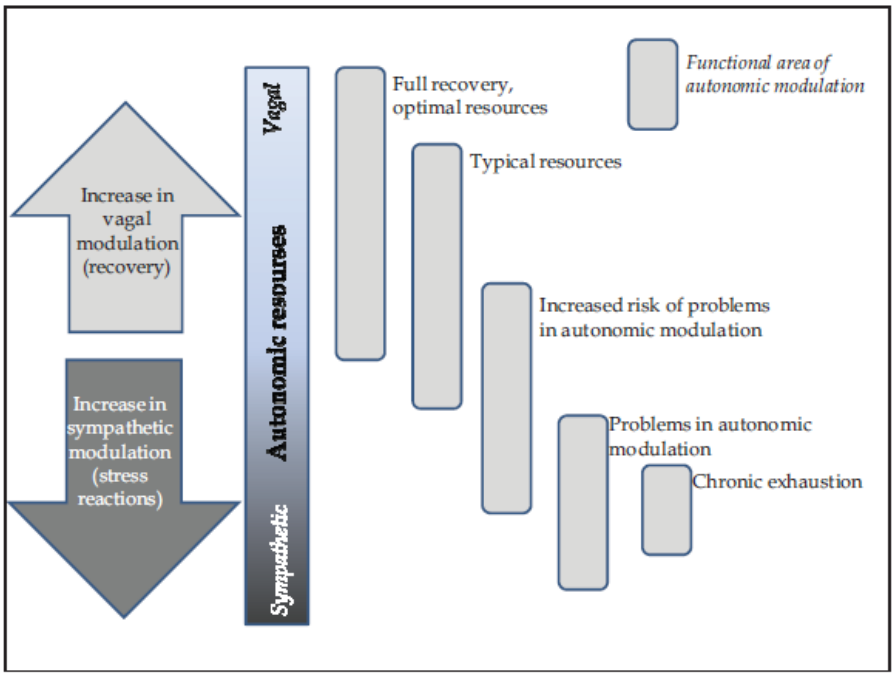

FIGURE 2. Model of the autonomic resources (Hynynen 2011).

When stress is constant, individuals get used to it. When daily stressors occur on several days, emotional habituation occurs already on second day. When there are multiple stressors on same day, emotional plateau occurs. (Bolger et al. 1989.) In long term that can lead to chronic stress and more severe symptoms like exhaustion and depression. It is notable that if you have need for recovery it is a major predictor of psychosomatic complaints and complaints of emotional exhaustion (Sluiter et al. 1999)

It has been shown in laboratory studies that measurements of HR and HRV can reveal stress symptoms as seen in Figure 3. The variation between subjects is high but the main directions can be clearly seen. When studying stress in real life, it would be good to be able to measure stress using noninvasive method. Hynynen et al. (2010) examined whether HRV method used in real life is related to self-reported stress and stress

symptoms. They found that self-reported stress was related to autonomic modulation measured during the orthostatic test but not during sleep. (Hynynen 2010.)

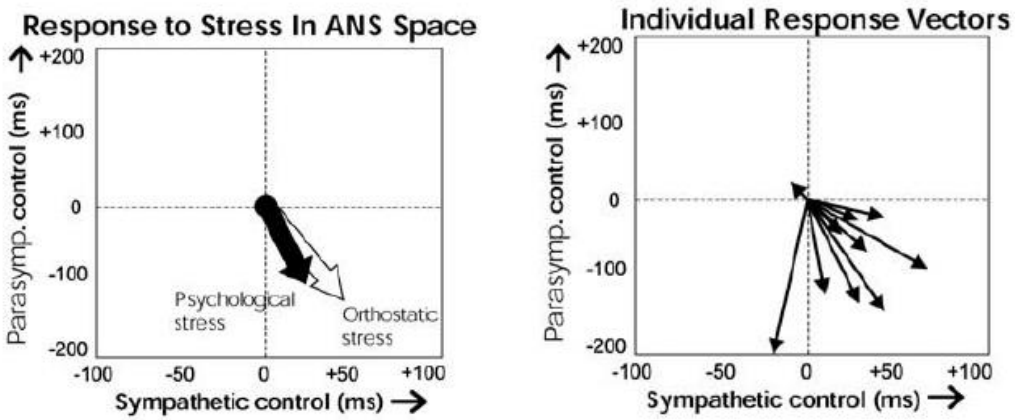

FIGURE 3. Sympathetically and parasympathetically mediated changes in heart period in response to stress (Berntson & Cacioppo 2004).

Vrijkotte et al. looked for the chronic work stress in 109 male white-collar workers with the model that divided (1) high imbalance, a combination of high effort and low reward at work, or (2) high over commitment, an exhaustive work-related coping style indexing the inability to unwind. High imbalance was related to higher heart rate during work time and right after work, higher systolic blood pressure during both work and leisure time and lower vagal tonus during whole day. With high over commitment such connections were not observed. (Vrijkotte ym. 2000.) On the contrary Brady et al. (1993) found that HR decreases when there is low subjective workload. (Brady et al. 1993). Peters et al. found that lack of controllability of task and high mental effort increased sympathetic effects (Peters et al. 1998).

Collins et al. (2005) researched- whether job strain and autonomic indices are associated. They observed one working day and the following free day after that, lasting in total for 48 hours. They used questionnaires and electrocardiogram measurements and found that job strain and low decision latitude were associated with low vagal

tonus. Stress during the work day was associated with high sympathetic activity. (Collins et al. 2005.)

Myrtek et al. (1996) studied acute, chronic and subjective stress, objective strain and behavior in normal studying conditions with university students. Subjects were young women, and measurements were done during their normal school day for 23 hours. To evaluate acute stress authors compared physiological and self-reported knowledge between study actions and leisure time actions. To evaluate chronic stress they compared stressed and unstressed groups. With higher stress levels HRV was lower and HR was higher during studying than during leisure time. Physical activity was higher during leisure time. Students with chronic stress had higher HR and lower HRV during studying compared to the students who were not chronically stressed. And there were no differences between physical activity levels. (Myrtek et al 1996.) Lower HRV during studies indicates increased mental load. For chronically stressed students HR was significantly higher and HRV lower than for unstressed students. (Myrtek et al. 1996). In 1999 Myrtek et al. found that decrease in HR indicates monotony effect of work (Myrtek et al. 1999).

Adams et al. (1998) studied the effect of night shift to blood pressure (BP) and HRV with emergency physician. 8 males and 4 females average age 34 ± 4 were involved the measurements, which lasted 24 h, including 8 hours night shift, and 8 hours before and after the shift. Diastolic blood pressure (DBP) was higher during the night shift compared to no-shift results. In the systolic blood pressure (SBP) and HR there were no differences. In HRV variables there were many changes: low frequency power, high frequency power ratio (LFP/HFP) was different between pre shift-shift comparison. R-to-R peak interval (RRI), standard deviation of NN interval (SDNN), HFP and LFP/HFP differed between every time points (pre, post and during the shift). (Adams et al. 1998.)

There are also studies where the effects are not so clear. Riese et al. (2004) studied job strain related to ambulatory blood pressure, heart rate and heart rate variability. They defined job strain with Karasek model. Job strain was not related to change in HR, HRV or BP. Job strain was not related to recovery during the night after the work day or after the leisure day. High job strain was related to higher BP during work time. (Riese et al 2004.) Sammer (1998) concluded that the complexity of heart dynamics is related to the type of task and that the predictability of heart dynamics is related to the amount of load. (Sammer 1998.)

Because of the complexity of stress it is difficult to develop a method to evaluate the amount of stress in the real world, and to determine differences between positive and negative stress. Dopkin & Pihl (1992) tried to develop a way to measure stress -factors and –reactions in real world. They asked psychological questions 8 times per day for three days from 55 subjects aged 26 years. During those three days they measured also HR. HR was higher in stress-situations. Physical stress factors raised stress more than stressors related to environment, individual or interaction between individuals. Sports, drugs, alcohol and smoking were related to HR. Three emotional responses were seen in stressed subjects; anxious, hostile and depressed. Two last feelings were also related to lower HRV. Results were similar to the studies conducted earlier. Authors were confident that in the future HRV-method will allow accurate measurement of stress also in real life. (Dopkin & Pihl 1992.)

There is evidence of the effects that stress causes individuals. Still the exact way to measure stress is missing and more evidence is needed. For example the sensitivity of HRV-method is still uncertain. In previous studies, groups have been divided so that those without who have high self-reported stress are in one group and those without stress are in the other group (Berntson & Cacioppo 2004 Myrtek et al. 1996 & 1999, Brady et al. 1993, Adams et al. 1998). Differences and changes are seen (see Figure 2), but on an individual level, when using HR- and HRV-levels as indicators of stress main reason causing the difference cannot be identified. The fact-, that different breathing

styles (Bernardi et al. (2000) or nutritional status (Dyerberg et al. 2004) may have an influence that leads to statistical differences in HRV measurements suggests that, results should be interpreted with caution. (Bernardi et al. 2000.)

There is daily variation in an individual's mood which can also affect long term perceived stress and the results of questionnaires. Perceived and physical stress have an effect on an individual's mood, which in turn affect perceived and physical stress. Stressors, major life events or daily hassles also affect an individual's mood (Eckenrode 1984). Daily hassles are related to negative mood more than life stress, whereas life stress is a better predictor of subsequent positive mood than hassles. (Wolf et al. 1989.) Hassle severity predicts end-of-day mood, fatigue and subjective mood (Zohar 1999). Stressful events increase negative effects and decrease positive effects on mood. When perceived stress is higher, the greater the effect (especially negative effect but also positive effect) it has on mood. (van Eck et al. 1998, Steptoe et al. 2000.) If workload is too high or the task is unpleasant, negative effects increase and positive effects decrease (van Eck et al. 1995, Repetti 1993.) The day of the week also has a strong effect on mood and perceived stress. Therefore, stressors can also affect mood the following day (Stone et al. 1993.) Negative effects have no correlation with physiological stress outcomes. Trait positive affectivity has been shown not to attenuate relationships between work stressors and either subjective or objective stress outcomes. (Schaubroeck et al. 1992.)

When measuring or defining factors that have effect on stress, it is difficult to define which is the cause and which is the consequence. Humans are psycho-physical complexes and everything is related to everything. In conclusion it seems that the individuals own estimation is still the best indicator of stress as Levi stated already in 1992 (Cox et al. 2000, Levi 1992.)

Many studies have shown that endurance training decreases heart rate (HR) and increases heart rate variability (HRV) at rest regardless of the status of the group (age,

gender, cardiovascular diseases, overweight). Raise in HRV means increased variation between RR intervals, raised HF power and raised HF-related variables. (Brandao et al. 2009, Levy et al. 1998, Iellamo et al. 2002, Sandercock et al, Bernardi et al. 1996, Jurca et al, 2004, Schuit et al. 1998,) Short term effect of endurance training is that during and after the exercise HR increases and HRV decreases (Bernardi 1996). It depends on the intensity of the training that how long after the training HR is still raised and HRV decreased. The higher the intensity, the bigger are the changes and the impact is longer. (Iellamo et al. 2002, Sandercock et al, Bernardi et al. 1996, Munk et al. 2009.)

Strength training has impact only on acute HR and HRV, studies have not found any improvements in rest HR and HRV values after strength training periods (Madden et al. 2006). Changes in lifestyle are also affecting HR and HRV values (Carnethon et al. 2006.) To see some changes in rest HR and HRV a period of constant endurance training is needed. For example in relaxation intervention study there were no changes in HR and HRV (Sneed et al. 2001). On the contrary biofeedback and breathing intervention for coronary heart disease (CHD) patients did have effect on HR and HRV (Nolan et al. 2005.) Those results might be through better control of breathing and low level of HRV in CHD patients. When both mental and physical stress have impact on rest HR and HRV, it is difficult to evaluate in real life conditions what is the reason of "stress like" symptoms in HR and HRV. (Berntson & Cacioppo 2004).

3 THE CARDIAC AUTONOMIC SYSTEM

3.1 Autonomic nervous system

Autonomic nervous system (ANS) is part of the involuntary nervous system. Its activities are guided predominantly in the spinal cord, brain stem and hypothalamus. In addition, the cerebral cortex, particularly limbic system can send impulses to the lower of the nervous system and thus affect autonomic control. (Guyton & Hall 2006, 748.) ANS function is to regulate homeostasis and maintain body functioning. It controls and monitors the activity of the body, such as heart rate, digestion, temperature, blood pressure, and seems to affect emotional behavior in many ways. (McArdle et al. 2010, 328.) ANS responds very fast to changing conditions and for example autonomic modulation can rise HR to double in 3-5 seconds, or it can start sweating in a few seconds. By affecting heart rate, ANS regulates HRV. (Guyton & Hall 2006, 748)

Autonomic nervous system is divided into two parts, sympathetic and parasympathetic and it adapts to different challenges by regulating sympathetic and parasympathetic activity. (McArdle et al. 2010, 328.) Sympathetic nervous system (SNS) acceleratesthe functions of its target organs and parasympathetic (PNS) reduces the speed of reactions in its target organs (Figure 4). Sympathetic and parasympathetic nervous systems are often thought to be antagonists, but in reality, they operate also in parallel, and at the same time. In addition, it is worth considering that they do not necessarily affect the same target organ at the same time. In different situations one part of the nervous system may be more active than another. (McArdle et al. 2010, 328; Hynynen 2011.) Figure 5 shows the nervous trunk of SNS and PNS.

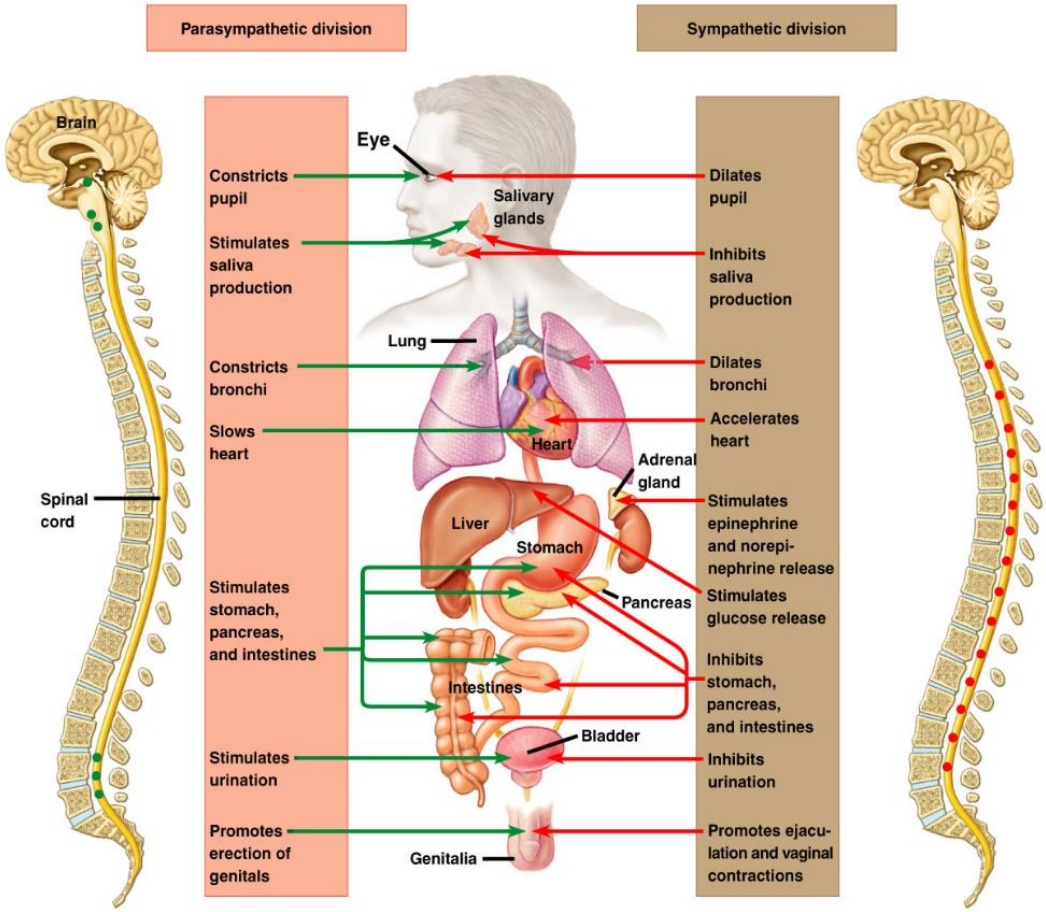

FIGURE 4. Autonomic nervous system.
(http://www.austincc.edu/apreview/PhysText/PNSefferent.html)

3.1.1 Sympathetic nervous system

Sympathetic stimulus excites body functions and target organs and the effect of SNS is shown in Figure 5. Sympathetic nerve trunk starts from thoracic spine T1 and ends at lumbar spine L2. In the neck there are three ganglia', which can be seen in Figure 5.

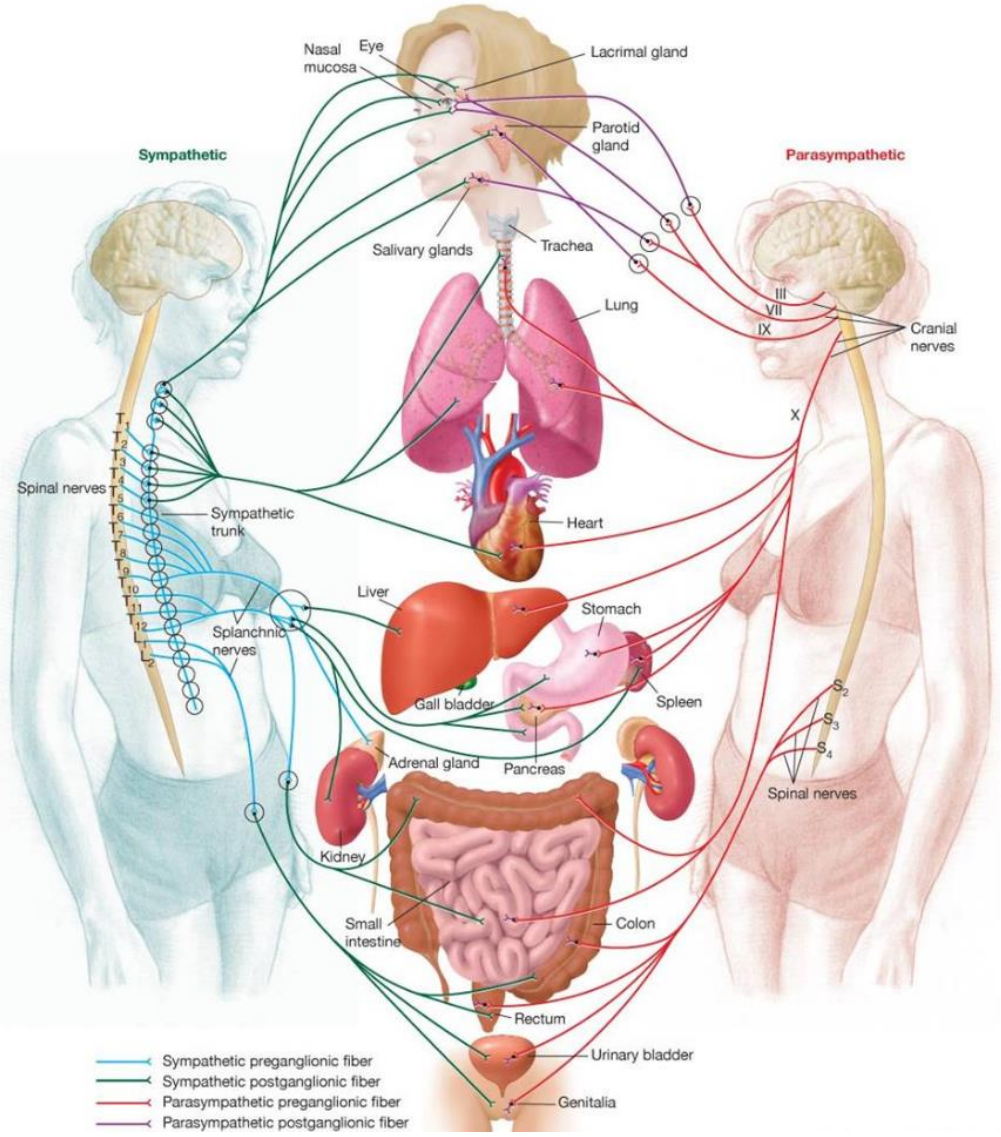

FIGURE 5. Nerve trunks of autonomic nervous system (SNS and PNS) (http://www.austincc.edu/apreview/PhysText/PNSefferent.html).

In the sympathetic pathway preganglionic neurotransmitter is acetylcholine (ach) and in post ganglionic neurons neurotransmitter is norepinephrine, (Figure 6). Stimulation of the sympathetic cardioaccelerator nerves releases the cathecholamines epinephrine and norephinephrine. It lasts 20-30s for them to reach their maximal responses. Sympathetic modulation is particularly strong in emotional situations and it is responsible for aggressiveness, power, and speeding up of demanding tasks in so called “fight or flight”

occasions. SNS raises the body's activation level to meet changes in physical or physiological phases. (Guyton & Hall 2000 748-758.)

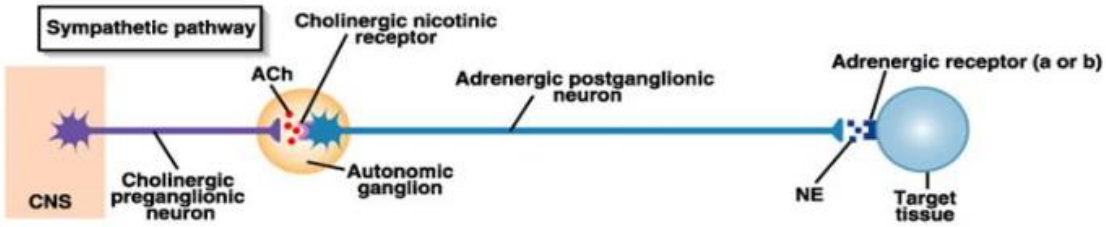

FIGURE 6. Sympathetic pathway (http://www.austincc.edu/apreview/PhysText/PNSefferent.html).

3.1.2 Parasympathetic nervous system

Parasympathetic modulation is concerned to keep body's energy consumption as low as possible. It decreases the level of its target organs function. Target organs and the effect of PNS are shown in Figure 5. Parasympathetic preganglionic neurons originate from the dorsal motor nucleus and nucleus ambiguous in the medulla oblongata. Four cranial nerves and three spinal nerves are responsible for PNS function, see Figure 5. Parasympathetic preganglionic neuron have cell body in the nuclei of the oculomotor, facial, glossopharyngeal, and vagus cranial nerves and in the lateral gray horns of the second through fourth sacral segments. Their axons pass to terminal ganglia near or within the visceral receptor. Parasympathetic postganglionic neurons cell bodies are in the terminal ganglia and their axons synapse with single visceral effectors. Parasympathetic pathway is presented on Figure 7. (Guyton et al. 2000, 748-758.)

Stimulation of the parasympathetic cardioaccelerator nerves releases ach. Ach is a neurotransmitter in both preganglionic and postganglionic neurons. Ach can affect HR beat by beat. Basically parasympathetic modulation slows the rest heart rate from 110-120 bpm (beats per minute) to 60-80 bpm. Parasympathetic ganglia are located closer to the target organs and are therefore more specific than the sympathetic ganglia. Parasympathetic modulation slows down and controls the vital functions.

Parasympathetic nervous system is thought to be more active in the night and sympathetic in the day. Differences of the influence between parasympathetic and sympathetic modulations are shown in Figure 8. (Guyton and Hall 2000, 748-758; Hynynen 2011.)

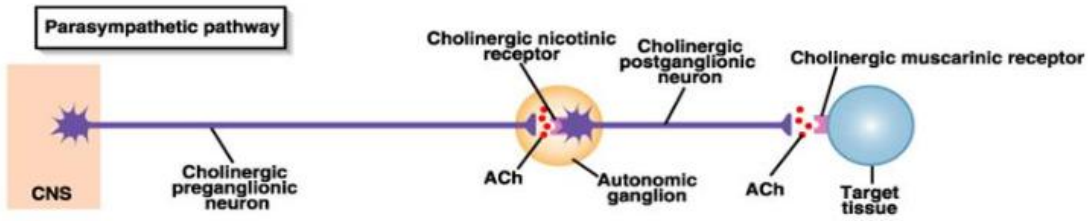

FIGURE 7. Parasympathetic pathway (http://www.austincc.edu/apreview/PhysText/PNSefferent.html).

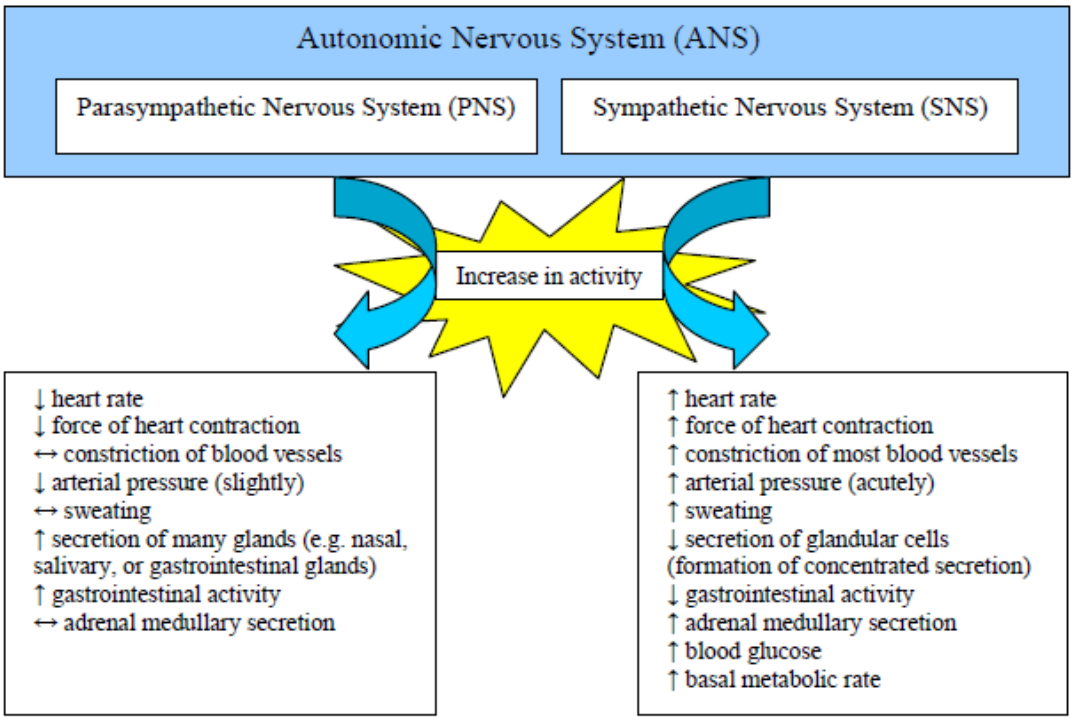

FIGURE 8. Autonomic nervous system and effects of parasympathetic and sympathetic activity. (Myllymäki 2006; modified from Guyton 2000.)

4 HEART RATE VARIABILITY AS A PHYSICAL MEASUREMENT OF STRESS

4.1 Heart rate variability

4.1.1 Autonomic regulation of HR and HRV

Heart rate is strongly affected by autonomic regulation and ANS is the main regulator of HRV (Winsley 2002). Consequently HRV is used to describe the influence of ANS to HR. (Task force 1996). Due to autonomic modulation HR is never completely regular. HR is changed by different reflexes and individual characteristics. For example there is decrease in HR during expiration and increase in HR during inspiration. Baroreceptors also affect HR. When blood pressure (BP) decreases, baroreceptors sense the change and send fewer impulses to the vasomotor center. This leads to an increase in sympathetic activity and decrease in parasympathetic activity which increases HR and thus BP. Chemo-, metabo-, and mechanoreceptors also affect autonomic control and HRV. Individual characteristics also affect autonomic modulation. For example gender, age, body composition and aerobic fitness may have impact on HR and HRV. (Martinmäki 2009).

Sympathetic influence shortens R-R interval and increases HR, and the effects of parasympathetic influence are opposite. Without autonomic modulation resting HR would be 90-120 bpm but with autonomic modulation and hormonal reflective factors resting HR is about 60-80 bpm. (Martinmäki 2009.)

Parasympathetic impact is faster than sympathetic impact. Parasympathetic impact can be seen after 0.5 second after the neural impulse. After the impulse effect stabilizes in 1 second. Sympathetically mediated increase in HR can be detected after 1-2 seconds and

it will reach its maximum in 4 seconds while baseline will be reached within 20 seconds after impulse. (Martinmäki 2009, Hynynen 2011.)

4.1.2 Main principles of HRV method

In a continuous electrocardiographic (ECG) record, each QRS complex (Figure 9) is detected. HRV means variations of both instantaneous HR and R-R intervals (RRIs, or normal to normal intervals) (Figure 10). (Malik et al. 1996). There are many different methods to analyze HRV. Most commonly used are time domain and frequency domain methods. Other methods are called non-linear methods, even though they are no more non-linear than the others, but they are more complex methods. Most used of the "non-linear methods" is Poincare' plot. Other methods used are the correlation dimension, nonlinear predictability, pointwise correlation dimension and approximate entropy. (Vanderlei et al 2009; Malik et al. 1996; Hynynen 2011.)

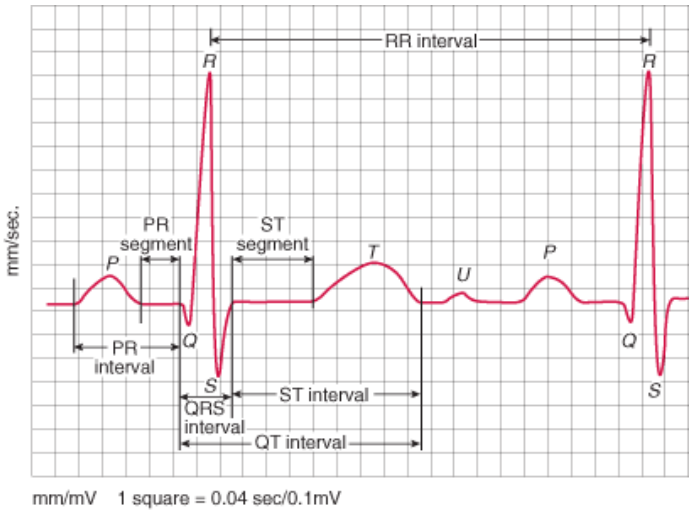

FIGURE 9. QRS complex and RRI.
(http://www.merckmanuals.com/professional/sec07/ch070/ch070e.html?qt=Ventriculoarteria2520and%2520atrioventricular%2520discordance&alt=s)

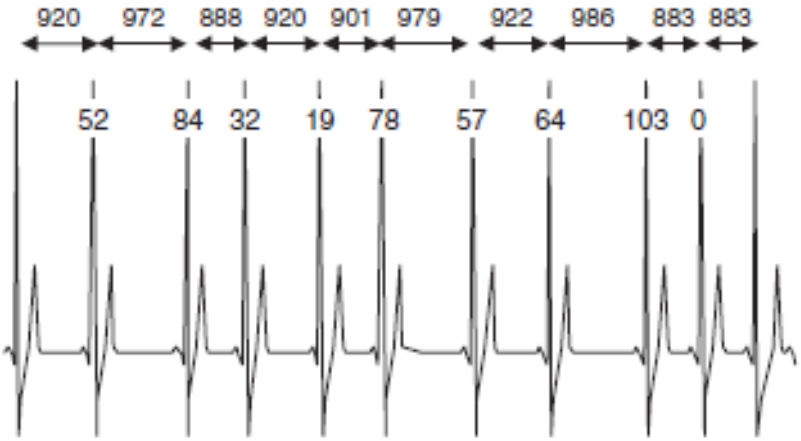

FIGURE 10. Example of an ECG output over 11 beats. R-R interval times and difference between adjacent R-R intervals are displayed. (Achten & Jeukendrup 2003.)

4.1.3 Different HRV measuring methods

Time domain analysis. Time domain analysis describes changes in both, HR and HRV. In time domain analysis there are two classes, (a) those derived from direct measurements of the normal to normal intervals (NN intervals) or instantaneous heart rate, and (b) those derived from the differences between NN intervals (see Figure 5). These variables can be calculated with simple statistical methods. (Vanderlei et al. 2009; Malik et al 2009.)

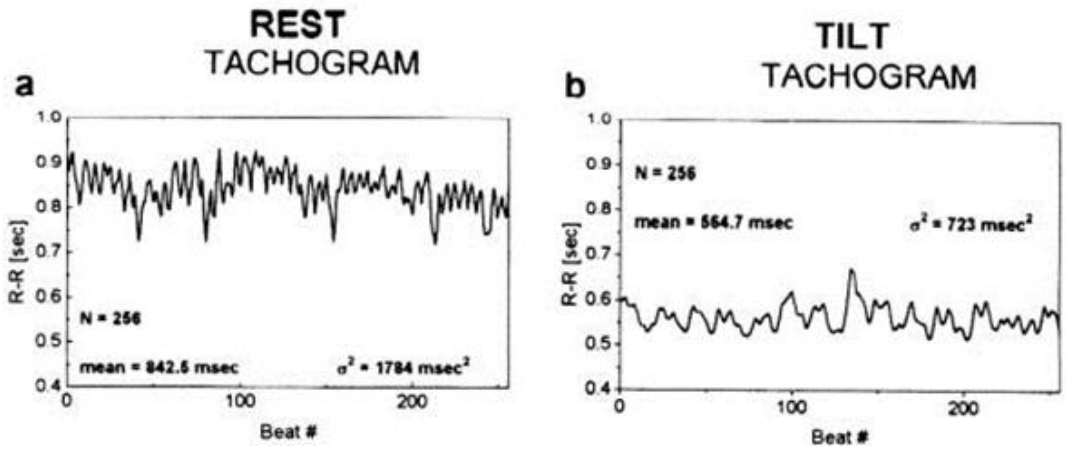

FIGURE 11. Differences between rest and tilt tachograms in RRIs. (Malik et al. 1996.)

In 1996 Malik et al. outlined that four of the time domain variables should be used when analyzes are made: "(1) SDNN (estimate of overall HRV), (2) HRV triangular index (estimate of overall HRV), (3) SDANN (estimate of long-term components of HRV), and (4) RMSSD (estimate of short-term components of HRV)." (Malik et al. 1996.) Currently, RMSSD and SDNN are more used than the others. The simplest index of the time domain variables is the standard deviation of the RRIs (SDNN-estimates overall HRV, Table 1). The most commonly used index is the square root of the mean of the sum of the squares of differences between adjacent RRIs (RMSSD) and it estimates the short-term components of HRV. RMSSD estimates high frequency variation in HR and it is mainly vagally mediated. SDANN (standard deviation of the averages of NN intervals in all 5 min segments of the entire recording) is the standard deviation of 5-minute intervals over the measurement period. SDANN shows variations in over 5-minute periods. (Vanderlei et al. 2009; Malik et al. 1996; Task force 1996.) NN50 is the "number of pairs of adjacent NN intervals" (Malik 1996). pNN50 is "NN50 count divided by the total number of all NN intervals" (Malik 1996). Geometric presentation of time domain variables can be seen in Figure 12 (Task force 1996).

TABLE 1. Different time domain measures of HRV (Malik et al. 1996).

Variable	Units	Description
		Statistical Measures
SDNN	ms	Standard deviation of all NN intervals
SDANN	ms	Standard deviation of the averages of NN intervals in all 5-minute segments of the entire recording
RMSSD	ms	The square root of the mean of the sum of the squares of differences between adjacent NN intervals
SDNN index	ms	Mean of the standard deviations of all NN intervals for all 5-minute segments of the entire recording
SDSD	ms	Standard deviation of differences between adjacent NN intervals
NN50 count		Number of pairs of adjacent NN intervals differing by more than 50 ms in the entire recording; three variants are possible counting all such NN intervals pairs or only pairs in which the first or the second interval is longer
pNN50	%	NN50 count divided by the total number of all NN intervals
		Geometric Measures
HRV triangular index		Total number of all NN intervals divided by the height of the histogram of all NN intervals measured on a discrete scale with bins of 7.8125 ms (1/128 seconds) (details in Fig 2)
TINN	ms	Baseline width of the minimum square difference triangular interpolation of the highest peak of the histogram of all NN intervals (details in Fig 2)
Differential index	ms	Difference between the widths of the histogram of differences between adjacent NN intervals measured at selected heights (eg, at the levels of 1000 and 10 000 samples)[20]
Logarithmic index		Coefficient φ of the negative exponential curve $k \cdot e^{-\varphi t}$, which is the best approximation of the histogram of absolute differences between adjacent NN intervals[21]

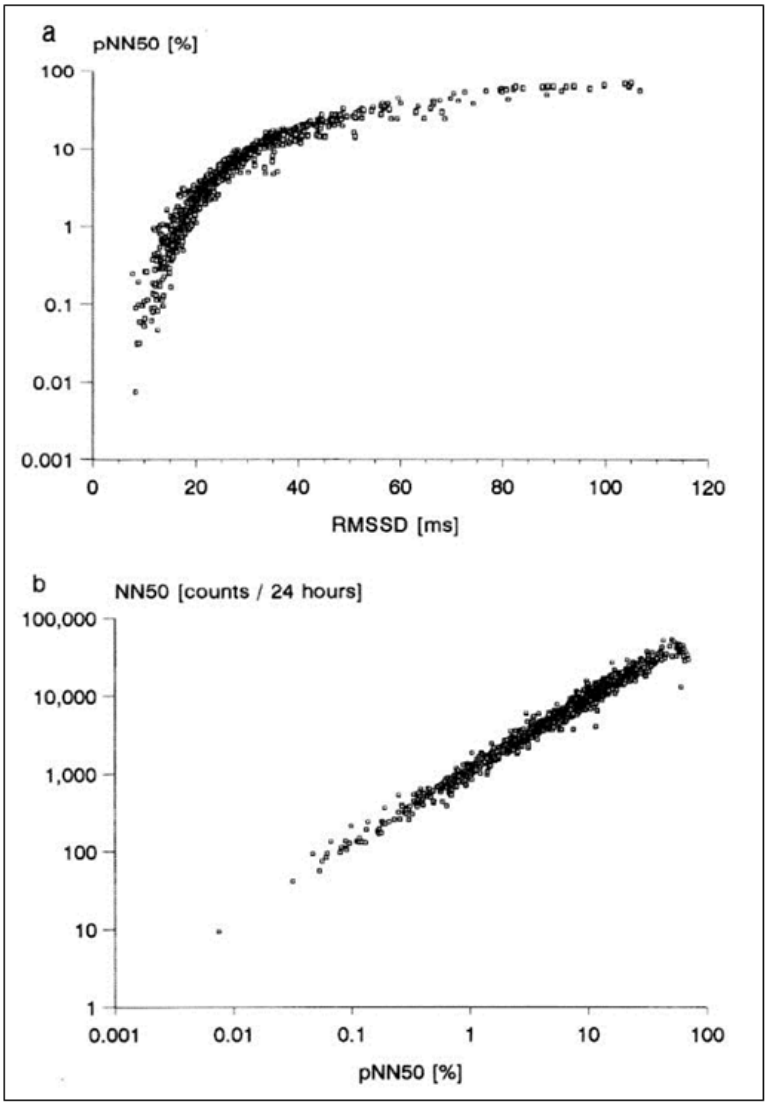

FIGURE 12. Geometric view of a relationship between-, a) RMSSD and pNN50 and, b) NN50 and pNN50 (Task force 1996).

Frequency domain analysis. HRV varies with many frequencies and frequency domain analysis divides the RRI data into its frequency components and quantifies them in their relative intensity. In frequency domain methods the overall variability of RRIs is represented by total power (TP). Three main spectral components are distinguished in a spectrum calculated from short term recordings of at least 1-2 min: very low frequency (VLF; ≤0,04Hz), low frequency (LF; 0,04-0,15Hz), and high frequency (HF; 0.15-0,4Hz) components. Frequency domain variables are shown in Table 2. (Malik et al. 1996.)

Power spectral density (PSD) represents how power/variance distributes as a function of frequency. PSD values are always only estimations despite the method used. Different methods to calculate PSD are divided to parametric and nonparametric methods. There are advantages in both methods used, in nonparametric methods the algorithm is simple (usually Fast Fourier Transform) and the processing speed of the algorithm is high. In parametric methods there are smoother spectral components, easier post processing of spectrum with automatic calculation of HF and LF, and accurate estimation of PSD even in short samples. Frequency components are studied with short, 2-5-minute periods or long up to 24 -hour periods. The ratio between LF and HF is dependent of vagal activity. Problem in long measurements is that the reasons of HRV are changing during the day and because of that the origin of the changes is difficult to track. (Malik 1996.)

TABLE 2. Frequency domain measures of HRV. (Malik et al. 1996).

Variable	Units	Description	Frequency Range
		Analysis of Short-term Recordings (5 min)	
5-min total power	ms^2	The variance of NN intervals over the temporal segment	≈≤0.4 Hz
VLF	ms^2	Power in VLF range	≤0.04 Hz
LF	ms^2	Power in LF range	0.04-0.15 Hz
LF norm	nu	LF power in normalized units LF/(total power−VLF)×100	
HF	ms^2	Power in HF range	0.15-0.4 Hz
HF norm	nu	HF power in normalized units HF/(total power−VLF)×100	
LF/HF		Ratio LF [ms^2]/HF[ms^2]	
		Analysis of Entire 24 Hours	
Total power	ms^2	Variance of all NN intervals	≈≤0.4 Hz
ULF	ms^2	Power in the ULF range	≤0.003 Hz
VLF	ms^2	Power in the VLF range	0.003-0.04 Hz
LF	ms^2	Power in the LF range	0.04-0.15 Hz
HF	ms^2	Power in the HF range	0.15-0.4 Hz
α		Slope of the linear interpolation of the spectrum in a log-log scale	≈≤0.04 Hz

HR changes during respiration are caused by parasympathetic nervous system and those are seen in HF (0.15-0,4Hz) values. Increases in tidal volume increase sympathetic modulation. Baroreflex resists arterial blood pressure decrease, which is seen in 0,1 Hz

low frequency HRV. Mechanisms behind the changes in LF and VLF are not yet known but possibilities are for example temperature regulation, cyclic variation, diurnal cycles. Differences in frequency domain analysis are shown in Figure 13. (Brenner 1998, Martinmäki 2009, Guyton et al. 2000.)

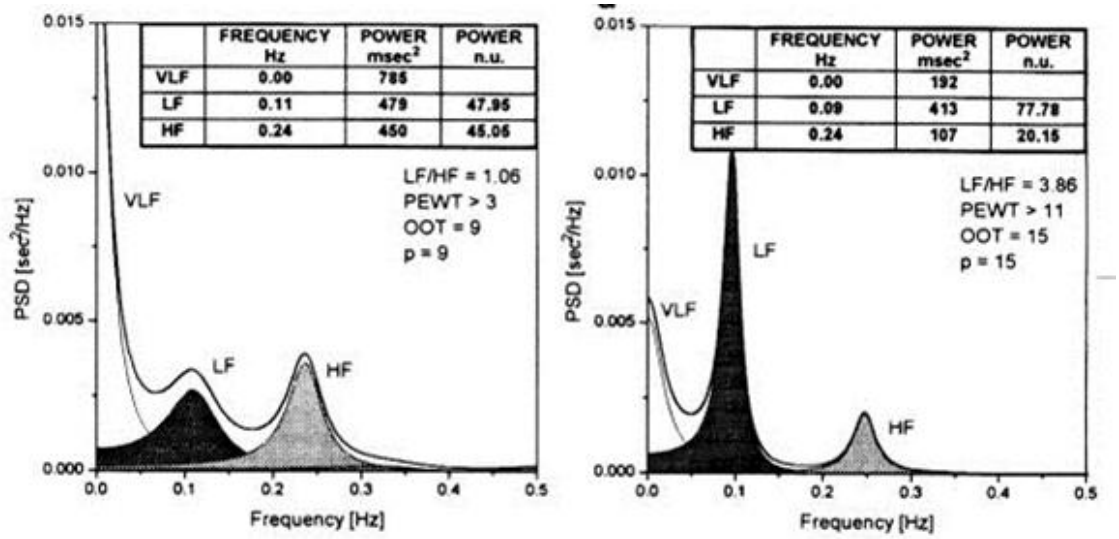

FIGURE 13. An Example of differences in Frequency domain analysis after rest (left picture) and head-up tilt (right picture). (Malik et al. 1996).

HRV values are individual so rather than giving some guideline values, results should be compared to the earlier results of the same individual in same kind of measurement, not to the others. Results of different length should not be compared because of the nature of the measurement. Malik et al. (1996) give some directions for normal values for HRV variables in Table 3.

Table 3. Normal values of standard measures of HRV (Malik et al. 1996.)

Variable	Units	Normal Values (mean±SD)
Time Domain Analysis of Nominal 24 hours[181]		
SDNN	ms	141±39
SDANN	ms	127±35
RMSSD	ms	27±12
HRV triangular index		37±15
Spectral Analysis of Stationary Supine 5-min Recording		
Total power	ms^2	3466±1018
LF	ms^2	1170±416
HF	ms^2	975±203
LF	nu	54±4
HF	nu	29±3
LF/HF ratio		1.5-2.0

See Table 1 also.

5 RESEARCH QUESTIONS AND HYPOTHESES

When combining sedentary work with the rush in families with small kids and the fact that people are spending more and more time with social media, it is only natural that parents do not have time to think about their own wellbeing. And when you are not thinking about your actions, you usually choose sedentary behavior instead of physical activity. Lack of physical activity is suggested to be related to higher stress and exercise is suggested to be a treatment for handling stress (Mooren & Völker 2005, Eckenrode 1984, Wolf et al. 1989, Zohar 1999, van Eck et al. 1998, Steptoe et al. 2000). Lately it has also been shown that not only lack of exercise but also sedentary behavior is an independent health risk (Katzmarzyk et al. 2009).

This thesis was part of a family based intervention (Finni et al. 2011) and the purpose was, by tailored counseling, to reduce the frequency and duration of sitting periods during work and leisure life thereby decreasing physical inactivity in every domain of a subject's life. One major goal was to include all of this to families' every day routines. The main purpose of this thesis was to examine whether changes in physical activity and sitting time can be realized after counseling and whether it has an effect on stress. In addition associations between different methods to assess stress were of interest. This led us to the following research questions and hypotheses:

Specific research questions and hypotheses

1. Does intervention (tailored counseling to decrease sitting time and increase physical activity) have effect on physical activity-, perceived-, and measured stress (HRV, day night and orthostatic test measurements) for sedentary workers with kids during a yearlong intervention?

HYPOTHESIS:

Intervention increases physical activity and decreases stress. (Hynynen et al. 2010, Berntson & Cacioppo 2004 Myrtek et al. 1996 & 1999, Brady et al. 1993, Adams et al. 1998).

2. Is there an association between daily physical activity and stress?

   HYPOTHESIS:

   There will be an inverse association between physical activity and stress (Mooren & Völker 2005, Valkeinen et al. 2011, Hirvensalo et al. 2011, Heikkinen & Ilmarinen 2001, Yang 2007).

3. Is self-reported stress related to stress measured by HRV?

   HYPOTHESIS:

   Stress measured in real life by HRV during orthostatic test after waking has been previously found to be associated to self-reported stress (Hynynen et al. 2010). In Hynynen's study there were 99 participants aged between 20-60 years, and most of them were white collar workers. The subject type is pretty similar than in our study. Therefore, we expect similar results from this study.

6 METHODS

6.1 Experimental design

This thesis was part of a larger intervention study (Finni et al. 2011) and experimental design described here is only from the part that is related to this thesis.

The study was a randomized controlled intervention lasting 12 months. In this thesis three measurement points were used: baseline, 6 month, and 12 month. The whole study design is shown in Figure 14. The baseline measurements were done before counseling and purpose was to measure a week of subject's normal life. During that week heart rate measurements were done. In the baseline measurement questionnaires of occupational stress, MET (Metabolic Equivalent), activity questionnaire, and work ability index (WAI) were given for subject's to answer. After baseline measurements the intervention group was given tailored counseling and, the control group was not. At time points 6 month and 12 month the measurements were repeated. The first 6 months contained reinforced counseling and the researchers were in contact with the subjects every month via e-mails and phone calls. The last 6 months was a maintenance period, which was used to determine how permanent any possible changes were. Physical activity was assessed using MET-, and activity questionnaires, work ability was assessed by WAI, and stress was assessed both subjectively (by occupational stress questionnaire) and objectively (by HRV measurements). Every three months HR was measured for three days and two nights. Ethichs approval for the project was received from the Ethics committee of Central Finland Health Care District on March 25, 2011.

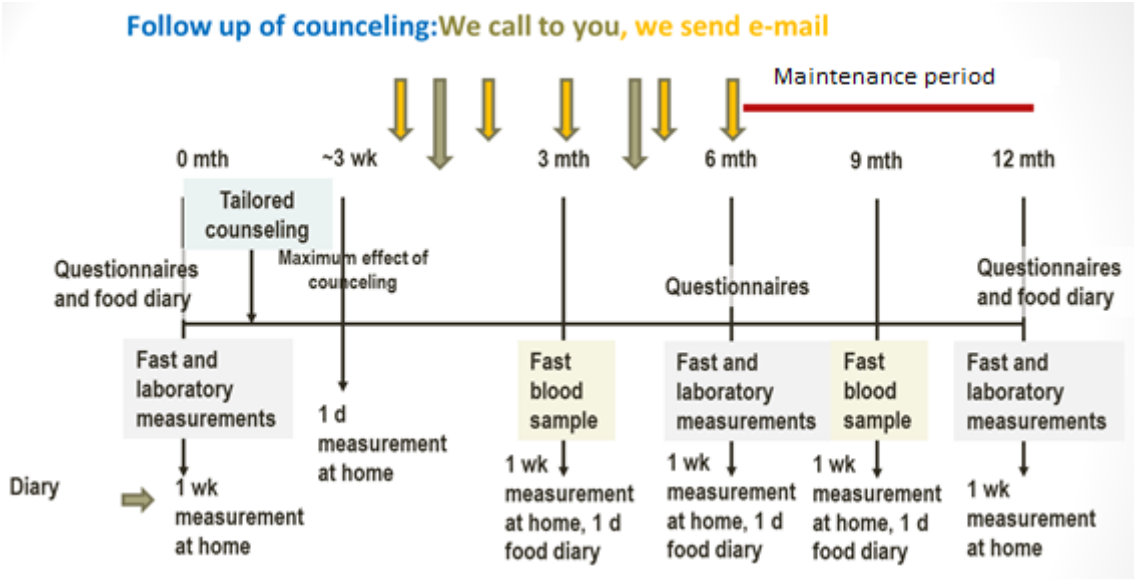

FIGURE 14. Study design.

6.2 Subjects

Subjects were recruited from Jyväskylä area. Recruiting was done through kindergartens and at least one parent and one kid needed to take part to the study. All in all 133 adults in this study, of which 123 completed the whole study more accurate information is presented in Table 4. Subjects were divided into intervention group which got tailored counseling, and to control group which continued their normal life. Study's recruiting area contained 11 schools and 17 kindergartens. Those were randomized after balancing socioeconomic and environmental factors and from one school or kindergarten there came subjects for only one group (intervention or control). In intervention group 71 subjects started in the study and in control group 62 subjects. During the study there were some drop outs because of changes in life situations like pregnancy for women and overall lack of free time or motivation.

TABLE 4. Subjects who completed the study.

Subjects	Intervention group	Control group	All
Adults	65	58	123
Men	25	27	52
Women	40	31	71

6.3 Measurements

During the weeks of measurement the subjects wore an Alive HR monitor (Alive Technologies, Perth, Australia) to measure HR and HRV. To report their normal daily behavior during the week subjects were given activity diaries (appendix 1). In time points 0 mth and 12 mth they also got activity questionnaires (for MET-values). At time points 0 mth, 6 mth and 12 mth subjects filled in also questionnaires represented below, those were send to subjects by email, or if they wanted they had also the opportunity to get printed versions of those as well.

Questionnaires have been made by Finnish Work Health Department and validity of those has been measured with many studies before (Ilmarinen 1995, Ilmarinen et al. 2005, Tuomi et al. 2006, Zwart et al. 2002, Elo et al. 2012). The following questionnaires were assessed at baseline, 6 months and 12 months:

- MET: Whole year MET questionnaire was done in the beginning of the study and after the study. MET questionnaire describes the level of physical activity of subjects previous year. Whole questionnaire is in Appendix 4.
- Occupational stress: Occupational stress questionnaire describes the stress level of subject related to work. Questionnaire gives numeric value and the bigger the number is the more stressed you are. Whole questionnaire is in Appendix 3.
- Activity questionnaire was used in this thesis to see the changes in sitting habits during work time and leisure time. For work time the % of working time spent

sitting was recorded. For leisure time the question was about time spent sitting (h) during leisure time. Questions used in the thesis are in Appendix 5.

- Work ability index: WAI describes "how good is the worker at present, in the near future, and how able is he or she to do his or her work with respect to the work demands, health and mental resources?" (Ilmarinen ym. 2005.) The higher the index is, the better the work ability. Whole questionnaire is in Appendix 2.

HRV measurements were done by Alive devices and the results were analyzed in Jyväskylä University with Firstbeat HEALTH–software (Firstbeat technologies, Finland, Jyväskylä). The measurements were extracted to digital form and then further analyzed by the software using Fast Fourier Transform and neural network modeling (Saalasti 2003). Every three months HR was measured for three days and 2 nights. In the results the average of three days and two nights are used, respectively. After the night measurement subjects were asked to do an orthostatic test immediately after awakening, in which they were asked to lie down in supine position for 5 minutes and after that stand up next to bed and stand quietly for three minutes. They were advised to write down to the diary the exact times of the orthostatic test. In HRV measurements it is important that the time periods compared are exactly the same length and they represent the same part of the day. That is why the following standard operations for the analyses were done: HR measures during the day were analyzed by cutting the days into 14 hours clips (starting from awakening) to describe the whole day HR and HRV. Night measurements were cut to 4 hour clips (for one night) so that clip started at midnight or at least 30 minutes after falling asleep. For orthostatic test, the first and last 30 seconds of supine rest and standing were cut off, so that the time for laying was 4 minutes and for standing 2 minutes. (Hynynen 2011.) HR and HRV variables analyzed from these time periods were: Average HR, RMSSD (indicates vagal activity), SDNN (represents the overall variability of RRIs), HF (indicates vagal activity), LF (indicates sympathetic and vagal activity), HF^2 (indicates vagal activity), lfhfratio (indicates vagal activity), and $lfhf^2$ratio (indicates vagal activity).

6.4 Statistical analyses

All data was analyzed using Microsoft Excel 2010 and IBM SPSS 20.0 (SPSS Inc., Chicago, Illinois, USA) software. For normalizing data, for statistical comparisons, HRV variables were log-transformed, but absolute values are reported in the results. To compare the changes between groups over 1 year period, repeated measures ANOVA was used. Paired sample t-test was used to compare differences between the groups at baseline. Bivariate correlations were done to detect associations between variables. The level of significance was set at $p < 0,05$, so that $p < 0,05$ = *; $p < 0,01$ = **; and $p < 0,001$ = ***.

For each variable the number of subjects varies since we did not have sufficient data from all subjects from all variables so the maximum number of available subjects' data was used in each case. In the results, the number of subjects is given for all variables and it ranges from 42 to 90.

7 RESULTS

7.1 Self-reported sitting time

For sitting time analyses the number of subjects was 58, (IG N=29, CG N=29). For the working days there were statistically significant changes in the self-reported sitting times. In the first 6 months the sitting time at work decreased by 6% in the intervention group in contrast to control (p=0,017). During the last 6 months the sitting time at work did not change. For the control group there were no statistically significant changes in sitting time during the work day. Changes between the groups can be seen in Figure 15.

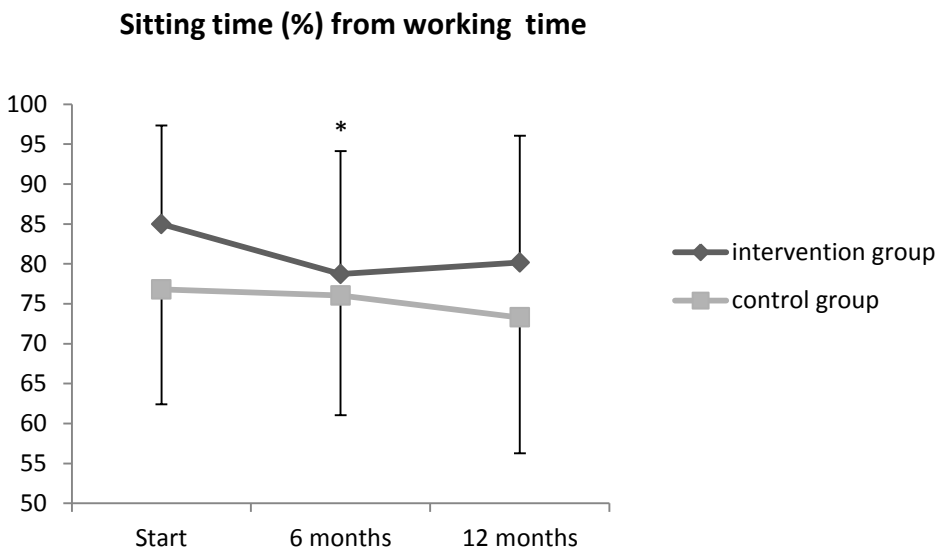

FIGURE 15. Self-reported sitting time in work (%) during the yearlong intervention. Repeated measures Anova revealed significant time effect (p=0,001) and interaction was nearly significant (p=0,057). Contrasts revealed that the change occurred during the first 6 months (p=0,017).

For leisure time there were no changes in self-reported sitting times during the year in either group. Time spent sitting during free time was approximately 3 hours/d for both groups and for every time point. Absolute values can be seen in Table 5.

TABLE 5. Sitting time in leisure time, hours/d.

	Baseline	6 months	12 months
intervention group n=29	3,0 ± 1,2	2,8 ± 0,9	2,9 ± 1,2
control group n=29	2,8 ± 0,7	2,6 ± 0,8	3,0 ± 1,0

7.2 Physical activity

For physical activity questionnaire the number of subjects was 90, (IG N=48, CG N=42). There were no statistical differences in MET values between the groups or changes over time. Absolute values can be seen in Table 6.

TABLE 6. Physical activity for both groups in MET values for the year before the study and for the year during the study.

group	Baseline	12 months
intervention group n=48	4,4 ± 3,5	4,2 ± 2,7
control group n=42	5,4 ± 3,0	5,6 ± 3,0

7.3 Work ability index and stress questionnaires

For the work ability index the number of subjects was 66, IG=30, CG=36. Work ability index decreased slightly in both groups during the year without statistical changes or differences between the groups (for absolute values see Table 7).

TABLE 7. Work ability Index at the beginning and end of the study.

group	Baseline	12 months
intervention group n=30	43,3 ± 3,9	42,6 ± 5,3
control group n=36	42,8 ± 3,3	41,36 ± 4,9

For the stress questionnaire the number of subjects was 57, IG= 27, CG=30. Stress questionnaire shows that there were no differences between the groups at the beginning

of the intervention. During the first 6 months the stress level decreased for the intervention group and increased for the control group (p=0,019 for the difference at 6 months).. After 12 months there were no differences between the groups (see Figure 16).

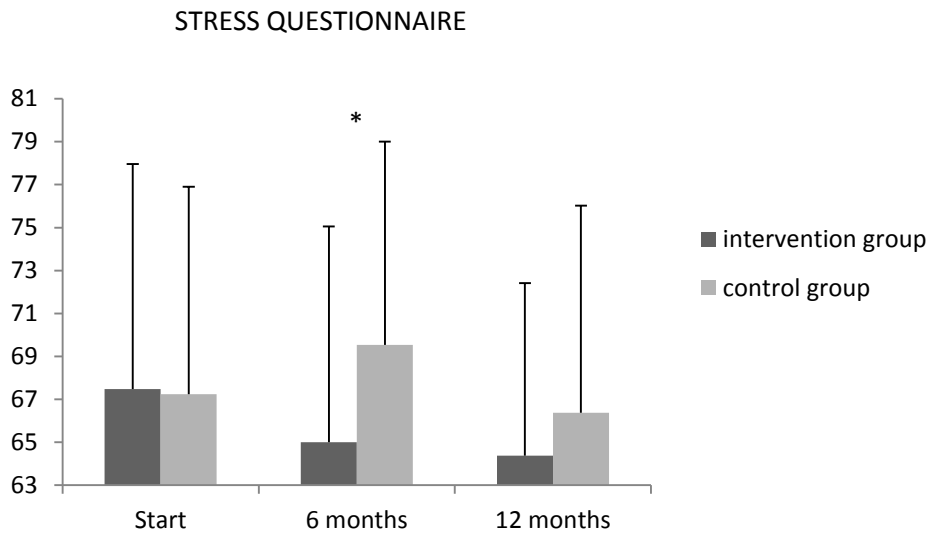

FIGURE 16. Perceived stress during the year, the higher the bar the higher the stress level. There was statistical difference between the groups at the six month time point (p= 0,019).

7.4 HR and HRV variables

7.4.1 HR and HRV during orthostatic test

For the orthostatic test analyses the number of subjects was 57, (IG N=33, CG N=24). In orthostatic test significant differences between the groups were found only in supine position in the first 6 months of intervention. Changes were seen in average heart rate and HF related variables. In standing position there were no differences in any variable (Average HR, RMSSD, SDNN, HF, LF, HF^2, lfhfratio, $lfhf^2$ratio).

Average heart rate rose for the intervention group and decreased for the control group in the first 6 months. For intervention group changes were as follow: start 62 ± 9 bpm, 6 months 63 ± 10 bpm, and for 12 twelve month 59 ± 9 bpm. For control group the values were 61 ± 8 bpm, 6 months 59 ±9 bpm and for 12 months 60 ± 10 bpm. Between the groups there was a statistical difference (p=0,038) in time point 6 months. At the beginning and end there was no difference between groups. The average HR for both groups decreased from the start to last measurement point from 62 ± 9 bpm to 60 ±9 bpm, but there was no statistical difference. Changes in average HR are shown in Figure 17.

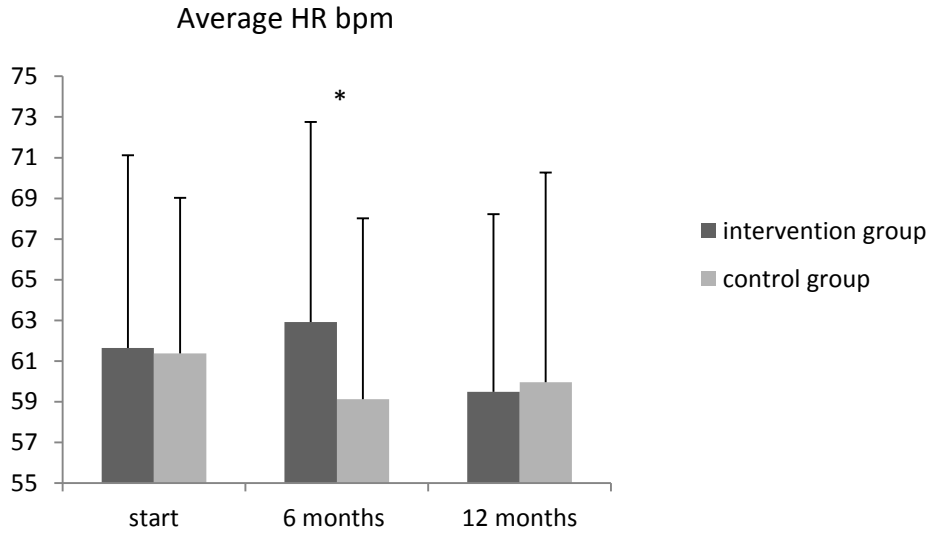

FIGURE 17. Changes in average HR during orthostatic test supine rest part, in intervention and in control group. There was a statistical difference between the groups between start and 6 month, time points (p=0,038).

There were differences in HF power reflecting altered vagal activity. For the intervention group, HF power decreased from start to 6 month time point from 3276 ± 3477 to 2696 ± 3015 and during the same time HF power increased for the control group from 1876 ± 1997 to 2479 ± 2367. The difference between groups was significant (p=0,017). The value for the intervention group raised above the start level to 3343 ± 3445 at 12 months and for the control group the value was lower than the start level at

1853 ± 2172 but this change did not reach statistical significance (p=0,06). Changes can be seen in Figure 18.

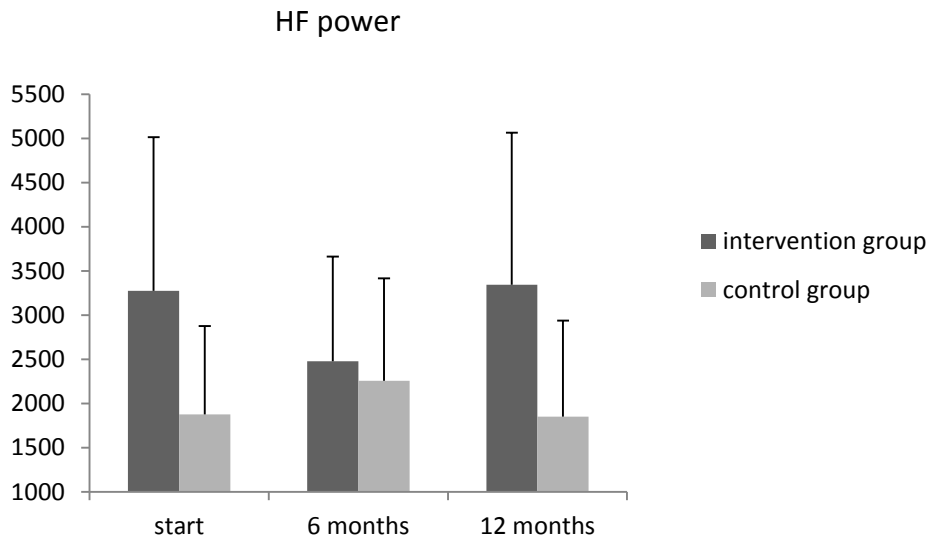

FIGURE 18. HF power during the year long intervention, in orthostatic test supine rest part, in intervention and in control group. There is almost statistical difference between the changes of the groups after six months (p=0,06).

TABLE 8. All HF related variables, P values indicate significant difference between groups.

group	intervention n=33	control n=24	p-values
HF^2 start	3899 ±4021	2219 ± 2367	
HF^2 6 months	2967 ± 2751	2691 ± 2763	p=0,021
HF^2 12 months	4076 ± 4030	2182 ± 2509	p=0,05
lfhfratio start	177 ± 145	249 ± 206	
lfhfratio 6 months	236 ± 213	195 ± 183	p=0,02
lfhfratio 12 months	232 ± 281	222 ± 128	
lfhf^{2}ratio start	154 ± 122	198 ± 148	
lfhf^{2}ratio 6 months	191 ± 168	154 ± 125	p=0,038
lfhf^{2}ratio 12 months	191 ± 196	183 ± 103	

There were no differences in SDNN and in LF. In RMSSD there is almost significant difference (p=0,071) between the change of the groups in 6 month time pointResults are sown in Figure 19.

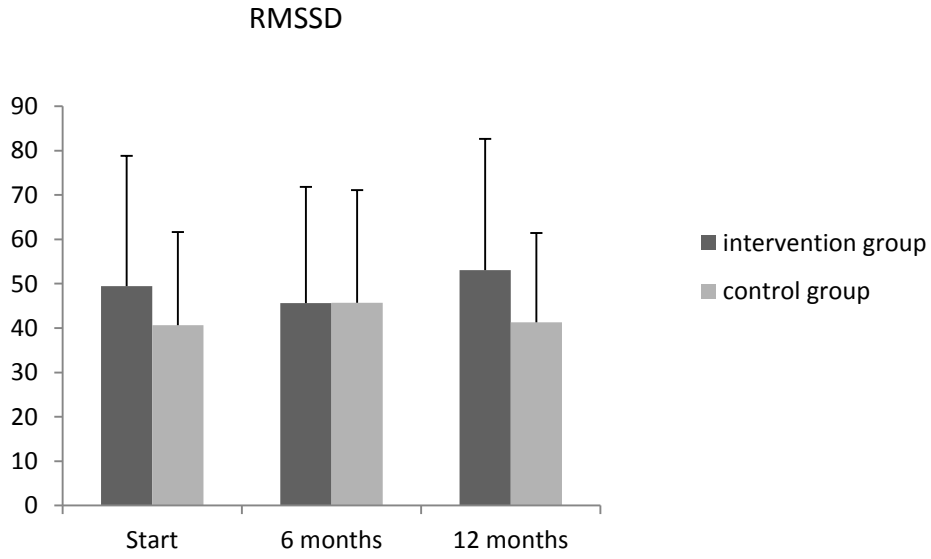

FIGURE 19. RMSSD during the year long intervention, in orthostatic test supine rest part, in intervention and in control group. No statistically significant changes were observed.

7.4.2 HR and HRV during sleep

For the HRV sleep analyses the number of subjects was 66, (IG N036, CG N=30). There were no statistical differences in HR and HRV variables during sleeping in any time point in any variables. All values can be seen in Table 9.

TABLE 9. HR and HRV values for night measurements. There were no statistical differences between groups.

Variable	intervention group (n=36)	control group (n=30)
average HR start	60 ± 9	57 ± 8
average HR 6 months	61 ± 7	58 ± 9
average HR 12 months	61 ± 7	59 ± 8
average RMSSD start	51 ± 22	47 ± 21
average RMSSD 6 months	48 ± 21	48 ± 25
average RMSSD 12 months	49 ± 22	44 ± 20
average SDNN start	103 ± 27	101 ± 31
average SDNN 6 months	99 ± 30	104 ± 32
average SDNN 12 months	104 ± 37	99 ± 29
average HF start	2609 ± 1857	1890 ± 1737
average HF 6 months	2344 ± 1713	2098 ± 2022
average HF 12 months	2468 ± 1882	1736 ± 1438
average LF start	3137 ± 2049	2572 ± 1695
average LF 6 months	3236 ± 2185	2592 ± 1550
average LF 12 months	2988 ± 2579	2313 ± 1558
average HF^2 start	3108 ± 2214	2286 ± 2075
average HF^2 6 months	2789 ± 2050	2532 ± 2432
average HF^2 12 months	2926 ± 2195	2110 ± 1760
average lfhfratio start	185 ± 118	220 ± 152
average lfhfratio 6 months	191 ± 100	233 ± 149
average lfhfratio 12 months	172 ± 80	224 ± 161
average lfhf^{2}ratio start	145 ± 83	172 ± 108
average lfhf^{2}ratio 6 months	150 ± 69	180 ± 108
average lfhf^{2}ratio 12 months	137 ± 62	173 ± 113

7.4.3 HR and HRV during the day

For the day HRV measurements the number of subjects was 42 (IG N= 25, CG N=17). There were no statistical differences in HR and HRV variables during the daytime at any time point in any variables. All values can be seen in Table 10.

TABLE 10. HR and HRV values for daytime measurements. There were no statistical between-group difference.

Variable	intervention group(n=25)	control group (n=17)
average HR start	81 ± 9	76 ± 9
average HR 6 months	80 ± 9	76 ± 9
average HR 12 months	81 ± 10	78 ± 8
average RMSSD start	31 ± 8	34 ± 13
average RMSSD 6 months	31 ±10	35 ± 14
average RMSSD 12 months	32 ± 12	31 ± 12
average SDNN start	130 ± 35	138 ± 37
average SDNN 6 months	120 ± 27	134 ± 54
average SDNN 12 months	119 ± 30	129 ± 39
average HF start	1207 ± 754	1280 ± 1198
average HF 6 months	1164 ± 779	1301 ± 1261
average HF 12 months	1615 ± 2175	1092 ± 1094
average HF start	2481 ± 1110	2506 ± 1239
average LF 6 months	2374 ± 1128	2537 ± 1328
average LF 12 months	3008 ± 2637	2251 ± 1138
average HF^2 start	1427 ± 866	1556 ± 1396
average HF^2 6 months	1379 ± 887	1579 ± 1484
average HF^2 12 months	1876 ± 2512	1322 ± 1282
average lfhfratio start	373 ± 197	358 ± 131
average lfhfratio 6 months	397 ± 151	381 ± 150
average lfhfratio 12 months	377 ± 199	394 ± 159
average lfhf^{2}ratio start	283 ± 134	266 ± 98
average lfhf^{2}ratio 6 months	296 ± 151	282 ± 107
average lfhf^{2}ratio 12 months	278 ± 129	288 ± 125

7.5 Associations between physical activity and stress

There were no associations between physical activity and stress. The only significant correlations found related on the variables used in this study were between work ability index and perceived stress (p<0,0001). R values varied between 3 measurements from r=-0,617 to r=-0,625. Correlation at baseline measurement is shown in Figure 20.

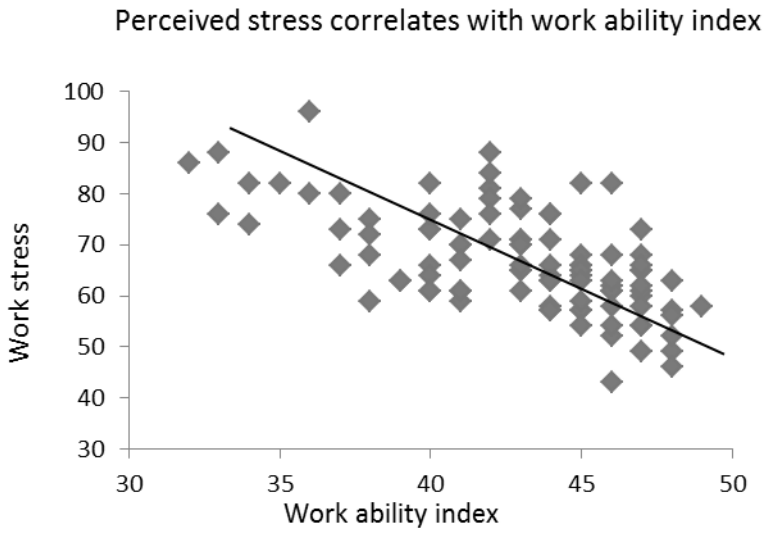

FIGURE 20. Negative correlation between perceived stress and work ability index at baseline measurement(r=-0,617; p=<0,0001).

7.6 Stress-questionnaires and HRV relationship

Figure 21 shows that there was no correlation between results of stress questionnaire and HF power in supine position during orthostatic test at the three measurement point. Correlations were checked with every HRV variable and every measurement (day, night and both parts of orthostatic test) but no correlations occurred.

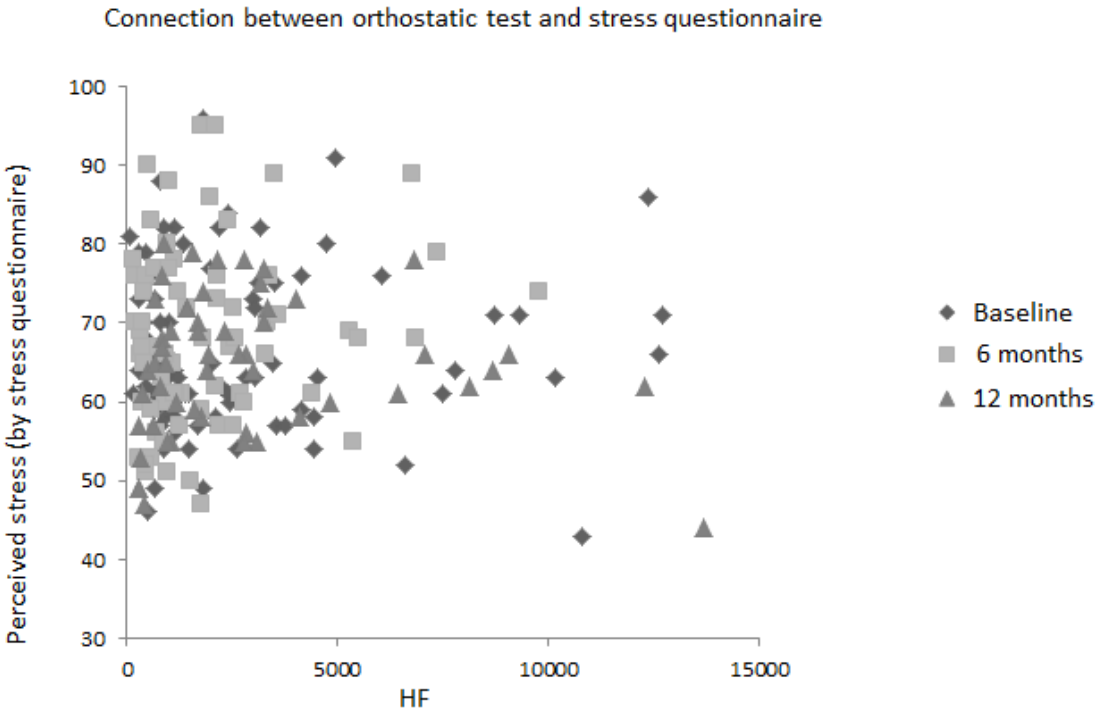

FIGURE 21. There were no correlations between HF of orthostatic test supine rest part and perceived stress at baseline (start) 6 months and 12 months.

8 DISCUSSION

The aim of this study was to examine whether sedentary behavior, during work and leisure time could be reduced and physical activity increased by counseling in Finnish families with small children and parents who perform sedentary work. An additional aim was to investigate whether the possible changes influence stress measured by questionnaire and HRV, and whether there is an association between these two ways of measuring stress.

The main findings of the study were that intervention decreased self-reported sitting time during working hours and decreased perceived stress. Changes in HRV variables occurred in orthostatic test but the results were inconsistent with those from questionnaires. It was also noted that the observed effects of intervention lasted only the reinforced 6 month-counseling period and the effect disappeared during the maintenance period.

8.1 Impact of tailored counseling on sitting time and physical activity

Reducing sitting time in work and leisure time and cutting long sitting periods were the main goals of the study. In the beginning of the study IG had slightly higher % of sitting time at work (85 ± 12 %) than CG (77 ± 14%). The change at the 6 months-' time point was statistically significant (p=0,017), when sitting time at work decreased more for IG (6%) than for CG (1%). At point 12 months there were no statistical differences between the groups. During the first 6 months of the study, possibly due to the counseling, the intervention group managed to decrease their sitting time compared to the control group. The reduction in sitting time plateaued after that. The plateau might be due to the fact that the last six months served as a maintenance phase and the counseling did not happen as often as during the first 6 months. During the maintenance phase subjects did not pay that much attention to reduce sitting time anymore. When

that is divided for the whole day, it might have great effect on cutting long sitting periods instead of reducing the total amount, which already could have health benefits (Healey et al. 2008).

There were no changes in sitting time during the leisure time. It could be because it is really hard to change life patterns especially when you have small children and you are in a hurry all the time (Finni et al. 2011). When struggling with lack of time you do not have time to think which options are good for your health.

It seems that the counseling did not have an impact on physical activity between baseline and 12 month measurements. There were no statistical differences or changes in physical activity according to MET questionnaire. When looking at the MET values for both groups it seems to be that in the beginning of the study the intervention group had lower physical activity values than the control group. The difference had tendency to increase during the year. Control group seemed to be physically more active than intervention group and the counseling seems to have no effect on physical activity. It needs to be remembered that the main focus of counseling was to reduce sedentary behavior and therefore it may not have had influence on physical activity. There might also be some variation in reporting habits and when taking into account that in the questionnaire subjects needed to remember activities for the previous year there might be some errors as well. The difference between the groups might be due to the fact that control group got the counseling after finishing the study, so they needed to wait for the counseling for a whole year. That might have led to the situation that only the ones who had a major interest in their own wellbeing and high will to improve it participated in the study. Usually they happen to be in better shape than less motivated people.

8.2 Impact of tailored counseling on perceived stress

In perceived stress there was significant between-groups difference after six months. The stress level decreased for the intervention group and rose for the control group. After twelve months stress levels decreased also for control group so there were no statistical differences anymore. It can be so that the biggest impact of counseling can be seen after first 6 months when there were more contacts (meetings, calls, e-mails) than on maintenance period. After the maintenance period there were no between-group differences anymore. Higher physical activity can affect positively on mood and decrease stress (Mooren & Völker 2005, Eckenrode 1984, Wolf et al. 1989, Zohar 1999, van Eck et al. 1998, Steptoe et al. 2000). It can be also so that even though there are no positive changes in the individuals MET values, there still might be some changes in the life patterns (like reducing sedentary time) which affect wellbeing and perceived stress (Finni et al. 2011, Burton et al. 2011). Methods used in this study might have been too approximate to see those changes.

In work ability index (WAI) there were no changes between groups. When checking the changes inside the group WAI decreased for control group ($p=0,026$) and stayed the same for intervention group. We therefore assume that counseling may have helped subjects to maintain their work ability, while it decreased for the control group. Perceived stress has been shown to decrease due to counseling (to increase physical activity or just to improve life patterns) also in earlier studies (Sneed et al. 2001, Nolan et al. 2005).

8.3 Impact of tailored counseling on HR and HRV

There were large variations between subjects in HR and HRV values. There were no differences in daytime or night time HR or HRV, which have also been the case in earlier studies (Hynynen et al. 2006, Hynynen et al. 2011). In orthostatic test there were no changes in standing part of the test but in supine position there were some changes

during the year. As in other variables the changes were detected after the first 6 months and after 12 months there were no between-groups differences anymore.

Values that were changed in orthostatic test during the supine rest were average HR, hf, HF^2, lfhfratio, and $lfhf^2$ratio. Surprisingly HR increased for the intervention group. Also hf and hf related variables were changed so that the sympathetic tonus was higher for intervention group. That is in the line with changes in HR but in the literature it has been suggested that lower perceived stress is related to higher vagal tonus (Malik et al. 1996, Hynynen 2011).

In earlier studies there have been clear results that increased physical activity is increases vagal tonus at rest, when the sympathetic effect due to physical activity is over. During physical activity sympathetic tonus is raised and depending on the level and duration of physical activity sympathetic activity can be higher even for days. (Mooren & Völker 2005, Valkeinen et al. 2011, Hirvensalo et al. 2011, Heikkinen & Ilmarinen 2001, Yang 2007.) Sneed et al. 2001 found out that even though relaxation rehearsals may decrease perceived stress, they did not have an effect on HR and HRV (Sneed et al. 2001). In this study the impact might have been the same. Changes in behavior are too small to have an effect on HR and HRV but the changes can still be seen as decreased perceived stress. Humans are psychophysical complexes and even the feeling that you are doing something to improve your health may decrease stress levels (Sneed et al. 2001). The reasons, why changes in vagal activity at 6 months seem to be more beneficial for control group, are yet to be discussed. Most likely the intervention group subjects tried to be more active during the measurements (follow the counseling), which led to higher level of physical activity during the measurements and therefore to higher sympathetic activity during the tests. In control group there was no counseling and no pressure to be more active during the measurements and for that reason their sympathetic activity did not increase. Also the fact that the measurements were more familiar as the study progressed might have led to the situation that subjects were not so nervous because of them, which might be the reason for improved vagal activity in the

control group. All in all so many things affect HRV that there is no one explanation for the results.

8.4 Associations between perceived stress, physical activity, and HRV

Even though literature lets us assume that there are associations between stress and physical activity, we could not find any associations between stress and physical activity in this study. When looking at the results, it seems that stress and sitting time both decreased for the intervention group and increased or remained the same for the control group. On individual level it was not so clear and there were no correlations with those changes. There can be many things affecting the fact that there were no associations between different measurements. One major reason is that in this study the aim was to decrease sedentary behavior. In most previous studies physical activity involves exercising. Changes in this study were not that big that questionnaires and HRV method would be sensitive enough to detect them. Another major thing is that there were large differences in the answering times for questionnaires. When taking into account that the day and time of day have effect the results, it is likely that variation in the answering habits affected the results. (Stone 1993.) It was also acknowledged that there can be seasonal variation in results, but when using time of the year as a covariate we could not find any associations with the results.

According to the results, it is difficult to say if there is any connection between perceived and measured stress. The only statistical differences were seen after 6 months. And when examining perceived and measured stress, the results are inconsistent. While stress levels for the intervention group decreased according to the questionnaire, HF power decreased as well which indicates higher stress according to the literature (Malik et al. 1996). The reasons for changes in HR and HRV are discussed in the previous chapter (8.4). It might be that increased physical activity and decreased sedentary time translated to lower perceived stress of the intervention group but at the same time the sympathetic tonus increased because of physical activity, as seen in HR and HRV.

8.5 Limitations and methodological considerations

Even though the study was well planned and carefully designed it contained also some problems and limitations. It might be so that due to those problems and limitations there were only few statistical significant differences in the results. Problems and limitations were related to subjects, measurements, and timing.

One major problem is that subjects were participating by their own will. It means that subjects were people who were interested on their wellbeing and improving it. So both, the intervention group and the control group were participating in the study to improve their wellbeing (and fitness). It means that even though the control group did not get any counseling they went through all measurements and also wanted to improve the results, thus may have increased their physical activity. Also the fact that subjects were humans with families and different life situations affected the results (Rovio et al. 2009). Some subjects could commit to the study better than others. Some changed their behavior, some did not, and for some the life pattern went even worse. For some people the measurements and devices were stressors themselves. Due to those and many other reasons the variation of the data is remarkable.

In the measurements there were also some problems. In some measurements there were anacceptably large errors in the data, which were not included to the analyses. Reasons for the errors or missing data were bad electrode contacts, broken devices or broken wires, incorrect use of devices and human error during measurements (for example orthostatic test).

It was supposed that time of the year could have effect on the results. The assumption was that during the summer time people are more active than in winter time. It might be so with some individuals but on group level there were no changes.

Subjects responded to the questionnaires at home. That may have had an effect on the results due to many possible (time of the day, mood, hassles, rush…). It can also be so that most busy people did not have time to answer the questionnaires which may also affect the results. There might also be some changes in the results because of the daily variation on the answers. Stone et al. (1993) stated that mood has an effect on answers, so the answering situation may have impact on the results (Stone et al. 1993.). It will be interesting to see whether changes can be detected with different measurement methods (like accelerometer and blood samples).

It is difficult to measure, if small changes in behavior have effect or not on individual's wellbeing. Reasons for that are discussed more detailed in chapter 8.5. On the group level, changes that can be incorporated to normal life of families are limited. But even though the changes are small, they can be beneficial for long term health.

In measuring changes in behavior, not many indicators are sensitive enough. In this study questionnaires and HR measurements were used to detect the changes. There were some changes but maybe these are not the best ways to measure such small changes. The conclusions of methods used in this study are as follows:

1. Work ability index might be too approximate to detect changes in this kind of study, where the main focus was on reducing inactivity.

2. Stress questionnaire detected some changes between the groups. Still it is considered, as Levi stated already on 1992, the best way to measure individual stress (Levi 1992).

3. MET questionnaire might be too approximate to detect changes in this kind of study, where the counseling was aimed to reduce inactivity, not increasing physical activity.

4. HR and HRV methods could be helpful for detecting and evaluating stress alongside an individual's own estimation. It still needs to be remembered that several things affect the results, and in earlier studies only orthostatic test in

supine position has been found to be related to stress measured by questionnaires. (Hynynen 2011.)

8.6 Conclusions

It can be concluded that the intervention decreased self-reported sitting time during working hours and decreased perceived stress during the first 6 months of the counseling intervention. The results show that behavioral changes can be made with counseling even in busy families with children. The results occurred during the reinforced counseling which means that people needed to be reminded monthly of the counseling so that the effects were maintained. However, other methods used in the study may still reveal whether the counseling had some other health benefits as well as the sustainability of these benefits.

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APPENDIXES

Appendix 1. Diary and advices for one week measurement

Mittaus	ID	Nimikirjaimet	Alive nro

Perheen arkiliikunta ja hyvinvointi

Palautan laitteet ja päiväkirjat __.__./__.
Vivecalle ☐ päiväkodille/koululle ☐

Huom! Ilmoitathan tutkijoille mikäli et pysty palauttamaan laitteita sovitusti! Tutkijoiden yhteystiedot:

Arto Pesola p. 0400 614 937
Arto Laukkanen p. 040 684 6255

Ohjeet viikon mittaukseen

- **Toivomme Sinun jatkavan normaalia elämää** mittausten ajan.
- **Täytä aktiivisuuspäiväkirjaa** (sivut 5-11).
- **Laitteisiin tai nappuloihin ei tarvitse koskea.** Laitteet mittaavat koko ajan, eikä niitä tarvitse sammuttaa erikseen.
- **Tee ortostaattinen koe** yhden sykemittauspäivän aamuna (sivu 5)
- **Laitteiden kanssa ette voi:**
  - Tehdä asioita, joissa laitteet kastuvat huomattavasti (esim. käydä suihkussa tai uimassa)
  - Harrastaa lajeja, joissa laitteet rikkoutuisivat erittäin helposti (esim. kamppailulajit).
- **Suihkussa käyminen.** Suihkussa käymisen ajaksi kaikki mittalaitteet tulee riisua. Tämän vuoksi mittausten kannalta olisi parempi, jos kävisitte suihkussa aamulla ennen mittausten aloittamista ja/tai illalla mittausten lopettamisen jälkeen. Jos teidän tarvitsee käydä suihkussa kesken mittausten, merkitkää päiväkirjaan tarkka aika jolloin riisuitte laitteet ja aika, jolloin puitte ne takaisin päällenne.
- **Jos laitteessa ei näy valoa**, käynnistä laite tai ota yhteyttä tutkijoihin

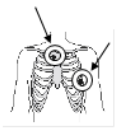
Laitekohtaiset ohjeet

Mittausten kesto

	1	2	3	4	5	6	7	
Kiihtyvyysanturi								palautus
Sykemittari								palautus

SYKEMITTARI – *pidetään 3 päivää ja 2 yötä*

Sykemittaria (sininen laite + elektrodit) pidetään 3 ensimmäistä päivää ja 2 yötä. Yöllä mittaria pidetään yösykkeen seuraamiseksi, josta saamme tietoa stressitasosta sekä palautumisesta. Jos elektrodit irtoavat, kiinnitä uudet elektrodit kuivalle ja puhtaalle iholle kuvan osoittamiin paikkoihin. Suihkussa käydessä elektrodit irrotetaan.



Kolmannen päivän iltana kun sykemittausta ei enää tarvitse suorittaa, **lataa tai vaihda akku.** Vanhan akun voit palauttaa päiväkodin palautuslaatikkoon. Laitteen johdot voi kääriä vyön ympärille kuvan osoittamalla tavalla ja elektrodipäät piilottaa samaan taskuun jossa mittalaite on. Johtokerän voi kiinnittää vyöhön esim teipillä. HUOM! Älä irrota johtoja!

KIIHTYVYYSANTURI - *pidetään koko viikko*

Kiihtyvyysanturin tulee olla vyötärölle kiinnitettävän vyön pussissa koko ajan, "Alive" teksti oikein päin. Päivinä 4-7, kun sykettä ei mitata mittarin voi ottaa nukkumisen ajaksi pois.

Ohjeet päiväkirjan täyttämiseen

Merkitse tyhjille viivoille päivän tapahtumia alku- ja loppuaikoineen. Esimerkkejä tutkimuksen kannalta merkittävistä tapahtumista:

- Fyysinen aktiivisuus (hyöty-, työmatka, tai vapaa-ajan liikunta)
- Psyykkisesti kuormittava tapahtuma (esim. kokous tai esityksen pitäminen)
- Palauttava tapahtuma (esim. TV:n katselu, päiväunet)
- Suihkussa käyminen tai muu aika jolloin laite on pois päältä

ESIMERKKIPAIVA	
7.15	Herääminen
8.30-9.00	Työmatka kävellen
9.10-9.30	Tärkeä palaveri/stressaava tilanne
16.00-16.10	Kotimatka auton kyydissä
17.30-18.45	Pihatöitä ulkona
21.50-22.05	Suihkussa käynti, laite pois vyötäröltä
22.30	Nukkumaanmeno

Jatka tarvittaessa kommentteja takasivulle.

Ortostaattinen koe:

Ortostaattisella kokeella selvitetään sykkeen muutosta makuulta seisomaan noustessa. Makaa herättyäsi rauhassa 5 minuuttia, jotta syke pysyy lepotasolla. Nouse sitten ylös ja seiso rauhallisesti paikoillaan 3 minuuttia. Sykettä mitataan kahtena yönä, joista toisen jälkeisenä aamuna tulee suorittaa ortostaattinen testi.

Päivä 1

PÄIVÄN TIEDOT			
Päivämäärä		Viikonpäivä	
Töissä ☐	Vapaapäivä ☐	☐ Normaali päivä ☐	Poikkeuksellinen päivä ☐
Jos poikkeuksellinen, niin miten			
Työmatka alkoi klo	Työaika alkoi klo	Työaika loppui klo	Työmatka loppui klo
Työmatkan kulkutapa (toihin)		Työmatkan kulkutapa (toista pois)	

LÄÄKITYS / ALKOHOLI
Käytitkö tänään jotain lääkkeitä (lääkkeen nimi ja annostus)?
Käytitkö tänään alkoholia? Montako annosta?

(tietyt lääkkeet ja alkoholi vaikuttavat sykkeeseen ja analyysin tuloksiin, siksi niiden kysyminen on tärkeää)

Muista pitää mittaria yön yli ja tehdä seuraavana aamuna ortostaattinen koe (ohje sivulla 5)! HUOM! Tarkista ennen kokeen aloittamista, että mittari on käynnissä.

PAIVAKIRJA	
Aloitus- ja lopetusaika	Mittausjakson tapahtuma

Muista pitää mittaria yön yli ja tehdä seuraavana aamuna ortostaattinen koe (ohje sivulla 5). HUOM! Tarkista ennen kokeen aloittamista, että mittari on käynnissä.

nukkumaan

Päivä 2

PÄIVÄN TIEDOT			
Päivämäärä		Viikonpäivä	
Töissä ☐	Vapaapäivä ☐	☐ Normaali päivä ☐	Poikkeuksellinen päivä ☐
Jos poikkeuksellinen, niin miten			
Työmatka alkoi klo	Työaika alkoi klo	Työaika loppui klo	Työmatka loppui klo
Työmatkan kulkutapa (toihin)		Työmatkan kulkutapa (toista pois)	

LÄÄKITYS / ALKOHOLI
Käytitkö tänään jotain lääkkeitä (lääkkeen nimi ja annostus)?
Käytitkö tänään alkoholia? Montako annosta?

(tietyt lääkkeet ja alkoholi vaikuttavat sykkeeseen ja analyysin tuloksiin, siksi niiden kysyminen on tärkeää)

UNIKYSELY EDELLISELTÄ YÖLTÄ		
Kävin nukkumaan klo	Heräsin aamulla klo	Nukahtaminen kesti arviolta n. _____min
Koen nukkuneeni viime yönä	☐ Hyvin ☐ Melko hyvin ☐ En hyvin enkä huonosti ☐ Melko huonosti ☐ Huonosti	
Häiritsikö sykelaite untasi?		
☐ Ei lainkaan	☐ Jonkin verran	☐ Paljon

PAIVAKIRJA

Ortostaattinen koe	Aloitusaika makuulla (5min)	Lopetusaika seisaallaan (3min)

Aloitus- ja lopetusaika | Mittausjakson tapahtuma

Muista pitää mittaria yön yli ja tehdä seuraavana aamuna ortostaattinen koe, jos et tehnyt sitä tänä aamuna (ohje sivulla 5).HUOM! Tarkista ennen kokeen aloittamista, että mittari on käynnissä.

nukkumaan

Päivä 3

PÄIVÄN TIEDOT

Päivämäärä	Viikonpäivä			
Töissä	Vapaapäivä		Normaali päivä	Poikkeuksellinen päivä
Jos poikkeuksellinen, niin miten				
Työmatka alkoi klo	Työaika alkoi klo	Työaika loppui klo	Työmatka loppui klo	
Työmatkan kulkutapa (töihin)	Työmatkan kulkutapa (töistä pois)			

LÄÄKITYS / ALKOHOLI

Käytitkö tänään jotain lääkkeitä (lääkkeen nimi ja annostus)?

Käytitkö tänään alkoholia? Montako annosta?

(tietyt lääkkeet ja alkoholi vaikuttavat sykkeeseen ja analyysin tuloksiin, siksi niiden kysyminen on tärkeää)

UNIKYSELY EDELLISELTÄ YÖLTÄ

Kävin nukkumaan klo	Heräsin aamulla klo	Nukahtaminen kesti arviolta
		n. _____min

Koen nukkuneeni viime yönä

- ☐ Hyvin
- ☐ Melko hyvin
- ☐ En hyvin enkä huonosti
- ☐ Melko huonosti
- ☐ Huonosti

Häiritsikö sykelaite untasi?

☐ Ei lainkaan ☐ Jonkin verran ☐ Paljon

PAIVAKIRJA

Ortostaattinen koe	Aloitusaika makuulla (5min)	Lopetusaika seisaallaan (3min)

Aloitus- ja lopetusaika | Mittausjakson tapahtuma

Sykettä ei tarvitse enää mitata, joten voit irrottaa rintakehälle kiinnitetyt elektrodit. Lataa akkua yön yli, tai vaihda akku ja käynnistä mittari uudelleen painamalla johtojen vieressä olevaa virtanappia n. 2 s. Tarkista, että valo alkaa vilkkua. Voit kääriä johdot mittarin ympärille (sivu 3). Aseta mittari vyötärölle aamulla.

Mittauksen lopetusaika	Akku ladattu tai vaihdettu	Mittarin käynnistysaika

Päivä 4

PÄIVÄN TIEDOT

Päivämäärä	Viikonpäivä			
Töissä	Vapaapäivä		Normaali päivä	Poikkeuksellinen päivä
Jos poikkeuksellinen, niin miten				
Työmatka alkoi klo	Työaika alkoi klo	Työaika loppui klo	Työmatka loppui klo	
Työmatkan kulkutapa (töihin)	Työmatkan kulkutapa (töistä pois)			

PAIVAKIRJA

Mittari vyötärölle klo

Aloitus- ja lopetusaika | Mittausjakson tapahtuma

Mittari pois vyötäröltä klo

Päivä 5

PÄIVÄN TIEDOT				
Päivämäärä		Viikonpäivä		
Töissä ☐	Vapaapäivä ☐		Normaali päivä ☐	Poikkeuksellinen päivä ☐
Jos poikkeuksellinen, niin miten				
Työmatka alkoi klo	Työaika alkoi klo	Työaika loppui klo	Työmatka loppui klo	
Työmatkan kulkutapa (toihin)		Työmatkan kulkutapa (toista pois)		

PÄIVÄKIRJA
Mittari vyötärölle klo

Aloitus- ja lopetusaika	Mittausjakson tapahtuma

Mittari pois vyötäröltä klo

Päivä 6

PÄIVÄN TIEDOT				
Päivämäärä		Viikonpäivä		
Töissä ☐	Vapaapäivä ☐		Normaali päivä ☐	Poikkeuksellinen päivä ☐
Jos poikkeuksellinen, niin miten				
Työmatka alkoi klo	Työaika alkoi klo	Työaika loppui klo	Työmatka loppui klo	
Työmatkan kulkutapa (toihin)		Työmatkan kulkutapa (toista pois)		

PÄIVÄKIRJA
Mittari vyötärölle klo

Aloitus- ja lopetusaika	Mittausjakson tapahtuma

Mittari pois vyötäröltä klo

Päivä 7

PÄIVÄN TIEDOT				
Päivämäärä		Viikonpäivä		
Töissä ☐	Vapaapäivä ☐		Normaali päivä ☐	Poikkeuksellinen päivä ☐
Jos poikkeuksellinen, niin miten				
Työmatka alkoi klo	Työaika alkoi klo	Työaika loppui klo	Työmatka loppui klo	
Työmatkan kulkutapa (toihin)		Työmatkan kulkutapa (toista pois)		

PÄIVÄKIRJA
Mittari vyötärölle klo

Aloitus- ja lopetusaika	Mittausjakson tapahtuma

Mittari pois vyötäröltä klo

*Voit palauttaa kaikki mittalaitteet sekä päiväkirjat **mielellään heti seuraavana aamuna** päiväkodille tai Vivecalle.*

Kiitos vaivannäöstäsi!

Tsemppiä viikkoon!

Appendix 2. Work Ability Index Questionnaire:

TYÖKYKYINDEKSI

1. Työkyky nyt verrattuna elinaikaiseen parhaimpaan

Oletetaan, että työkykynne on parhaimmillaan saanut 10 pistettä. Minkä pistemäärän antaisitte nykyiselle työkyvyllenne?
(0 tarkoittaa sitä, ettette nykyisin pysty lainkaan työhön)

0 1 2 3 4 5 6 7 8 9 10

täysin työkyvytön — työkyky parhaimmillaan

2. Työkyky työn vaatimusten kannalta

Millaiseksi arvioitte nykyisen työkykynne työnne **ruumiillisten** vaatimusten kannalta?

erittäin hyvä 5
melko hyvä 4
kohtalainen 3
melko huono 2
erittäin huono 1

Millaiseksi arvioitte nykyisen työkykynne työnne **henkisten** vaatimusten kannalta?

erittäin hyvä 5
melko hyvä 4
kohtalainen 3
melko huono 2
erittäin huono 1

3. Nykyiset sairaudet

Merkitkää seuraavaan luetteloon millaisia sairauksia tai vammoja teillä on **tällä hetkellä, toistuvasti tai usein**. Merkitkää lisäksi, onko lääkäri todennut tai hoitanut tätä sairautta. Kunkin sairauden kohdalla voi siis olla 2, 1 tai ei yhtään rengasta.

	kyllä: oma mielipide	kyllä: lääkärin toteama
Tapaturmavamma		
01 selässä	2	1
02 yläraajoissa/käsissä	2	1
03 alaraajoissa/jaloissa	2	1
04 muualla, missä ja millainen?	2	1
Tuki- ja liikuntaelinten sairaus		
05 selän yläosan, kaularangan kulumavika / toistuva kiputila	2	1
06 selän alaosan kulumavika / toistuva kiputila	2	1
07 iskiasoireyhtymä	2	1
08 raajojen (kädet, jalat) kulumavika / toistuva kiputila	2	1
09 nivelreuma	2	1
10 muu tuki- ja liikuntaelinten sairaus, mikä?	2	1
Verenkiertoelinten sairaus		
11 verenpainetauti	2	1
12 sepelvaltimotauti, (rasitus)-rintakipu (angina pectoris)	2	1
13 sairastettu sydänveritulppa, sydäninfarkti	2	1
14 sydämen vajaatoiminta	2	1
15 muu verenkiertoelinten sairaus, mikä?	2	1
Hengityselinten sairaus		
16 toistuvat hengitysteiden tulehdukset (myös nielurisa- ja poskiontelon tulehdukset sekä ohimenevä keuhkoputken tulehdus)	2	1
17 pitkäaikainen keuhkoputken-tulehdus	2	1
18 pitkäaikainen nuha	2	1
19 keuhkoastma	2	1
20 keuhkojen laajentuma	2	1
21 keuhkotuberkuloosi	2	1
22 muu hengityselinten sairaus, mikä?	2	1

	kyllä oma mielipide	kyllä lääkärin toteama
Mielenterveyden häiriö		
23 mielisairaus tai vakava mielenterveyden ongelma (esim. vakava masennustila, mielialahäiriö)	2	1
24 lievä mielenterveyden häiriö tai ongelma (esim. lievä masennustila, jännittyneisyys, ahdistuneisuus, unihäiriö)	2	1
Hermoston ja aistimien sairaus		
25 kuulosairaus, kuulovamma	2	1
26 silmäsairaus, silmävamma (muu kuin taittovika)	2	1
27 hermoston sairaus (esim. halvaus, hermosärky, migreeni, epilepsia)	2	1
28 muu hermoston ja aistimien sairaus, mikä?	2	1
Ruuansulatuselinten sairaus		
29 sappikivet, sappisairaus	2	1
30 maksa- tai haimasairaus	2	1
31 maha- tai pohjukaissuolen haava	2	1
32 maha- tai pohjukaissuolen katarri/ärsytystila	2	1
33 paksusuolen katarri/ärsytystila	2	1
34 muu ruoansulatuselinten sairaus, mikä?	2	1
Virtsa- tai sukuelinten sairaus		
35 virtsateiden tulehdus	2	1
36 munuaissairaus	2	1
37 sukuelinten sairaus (esim. naisilla munasarjatulehdus, miehillä eturauhastulehdus)	2	1
38 muu virtsa- tai sukuelinten sairaus, mikä?	2	1

	kyllä oma mielipide	kyllä lääkärin toteama
Ihon sairaus		
39 allerginen ihottuma	2	1
40 muu ihottuma, mikä?	2	1
41 muu ihosairaus, mikä?	2	1
Kasvain		
42 hyvänlaatuinen kasvain	2	1
43 pahanlaatuinen kasvain (syöpä), missä?	2	1
Umpierityksen ja aineenvaihdunnan sairaudet		
44 liikalihavuus	2	1
45 sokeritauti	2	1
46 struuma tai muu kilpirauhassairaus	2	1
47 muu umpierityksen tai aineenvaihdunnan sairaus, mikä?	2	1
Veren taudit		
48 vähäverisyys (anemia)	2	1
49 muu veren tauti, mikä?	2	1
Synnynnäiset viat		
50 synnynnäinen vika, mikä?	2	1
Muu vaiva tai sairaus		
51 mikä?	2	1

4. Sairauksien arvioitu haitta työssä

Onko sairauksistanne tai vammoistanne haittaa nykyisessä työssänne? Rengastakaa tarvittaessa useita vaihtoehtoja.

ei haittaa lainkaan/ei ole sairauksia	6
suoriudun työstä, mutta siitä aiheutuu oireita	5
joudun joskus keventämään työtahtia tai muuttamaan työskentelytapaa	4
joudun usein keventämään työtahtia tai muuttamaan työskentelytapaa	3
sairauteni vuoksi selviytyisin mielestäni vain osa-aikatyössä	2
olen mielestäni täysin kykenemätön työhön	1

5. Sairauspoissaolopäivät

Kuinka monta **kokonaista päivää** olette ollut poissa työstä terveydentilanne vuoksi (sairauden tai terveyden hoito tai tutkiminen) viimeisen vuoden (12 kk) aikana?

en lainkaan	5
korkeintaan 9 päivää	4
10–24 päivää	3
25–99 päivää	2
100–365 päivää	1

6. Ennuste työkyvystä kahden vuoden kuluttua

Uskotteko, että terveytenne puolesta pystyisitte työskentelemään nykyisessä ammatissanne **kahden vuoden kuluttua**?

tuskin	1
en ole varma	4
melko varmasti	7

7. Psyykkiset voimavarat

Oletteko viime aikoina kyennyt nauttimaan tavallisista päivittäisistä toimistanne?

usein	4
melko usein	3
silloin tällöin	2
melko harvoin	1
en koskaan	0

Oletteko viime aikoina ollut toimelias ja vireä?

aina	4
melko usein	3
silloin tällöin	2
melko harvoin	1
en koskaan	0

Oletteko viime aikoina tunteneet itsenne toivorikkaaksi tulevaisuuden suhteen?

jatkuvasti	4
melko usein	3
silloin tällöin	2
melko harvoin	1
en koskaan	0

Suostumus (yleinen työkyvyn edistäminen ja ylläpito)

Suostutteko siihen, että edellä olevista työkykyänne koskevista tiedoista laadittu yhteenveto ja työkykyindeksin pistemäärä voidaan liittää terveyskertomukseenne?

suostun ❑
en suostu ❑

allekirjoitus

Appendix 3. Occupational stress questionnaire.

Tervetuloa täyttämään PERHEEN ARKILIIKUNTA JA HYVINVOINTI -projektin kyselyä.

Tämä kysely koskee työstressiä.

Kyselyyn vastaaminen vie keskimäärin 5 minuuttia.

Psyykkiset oireet

Oletko viime aikoina ollut poikkeuksellisen väsynyt?

- ❍ en koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Tuntuvatko muut ihmiset sinusta ärsyttäviltä?

- ❍ ei koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Oletko masentunut?

- ❍ en lainkaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Oletko hermostunut?

- ❍ en koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Tunnetko itsesi yksinäiseksi?

- ❍ en koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Onko ajatusten koossa pitäminen tai keskittyminen sinulle vaikeaa?

- ❍ ei koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Somaattiset oireet

Onko sinulla päänsärkyä?

- ❍ ei juuri koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Onko sinulla niska-hartiasärkyä?

- ❍ ei juuri koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Onko sinulla selkäsärkyä?

- ❍ ei juuri koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Lyökö sydämesi liian nopeasti tai epätasaisesti?

- ❍ ei juuri koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Huimaako sinua?

- ❍ ei juuri koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Onko sinulla pahoinvoinnin tuntemuksia?

- ❍ ei juuri koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Tunnetko puristusta, ahdistusta tai kipua rinnassa?

- ❍ ei juuri koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Onko unen päästä kiinni saaminen sinulle..

- ❍ erittäin helppoa
- ❍ melko helppoa
- ❍ ei helppoa mutta ei vaikeatakaan
- ❍ melko vaikeata
- ❍ erittäin vaikeata

Millaista yöunesi on?

- ❍ en yleensä herää kesken unieni
- ❍ herään kerran yössä
- ❍ herään pari kertaa yössä
- ❍ herään 3-4 kertaa yössä
- ❍ uneni on katkonaista

Onko sinulla vatsakipuja?

- ❍ ei juuri koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Kirjoita tähän jos sinulla on tiedossa syy miksi heräät kesken unien

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Stressi ja terveys

Stressillä tarkoitetaan tilannetta, jossa ihminen tuntee itsensä jännittyneeksi, levottomaksi, hermostuneeksi tai ahdistuneeksi taikka hänen on vaikea nukkua asioiden vaivatessa jatkuvasti mieltä. Tunnetko sinä nykyisin tällaista stressiä?

- ❍ en lainkaan
- ❍ vain vähän
- ❍ jonkin verran
- ❍ melko paljon
- ❍ erittäin paljon

Minkälainen on terveydentilasi ikäisiisi verrattuna?

- ❍ erittäin hyvä
- ❍ melko hyvä
- ❍ keskinkertainen
- ❍ melko huono
- ❍ erittäin huono

Tyytyväisyys työhön ja elämään

Kuinka tyytyväinen olet nykyiseen työhösi?

- ❍ erittäin tyytyväinen
- ❍ melko tyytyväinen
- ❍ en tyytyväinen mutta en tyytymätönkään
- ❍ melko tyytymätön
- ❍ erittäin tyytymätön

Ihminen on vain harvoin täysin tyytyväinen omiin oloihinsa. Ajattele omaa työtäsi ja vertaa sitä tilanteeseen, jossa voisit sanoa olevasi täysin tyytyväinen. Kuinka paljon nykyisen työsi pitäisi muuttua ollaksesi täysin tyytyväinen?

- ❍ ei lainkaan
- ❍ erittäin vähän
- ❍ jonkin verran
- ❍ melko paljon
- ❍ erittäin paljon

Kuinka tyytyväinen olet elämääsi nykyisin?

- ❍ erittäin tyytyväinen
- ❍ melko tyytyväinen
- ❍ en tyytyväinen mutta en tyytymätönkään
- ❍ melko tyytymätön
- ❍ erittäin tyytymätön

Ihminen on vain harvoin täysin tyytyväinen omiin oloihinsa. Ajattele nyt koko elämäntilannettasi (perhe, vapaa-aika, työ) ja vertaa sitä tilanteeseen, jossa olisit täysin tyytyväinen. Kuinka paljon nykyisten olojesi pitäisi muuttua ollaksesi täysin tyytyväinen?

- ❍ ei lainkaan
- ❍ erittäin vähän
- ❍ jonkin verran
- ❍ melko paljon
- ❍ erittäin paljon

Kiire ja työnjako

Täytyykö sinun kiirehtiä suorituaksesi työstäsi?

- ❍ ei koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Kiire ja työnjako

Joudutko töiden liian suuren määrän takia jättämään töitä tekemättä?

- ❍ en koskaan
- ❍ harvoin
- ❍ joskus
- ❍ usein
- ❍ jatkuvasti

Ehditkö pitää taukoja tai lepohetkiä työn aikana?

- ❍ täysin riittävästi
- ❍ melko riittävästi
- ❍ ei riittävästi, mutta ei vähääkään
- ❍ melko vähän
- ❍ aivan liian vähän

Jakautuuko työmääräsi epätasaisesti siten, että työt ruuhkautuvat?

- ❍ erittäin usein
- ❍ melko usein
- ❍ joskus
- ❍ melko harvoin
- ❍ erittäin harvoin

Onko työnjako työyksikössäsi oikeudenmukainen?

- ❍ täysin oikeudenmukainen
- ❍ melko oikeudenmukainen
- ❍ en osaa sanoa
- ❍ melko epäoikeudenmukainen
- ❍ erittäin epäoikeudenmukainen

Onko työssäsi vaiheita, jolloin työ on liian vaikeaa?

- ❍ ei koskaan
- ❍ melko harvoin
- ❍ silloin tällöin
- ❍ melko usein
- ❍ jatkuvasti

Kuuluuko työhösi tehtäviä, joihin olet saanut liian vähän koulutusta tai opastusta?

- ❍ ei lainkaan
- ❍ hyvin vähän
- ❍ jonkin verran
- ❍ melko runsaasti
- ❍ erittäin runsaasti

Työn rasittavuus

Onko työsi henkisesti rasittavaa?

- ❍ ei lainkaan
- ❍ melko kevyttä
- ❍ jonkin verran rasittavaa
- ❍ melko rasittavaa
- ❍ hyvin rasittavaa

Onko työsi ruumiillisesti rasittavaa?

- ❍ ei lainkaan
- ❍ melko kevyttä
- ❍ jonkin verran rasittavaa
- ❍ melko rasittavaa
- ❍ hyvin rasittavaa

Appendix 4. MET Questionnaire

Vapaa-ajan liikunta viimeisen 12 kuukauden aikana
Mitä seuraavista liikuntamuodoista olette harrastanut viimeisen 12 kuukauden aikana?

Arvioikaa kunkin liikuntamuodon tavanomaisin rasittavuusaste valitsemalla yksi seuraavista luokista:

Aste	Rasittavuus	Hengästyminen
0	Kevyt	En hengästy
1	Kohtalainen	Hengästyn hieman
2	Rasittava	Hengästyn
3	Hyvin rasittava	Hengästyn voimakkaasti

Täyttäkää ITSE seuraava taulukko edellä olevan ohjeen mukaisesti

	En harrasta ollenkaan (rasti)	Kertaa kuukaudessa: tammikuu	helmikuu	maaliskuu	huhtikuu	toukokuu	kesäkuu	heinäkuu	elokuu	syyskuu	lokakuu	marraskuu	joulukuu	Keskimääräinen **aikakerta (min)**	Rasittavuusaste (0-3)
Kävely työmatkalla (yksi suunta =1 kerta)															
Pyöräily työmatkalla (yksi suunta =1 kerta)															
Hölkkä, juoksu, suunnistus															
Hiihto															
Kuntokävely, sauvakävely, patikointi															
Vapaa-ajan pyöräily, kuntopyöräily															
Uinti, vesivoimistelu															
Voimistelu															
Aerobic															
Salibandy, sähly															
Golf															
Muut pallo- ja mailapelit															
Laskettelu, lumilautailu															
Luistelu, rullaluistelu															
Soutu (matka-, kunto-)															
Tanssi															
Kuntosaliharjoittelu															
Keilailu															
Metsästys, marjastus, sienestys, kalastus															
Piha-, puutarha-, lumityöt															
Askartelu- ja remonttityöt															
Metsätyöt, halonhakkuu, metsänhoito															
Kotityöt, siivoaminen															
Muu, mikä:															
Muu, mikä:															

Appendix 5.

Following questions from activity questionnaire were used:

Kuinka monta prosenttia työajastasi käytät istumiseen keskimäärin?

(0 - 100)

Kuinka paljon keskimäärin päivässä VAPAA-AIKANA (poislukien työaika) istut? Sisällytä tähän TV:n katselu, tietokone-aika, ruokapöydässä istuminen jne. Kirjoita vastaus kokonaisina tunteina.

(0 - 24)