Satakunnan ammattikorkeakoulu
Satakunta University of Applied Sciences

MAIJA PIETILÄ

The Effect of active breaks for wellbeing at work

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Author(s)
Pietilä, Maija

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Abstract

In this master's thesis the objective was to research if active breaks during workday have an impact on individual's wellbeing at work and if so, what are the detected changes. The research study was made for a large company working in the IT field; the participants worked in different positions in the company.

The first week of the study the participants were guided to work as usual and have the first health assessment done by attaching Firstbeat device into their chest for three days. The first assessment was done to gather data from initial condition to later compare results to. Then the participants were guided to take two active breaks during workdays. In this case, active break meant a 15-minute moderate walk. On the second week of active breaks, Firstbeat assessment was then repeated. The participants also filled out short journal as well as a written interview after the research period. All the numerical data was formed into Firstbeat individual reports as well as group reports.

For this research, the Firstbeat generated data was input to usable form to compile statistics. The comparisons were made between the assessment periods in three main categories: stress and recovery, sleep, and physical activity. The results were promising. The changes especially in the category of physical activity were significant – also improvement of sleep quality and slight improvement of stress and recovery balance was detected.

As a conclusion, the benefit of active breaks came distinct. Living an active lifestyle is one of the corner stones in our overall wellbeing an seeing extensive increase especially in this category is assuring that in the long run the active breaks would benefit other categories even more as well.

Keywords
active break, Firstbeat, welfare technology, wellbeing, wellbeing at work, work wellbeing

CONTENTS

1 INTRODUCTION

This research aims to address the impact of active breaks on wellbeing at work in an office environment. The issue of wellbeing at work is not only a private issue of the individual; the amount of sickness allowanced paid by Kansaneläkelaitos, KELA, has grown significantly over the years. According to KELA's statistics, the number of individuals receiving sickness allowance due to mental reasons, has grown almost 15% between 2020 and 2021 when total receivers of sickness allowances grew only 3,5%. In 2021 the amount paid for mental reasons was over 275 million euros. (KELA, n.d.)

Since there is a significant financial gain to be achieved in both company and national level, it is important to explore ways to improve individual's work wellbeing. This research focuses on the prevention side and especially to the aspects where an individual has a possibility to influence with their own, small, everyday actions.

The aim is to explore the effect of taking active breaks on individual's wellbeing during the workday and spending the break with mild, physical strain. The physical strain in this case is a 15-minute walk. Purpose of the study was to find out the consequences of active breaks. In the wake of results, it might be possible in the future to make suggestions how to adapt the way of working, so that necessary changes can be made to support individuals' wellbeing. The data collection from the research group was done with qualitative and quantitative method.

This report is structured in chronological matter – in the second chapter the purpose of the study and motivation is discussed. The third chapter describes the terminology in the subject and the state of knowledge based on the current literature. Study methods are discussed in fourth chapter in detail and the results are reported in the fifth chapter. Chapter six will compare the findings to theoretical background. The report is summarized in the last, seventh, chapter in conclusion. At the end, the references and

appendices can be found. To be noted, the participant's individual research data is not part of the public appendix material.

2 PURPOSE AND JUSTIFICATION OF THE STUDY

The aim of the research in mind, the research questions are:

> RQ1: Per research, does active breaks during the workday effect on individual's wellbeing?
> RQ2: Per research, what are the seen effects on individual's wellbeing?

The research is necessary since there is a clear gap in this area of research. Wellbeing at work is highly researched subject but in the entity of wellbeing at work with active breaks in the office environment the research has not been studied completely comprehensively. The scope is also very large: wellbeing and work wellbeing are wide areas to study as a subject and so is active breaks as well. Active breaks cover variety of options what to study as active breaks: walking, stretching, yoga, circuit training and so on. Active breaks in general have been studied quite extensively, but less in an office environment.

Overall wellbeing at work has been studied extensively, with over a million results in Google Scholar alone. The aspects studied are, for example, digitality and wellbeing (Bordi et al., 2018), how to concept and measure wellbeing (Fisher, 2014), even the correlation between office lighting and wellbeing has been studied (Mills, 2007). Studies about the effect of active breaks covered, for example, active breaks in school environment (Mazzoli et al., 2021), among hospital workers (Armas et al., 2021) and active breaks altogether (Taylor, 2005).

With this research scope, Kim et al. (2016) and Kühnel and colleague's (2017) studies are particularly close to the subject and interesting results to have as a background. Kim et al. conducted their study in 2017 after realizing the lack of studies done in the field of recovery during workdays. Kühnel et al. found that short breaks are indeed important but the timing matters, too. Kühnel and colleagues state that "taking self-

initiated short breaks from work in the afternoon boosted daily work engagement, whereas taking short breaks in the morning failed to predict daily work engagement".

In Finland, active breaks in general have been studied, but in adolescent's school environment (Kantomaa et al., 2018). It has been stated, that having recess between classes has an impact on cognitive abilities, focus, behaviour, and enjoyment altogether. Studies also show that overall physical activity impacts individual's both physical and psychological wellbeing (Aira & Kämppi, 2017; Haapala, 2018).

Though people at workplace are not adolescent, one can presume the basis could be the same as studying at school – at least for now due to the lack of research. Even though this research is about active breaks in work environment, for lack of exact research, it is encouraging to see results in somewhat same, larger scope. The current state of research in wellbeing at work is discussed at length in chapter three, but the gap is clear in terms of the effect of active breaks in work environment, especially in office environment. Docent Markku Seuri (2013) states that it is self-evident, that the most important factor in individual's wellbeing is being active, after that comes healthy lifestyle and sleep. His statement also supports the justification of this research and clears that this research is needed and valid.

As mentioned in the introduction, the financial effect of individuals' wellbeing is significant. More importantly, in order to have enough work force, there is a significant pressure especially in Finland to lengthen individual's career. To be able to do this, Ministry of Finance has observed the risks to inhibiting longer careers. These are, for example, physical wellbeing, more time for recovery, adaptation to work and mental abilities. One solution they have presented is to adapt the work, the work environment, and the way to lead into a form that promotes employees' productivity and work wellbeing. (Lanttola, 2018)

To summarize the purpose of this study – the purpose of the study was to find out the consequences of active breaks. Hopefully with the results of this research, the everyday working life can be altered and adapted to support individual's wellbeing at work. There are existing studies of the subject, but not with a similar scope of studying active breaks (i.e., walking in this case) for work wellbeing. The importance of breaks in

general is not always noted. Research supporting the fact that investing in active breaks endorse wellbeing, and that there are tangible results of it, might lower the threshold for employers to commit to active breaks and work wellbeing in general.

3 WORK WELLBEING AND ACTIVE BREAKS

The term wellbeing at work itself is highly researched area. Even when just googling the words, one gets over 4,5 billion results. In comparison, the term ‘burn out’ gets only 523 million hits. Professors Chen and Cooper have profoundly studied wellbeing. According to Chen and Cooper, since around 1995 the interest of well-being at work has grown significantly. (Chen & Cooper, 2014, p. 16)

To clear the scope of the study and clarify the idea, the terminology used needs to be elaborated. In the next subchapters the terminology and the established research results are discussed.

3.1 Terminology of wellbeing

The most essential area of this research is the hypernym of *wellbeing* and more detailed, *wellbeing at work* or *work wellbeing*. Wellbeing altogether is highly researched area, and so is wellbeing at work, too. Even though research has been made, the consensus is still lacking, what truly is wellbeing at work and how it can be both measured and improved. In this chapter the term wellbeing is discussed and in the next subchapter the term work wellbeing is specified.

According to Centers for Disease Control and Prevention, CDC, wellbeing itself can be divided into several sectors: physical, economic, social, emotional, psychological wellbeing as well as development and activity, life and domain specific satisfaction and engaging activities and work (CDC, 2018). Beforementioned researchers Chen and Cooper (2014) have studied wellbeing especially from work wellbeing point of view. They have noted the status of research community not having a clear declaration of what is meant by wellbeing not to mention the practise of measuring it. Even the spelling of wellbeing is incoherent: at times with a dash, at times without it. Chen and Cooper states of measuring wellbeing “This scale is quite broadband and includes items relevant to basic human needs for competence, relatedness, self-acceptance, purpose, and optimism. It appears to have some overlap with core self-evaluations,

psychological capital, and engagement, while adding the important dimension of social wellbeing and prosocial impact." (Chen & Cooper, 2014, p. 24). The definition comprises multiple aspects regarding mental wellbeing and mental wellbeing state instead of including psychophysical aspects.

Chen and Cooper categorise wellbeing into well-established three main branches: hedonic, social and eudaimonic wellbeing. Hedonic wellbeing is based on theory that wellbeing is pleasure and that the positive affect trumps the negative ones. Eudaimonic wellbeing is about pursuing "a good life, not just a pleasant one" (Chen & Cooper, 2014, p. 11). This approach aims to satisfy basic needs as they state, partially quoting other researchers: "competence, autonomy, relatedness, and self-acceptance … focus is on growth, purpose in life, meaning, pursuing self-concordant goals, self-actualization, and virtue" (Chen & Cooper, 2014, p. 11). Social wellbeing emphasises the significance of social relationships for overall wellbeing – people have the need to interact with others (Chen & Cooper, 2014, p. 11-13).

Chen and Cooper (2014) states that one fact that has a common understanding in research society is definition of subjective wellbeing. Subjective wellbeing is also known for its abbreviation of SWB. It was first presented in 1984 by Ed Diener. Subjective wellbeing is a term under hedonic perspective of wellbeing – it's meaning is seen to maximize pleasure and minimize pain. (Albuquerque, 2010)

Subjective wellbeing is divided into three categories to measure subjects' feeling of their life. The categories are life evaluations, positive emotions, and negative emotions. Subjective wellbeing goes under hedonic perspective of wellbeing. Measuring these factors varies, for example measuring life evaluations can be done with questionnaires and affectivity (positive and negative emotions) for example using the PANAS method developed in 1988 by psychologists Watson, Clark and Tellegan. (Chen & Cooper, 2014, p. 10-16; Helliwell & Barrington-Leigh, 2010; Riopel, 2022). As previously stated, the methods of measuring wellbeing are not fully agreed in research community, but PANAS method is one on them.

3.1.1 Wellbeing at work

Starting off this chapter with the entity of wellbeing – subjective wellbeing and work wellbeing – is pictured below. Work wellbeing can be seen as a subcategory inside wellbeing and subjective wellbeing, as depict in picture 1 below. As previously stated, subjective wellbeing lands under hedonic perspective of wellbeing. In this chapter the terminology of work wellbeing is discussed.

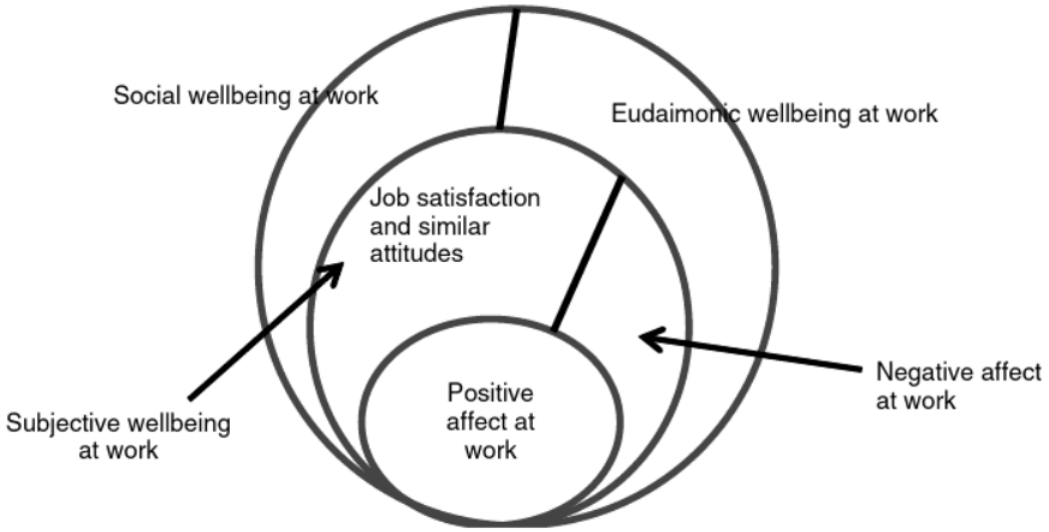
Picture 1. The context of wellbeing, subjective wellbeing, and work wellbeing.

Wellbeing at work or work wellbeing has as many definitions as explanators. Finland's Ministry of social affairs and health defines work wellbeing as "wellbeing at work means that work is safe, healthy, and pleasant – wellbeing at work increases productivity and commitment to the job, and it reduces incidents of sick leave" (Ministry of social affairs and health, n.d.). International Labour Organization, ILO, who is the United Nation's agency for work explicates work wellbeing as "relates to all aspects of working life, from the quality and safety of the physical environment, to how workers feel about their work, their working environment, the climate at work and work organization" (International Labour Organization, n.d.). ILO also points out

that work wellbeing is one of the key elements of ensuring companies long-term efficiency.

Unlike wellbeing in total, work wellbeing can sometimes be seen only as a physical aspect of workers, Eurofund states that sometimes the mental aspect is forgotten. Eurofund has an extensive study, EurWORK, in place about working conditions where wellbeing is seen as a larger entity: “EurWORK explores health and well-being in the workplace in the broadest sense: it examines the physical, mental, and social well-being of workers (including illness and disability) and how work and the way it is organised can contribute to this.” (Eurofund, 2016)

Chen and Cooper (2014) portray wellbeing at work also with a circular graph, see picture 2 below. In this picture it is seen that the subjective wellbeing is in the inner circle of positive affect at work, also social and eudaimonic wellbeing effects on positive experience of work.

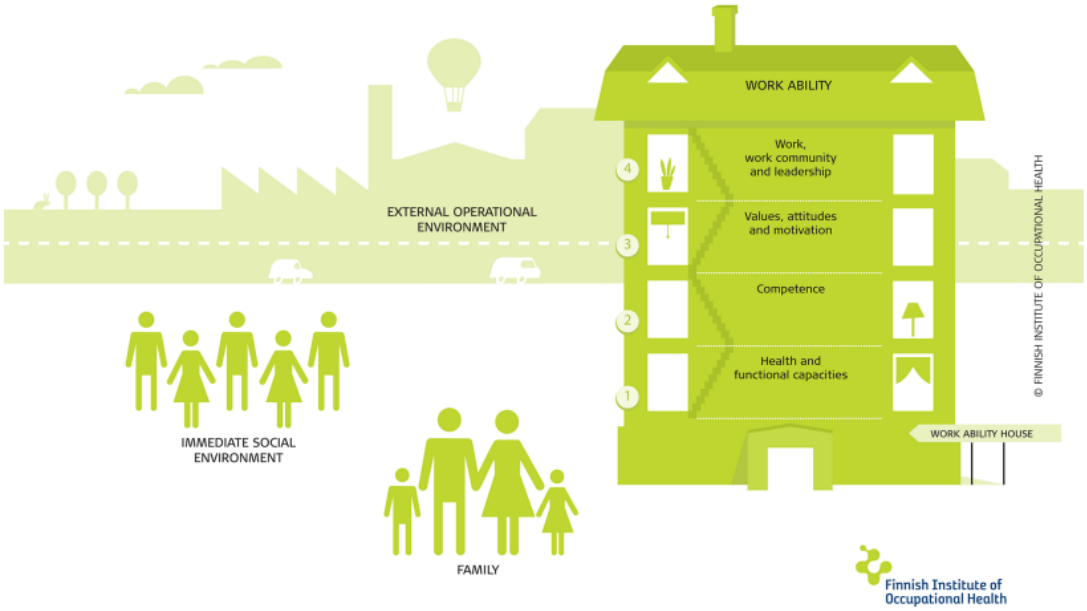


Picture 2. The entity of positive affect at work. (Chen & Cooper, 2014, p. 15)

Chen and Cooper have studied overall wellbeing extensively. When discussing work wellbeing they concluded that the scale of wellbeing is so extensive and in different research the terminology is defined case-by-case by the researchers themselves. A clear, congruent understanding of the vocabulary is non-existent and Chen and Cooper claim it is time to agree on “more comprehensive definition of overall wellbeing at

work" (Chen & Cooper, 2014, p. 25). By conceptualization of wellbeing at work, it would benefit the research itself as well as give means to more beneficial documentation. The same applies into methods the said work wellbeing is being measured and scaled. (Chen & Cooper, 2014, p. 25)

Work wellbeing can be seen as one aspect of work ability. The entity of work ability is described as the house of work ability by Finnish Institute of Occupational Health. The house of work ability is portrayed in picture 3 below. Work wellbeing can be placed on the first floor under health and functional capacities. The idea of the house of work ability is similar to Maslow's hierarchy of needs, meaning that the lower level is the base everything else is built on. (Finnish Institute of Occupational Health, n.d.)



Picture 3. House of work ability. (Finnish Institute of Occupational Health, n.d.)

3.2 Active breaks and work wellbeing

Another key term in this study is *active break*. Breaks in general during the workday and the duration varies depending on the country of working and the field of work. According to Stanford University, the term micro-break is something that lasts typically under five minutes (Stanford University, n.d.). In this research the duration of the break is 15 minutes; hence the term micro-break does not apply. According to Collective Agreement of the IT service sector 2022-2023, the breaks during the day

are not agreed precisely, per agreement: “Two refreshment breaks per day are included in the working hours.” (Collective Agreement of the IT service sector 2022-2023, n.d.). In the company executing this research the practice has been that the breaks are usually 15-20 minutes at a time.

Watson et al. (2019) who studied active breaks in classroom environment, describes active breaks as “short bursts of physical activity performed in the classroom as a break from learning tasks” (Watson et al., 2019). There is no common understanding of how long an active break is in working environment. In this research the active breaks duration is 15 minutes of physical activity.

As elaborated in chapter two, the research of active breaks in office environment were unfound. One of the reasons could be that in Finland breaks in general are seen differently from elsewhere; in Finland it is regulated in collective agreements the amount (and at times, even length) of breaks during workday, for example in collective agreement of the IT service sector it is agreed for the employees to have two breaks per day (Collective Agreement of the IT service sector 2022-2023, n.d.). whereas for example in the US, the research focuses on whether to enable breaks in general, Fritz et al, who researched different breaks during work life states “the time spent away from work due to breaks may be seen as detrimental to employee performance.” Where in Finland the breaks are a normal part of workday. A notable element is also the fact that researchers Fritz et al. are processing vacation time, sick days, weekends, evenings and breaks at work in one – as they could be comparable. Findings from Fritz et al. research is described in the picture 4. (Fritz et al., 2013)

Activities and Experiences	Health, Well-being, and Performance Outcomes
Relaxing experiences (taking a walk or reading a book)	• Increased positive mood and vigor • Decreased negative mood and exhaustion
Mastery or growth opportunities (learning something new)	• Increased positive mood and sense of vitality • Decreased fatigue
Psychological detachment from work (mentally and physically distancing oneself from work)	• Increased positive mood and life satisfaction • Decreased burnout • Highest levels of task performance and proactive behavior at medium levels of detachment
Social activities (spending time with friends or family)	• Increased positive mood, vigor, and overall well-being • Decreased disengagement • Increased job performance
Physical activities (exercise or outdoor activities) *Sleep and napping*	• Increased positive mood and vigor • Decreased fatigue • Increased work motivation • Increased task performance
Work-related activities (spending time working during the work break)	• Decreased well-being • Decreased sleep quality • Increased negative mood
Reflecting on work (thinking about the negative or positive aspects of work during time off)	Negative work reflection • Increased health complaints and exhaustion Positive work reflection • Decreased burnout • Increased proactive behaviors, creativity, helping behaviors, and pursuit for learning behaviors

Picture 4. Activities and outcomes according to Fritz et al. (Fritz et al., 2013, p. 278)

Physical activity altogether has clear benefits to human wellbeing. For example, Glazer et al. (2013) stated, that even though additional investigations are needed, their research indicated, that conducting short bursts of physical activity (less than 10 minutes), has a lowering effect on cardiometabolic risk. Franco et al. (2005) also concludes that physical activity leads to 1-4 years of longer life expectancy comparing to those with lifestyle of low physical activity.

Largo-Wight et al. studied the effect of outdoor breaks at work. Consensus of their research was that outdoor break reduced stress substantially more than a regular break spent indoors. Although it was not mentioned if the break was physically active, the importance of break was clear. (Largo-Wight et al., 2017)

Penzenstadler studied individual's work wellbeing in software engineering; her view was to study if practising mindfulness during workday would improve wellbeing at work. Penzenstadler lists the issues that IT sector in common is strained with: "…ever-expanding to-do lists, time to market pressure from management, deadline-driven development, continuous interruption during working tasks, and the juggle of balancing that with other areas of life (physical, mental, and emotional health, family, household, finance, friends, hobbies and community service). These demands of life in combination with a seemingly ever-increasing pace wear or burn out many people

in the long run Specifically, as software engineers, this also leads to decreased creativity and less efficiency in problem-solving." (Penzenstadler, 2020)

Taylor et al. research from 2014 clarified the benefits of active breaks, or booster breaks as called in the research, such as positive mindset, improving health and feelings of companionship at work. As impediment the report stated that was seen mostly the interruption to work, lack of interest and the non-existence of organization's support. In another study Taylor et al. also stated the fact, that more research is needed in integrating active breaks in work life context. Taylor stated that benefits of physical activity altogether have been studied, but not what having physical activity in workplace could benefit the wellbeing even tough Taylor et al. notes that "the workplace is an optimal venue to promote physical activity and reduce sedentary behavior" (Taylor et al., 2021).

Though the ways of measuring and terminology vary, the common conclusion is that being active during workday emphasises the work wellbeing as well as the individual's overall health. It has been established that outdoor breaks reduce stress significantly more than regular breaks and that active breaks show variety of positive effects such as positive mindset and mood, improve health and work motivation. These inferences encourage the continuation of research of active breaks in work environment and their connection to wellbeing.

3.3 The responsibility of work wellbeing

As concluding work wellbeing, it is important to acknowledge the dependence of responsibility: who is responsible for individual's work wellbeing? It is easy to say that just the individual or just the employer offering the work environment.

Cooper and Chen summarize their take on responsibility: "In the end, it will be up to everyone in the work setting— employers and employees working side by side— to find the requisite resources both within themselves and from identified best practices to leverage stressful stimuli for the common good" (Chen & Cooper, 2014, p. 198-199).

In Finland, the frame of work wellbeing is legislatively regulated. Finland has for example separate legislation of occupational health and occupational safety that legislates matters of work wellbeing from their perspective.

Occupational healthcare act mandates, that the occupational healthcare must be provided by the employer and the scope of the act is as follows

1) *the prevention of work-related illnesses and accidents;*
2) *the health and safety of the work and the working environment;*
3) *the health, ability to work and functional capacity of employees at the different stages of their working careers; and*
4) *the functioning of the workplace community*

(Occupational Health Care Act 21.12.2001/1383)

Occupational Safety and Health Act states the safety and health of the employees and responsibilities the employer to manage the circumstances so that the safety can be secured. (Occupational Safety and Health Act 23.8.2002/738)

According to Finnish Occupational Health Institute, the occupational health has four main goals to advance: prevention of occupational illnesses and accidents, promote health and safety of the work environment, promote the work and function ability of the workforce as well as advance the function of work community (Työterveyslaitos, n.d.) Overall, it can be stated that the work wellbeing is a conjoint effort of both employer and the employee.

4 MATERIAL AND METHODS

The purpose of this study is based on the fact, that a study with a similar scope has not been conducted, the research gap was clear. The purpose of this study was to find out the consequences of active breaks. Work wellbeing is highly studied, large scope, but having 15-minute walks as active breaks in an office environment has not been researched before.

The aim of this research was to address the impact of active breaks on wellbeing at work in an office environment. In this case, active breaks meant 15-minute walks twice a day. This study was conducted in February-March of 2022. In the next subchapters the study design, data collection, data analysis and ethical issues are discussed.

4.1 Study design

The starting point for the research was established data and research, and the need to answer research questions:

RQ1: Per research, does active breaks during the workday effect on individual's wellbeing?

RQ2: Per research, what are the seen effects on individual's wellbeing?

Research questions do not specify what specific effects the research is aiming to discover. Since it was intended to study all possible effects active breaks might have on work wellbeing, the study was needed to produce comprehensive results.

The data was decided to be gathered in two ways: objective, numerical data as well as subjective, free form, written data. Firstbeat Bodyguard 2 -device (later Firstbeat device) was selected to provide numerical data and a short interview for qualitative data. The qualitative material was analyzed using theme design and categorization. The numerical data was analyzed two different ways; in individual and group level; the analyses focused on comparing the assessments between two assessment periods.

Participants were also given personal report for both assessment periods and comparison analysis between two assessments.

4.2 Data collection

The study was conducted for an international company functioning in the information technology field, employing over 300 people in Finland, Sweden, and Estonia combined. The participants were the employees of the company focusing on Pori office for practical reasons. The recruitment was made via Teams presentation of the subject. The only criteria for participating were regarding health issues that were defined by the device used in the study (such as person with a heart disease could not participate). No age limit or such was set. The company had agreed to let participants use their working hours for the participation.

The research was scheduled into a three-week period as pictured in table 1 below. The research was planned so that it would allow to gather start and comparison data, hence the objective was to observe participants during a normal work week and then initiate active breaks during workdays.

The collected data was both numerical and qualitative. Numerical data was collected using Firstbeat devices. Qualitative data was collected with Fristbeat's journal entries and a separate, written interview. The Firstbeat results were composed into a wellbeing analysis for each participant; the analysis consisted of daily break down of the three-day assessment period and an overall average of the assessment period. A follow-up assessment was made in the third week of the study and both assessments were then combined into a comparison data.

Table 1. Study schedule

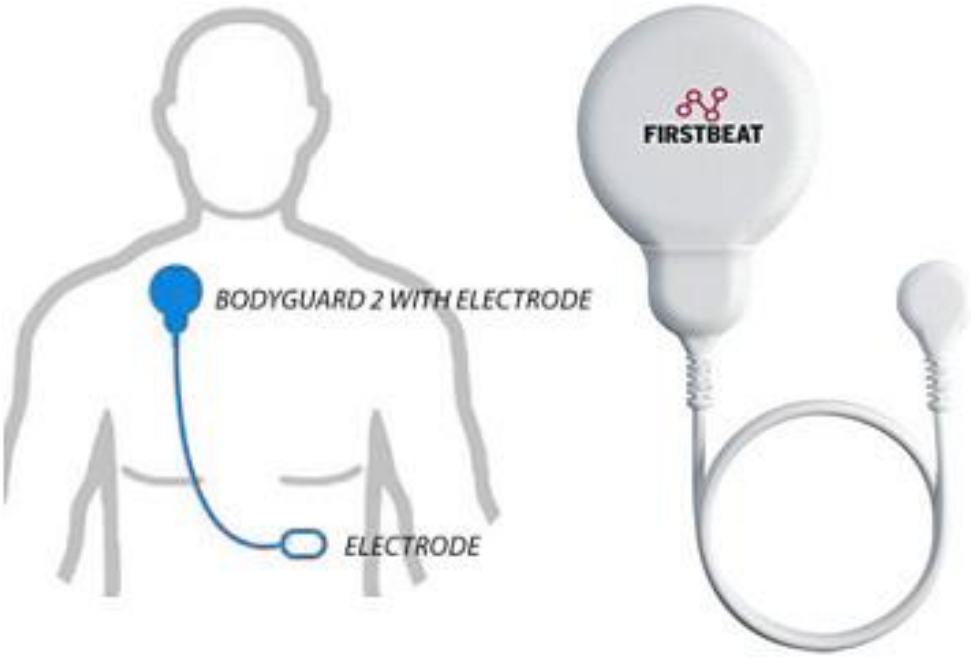
Week	Task	Firstbeat assessments
1	Regular breaks	Monday-Wednesday
2	2 active breaks/day	
3	2 active breaks/day	Monday-Wednesday

The measuring period was three days per assessment period. The starting point was to have the participants work as usual for week 1 and have the first assessment done with Firstbeat device. This was done to get baseline data to compare active week data to. After the first week, all participants had two active 15-minute breaks per day during weeks two and three as presented in the weekly plan, pictured in table 1 below. On the third week the follow-up assessment data was collected with Firstbeat device. The Firstbeat assessment days were Monday to Wednesday on both assessment period, i.e., on weeks one and three. The weekdays were kept the same, since there are certain weekly aspects that occurs regularly and to minimize other factors that may have had the effect on assessment results (for example, many works shorter Fridays).

Due to pandemic, the research group was also affected by the Covid situation. One of the participants got infected right before the second Firstbeat assessment and therefore no data was collected from that participant thereby their first measurements were also discarded. Another participant got infected on day 2 of the second assessment days but was able to continue measurements – though their results are indecisive towards the study goal and hence discarded. One can clearly see from the statistics when they got infected, and statistics distorted. Due to these occurrences, the research group was relatively small, only six people.

4.2.1 Firstbeat in data collection

The participants wore Firstbeat device during the study for a three-day period at a time. Firstbeat is a small, portable device that subject wore attached to them, see picture 5. Firstbeat is attached with two electrodes to the participant’s chest.



Picture 5. Firstbeat device and illustration how to wear it (Heartmath Institute, n.d.)

Firstbeat reports variety of factors, below listed the variables that were in the scope of this study:

- Stress and recovery balance
- Amount of stress reactions/day, hours
- Amount of stress reactions/day, percentage
- Amount of recovery (day and night), hours
- Amount of recovery (day and night), percentage
- Recovery during daytime, minutes
- Restorative effect of sleep
- Length of sleep, hours
- Amount of recovery during sleep, hours
- Amount of recovery during sleep, percentage
- Quality of recovery (heart rate variable, HRV)
- Health effects of physical activity
- Duration of physical activity (light, moderate, vigorous)

In addition to these factors, Firstbeat also provides feedback on energy expenditure and number of steps taken. These variables were not in the scope of this research. An example of complete Firstbeat assessment is in appendix I.

Firstbeat device monitors hear beat via two electrodes attached to subject's chest. Parak and Korhonen states the technology behind Firstbeat assessments: "device records ECG with electrodes, processes the signal with an integrated algorithm and provides beat-to-beat R-to-R interval (RRI) as an output with 1ms resolution." Parak and Korhonen also tested Firstbeat device and found that Firstbeat device was able to detect on average 99.95% of the heartbeats, missing only 0.05% of heartbeats. Parak and Korhonen concludes that Firstbeat device "provides an accurate method for long term HRV monitoring during daily life." (Parak & Korhonen, n.d.)

Validity and reliability are the reasoning why Firstbeat device was chosen to be used on research subjects. Firstbeat is a highly studied device and extensive research and development has been made. Firstbeat data has been collected in over 100 000 assessments. Firstbeat has been discoursed in numerical white papers and research articles. The device itself is easy to use and user errors are rare; this reasserts the position of validity of results. If using other, more complex method, the attention would have needed to be drawn also to the fact that subjects know how to use the device. The participants were not monitored during the research period, meaning daily discussion if they are conducting the breaks as agreed were not held. The study subjects were local therefore they could have been assisted with the devices in person, but no problems occurred. The participants also received a written guide and a video on how to use the device. (Firstbeat, n.d.-a)

There are physiological factors, that can effect on the assessment results. These include cases where the subject has a pacemaker, heart transplant, severe heart disease, continual atrial fibrillation or atrial flatter or uncontrolled thyroid disorder. In these cases, the results can be false. In case the subject has the flu with fever, that can also falsify the results and Firstbeat recommends the assessment to be postponed in these cases. In case the subject is using medication, it can have an impact on the assessment results. Firstbeat reports that beta blockers, asthma and allergy medication as well as sleeping pills and strong pain medications can have an effect on the assessment results. (Firstbeat, n.d.-b)

Errors can occur also by user errors. Firstbeat lists the most common errors as bad electrode contact due to the fact that the skin is not clean or has body hair in it or that

the cable in the device between electrodes is too tight. In case the results show steady error throughout the assessment period (day and night, 50-70% or more), it is likely due to a technical error with the device. (Firstbeat, n.d.-c)

The Firstbeat devices were activated and set ready to use by the researcher and the participants attached the device themselves to their chest the first morning of the assessment period. This automatically started the assessment period. The device was detached only when in contact with water (swimming, showering, sauna etc.), otherwise the device was in use three days at once. The participants were guided to change the electrodes at least once a day – by doing so they ensured that the electrodes stick properly and did not get loosen by accident, guaranteeing more accurate results.

After each assessment period the device was returned to the researcher, who then uploaded the data to Firstbeat system to create assessment reports and gain access to data (both numerical and journal entries). For the second assessment period the devices were again activated and the process itself was equivalent.

4.2.2 Qualitative data collection

Qualitative data was collected via Firstbeat's journal entries and separate written interview. The journal entries were short and quick mentions what has happened during the day as it was also part of the individual's daily reports that Firstbeat created. Written interview focused more on the entity of the research: how the participant felt about the active breaks and what were their subjective view on the benefits of active breaks.

The interview consisted of six questions, and it was done via email. The questions were formed in order to reach the most important information from the participants to avoid creating too long of an interview. The participants were given option to answer either Finnish or English. Finnish was used; therefore, entries were translated for this report. The questions in the interview were:

1. Was it easy to take a break in general? How did you feel about the "forced break" – did it feel like a burden or a good way to remember to take a break?

2. Did you manage to forget work during breaks, or did you think about work during breaks?
3. If you were to decide, would you keep active breaks in your everyday work life at least on a weekly basis?
4. Did you manage to return to work easily after the break?
5. Did you notice difference in your vitality/wellbeing/sleeping after a workday that included an active break? If you did, what kind?
   Open comments

4.3 Analysis

The gathered data was in two forms: numerical and written. The numerical data was analysed in two ways: in the beginning Firstbeat itself created visual reports for each individual. The report had daily scores as well as three-day overall scores. With Firstbeat was also created comparison reports between each individual's two assessments. These reports served mainly the individual's needs to receive the data in a consumer-friendly format. The raw numbers from these said reports were then input to Excel for further processing. Excel was also used to create tables for this report.

At first, an Excel sheet was created, where all the variables were listed with all the results by participants. The Firstbeat's categories were used. Example of the sheet below, as can be seen, the personal data was anonymized as presented as letters from A until F. The numbers seen in column A are from the first measurement period (week without the active breaks) and the data in "A Active" column is the numbers from the second assessment period (the week with active breaks). The third column, "A change" is the comparison between the assessments, presented in percentage. This table in full consisted three columns for each participant.

Table 2. Firstbeat data refining example in Excel.

Variable	A	A Active	A change	B	B Active	B change
Stress & recovery balance	29,0	37,3	29 %	21,0	39,3	87 %
Amount of stress reactions /day, hours	10,9	12,4	14 %	14,3	15,1	5 %
Amount of stress reactions/day, %	48,0	51	6 %	66,7	62,3	-7 %
Amounf of recovery (day & night), hours	3,5	4,6	31 %	2,5	5,5	119 %
Amounf of recovery (day & night), %	15,7	18,3	17 %	11,0	22,7	106 %
Recovery during daytime, min	45,0	38,7	-14 %	32,7	28,0	-14 %
Restorative effect of sleep	35,0	52,3	49 %	14,3	51,7	260 %
Length of sleep, hours	6,3	7,4	17 %	5,6	7,0	26 %
Amount of recovery during sleep, hours	2,8	3,9	41 %	1,9	5,0	160 %
Amount of recovery during sleep, %	42,3	52,3	24 %	46,0	72,0	57 %
Quality of recovery (heart rate variable, HRV)	35,3	44	25 %	20,3	22,0	8 %
Health effects of physical activity	52,7	71,7	36 %	38,0	63,0	66 %
Light exercise, hours	1,1	1,9	81 %	2,1	1,7	-19 %
Moderate exercise, hours	0,3	0,6	80 %	0,1	0,4	267 %

In Excel the comparisons were made to form conclusions for set research questions:

For RQ1, *"Per research, does active breaks during the workday effect on individual's wellbeing?"*, the data was collected from the journal and from the Firstbeat results comparing week 1 and week 3 data.

RQ2, *"Per research, what are the seen effects on individual's wellbeing?"*, is linked to RQ1 as in if there was an effect on wellbeing, what effect was.

In the research, the Firstbeat results were studied individually and among the group of participants. Group data was anonymized and formed after both assessment periods as well as into a comparison report. The percentages were also color coordinated to be able to see clearly if the change was for the better or for worse. Having a positive change resulted in green color except for the rows for stress reactions (rows 2 and 3 in the beforementioned example table). Averages were calculated from the results from each category from both measurement periods as well as change percentage between assessments.

Firstbeat system created group reports and group comparison reports semi-automatically, but research-wise the numbers were easier to process in Excel form and more interpretable than the pdf-group report. The reports from Firstbeat altogether are more consumer friendly and commercial – for larger-scale research Firstbeat has other functions to collect the data for study purposes. (Firstbeat, 2018)

The qualitative data consisted of Firstbeat's journal entries and separate written interview. The material was not extensive, so rendering was simple. Qualitative material was decided to analyse using theme design and categorization. After passing

review of the material, the results were gathered into reoccurring main themes according to the aspects reoccurring the most. During this process, the similarities were noted, as well as the divergence between participants. The main themes were relatively easy to form since the answers were even surprisingly consistent. Since the interview was concise, the amount of material remained appropriate and readable. Due to the nature of Firstbeat's journal entries, they were usable when analysing variables individually, for example when trying to find a reason for a specific reaction or poor sleep.

4.4 Ethical issues

The data collected is protected and legislatively under General Data Protection Regulation, also known as GDPR. GDPR is legislation for handling personal data. Finland's Office of the Data Protection Ombudsman simplifies area where GDPR applies: "All data related to an identified or identifiable person are personal data." In the research the data collected is personal data. (Office of the Data Protection Ombudsman, n.d.)

The research subjects were given an alias; hence their name is not shown anywhere in the collected data, except in individual reports provided by Firstbeat. The reports were given only to the subject themselves; group report and all appendices of this report are anonymous. The raw research material was not released to anyone and individual reports even without name were not included, since the group was small, and un-anonymized variables (such as age) could have been identifying information.

The Firstbeat data altogether is stored in a location pointed by the Firstbeat company. The material regarding this research (such as individual Firstbeat reports and journals) is stored to OneDrive and is protected with additional password. After the thesis is published, the research data will be permanently deleted.

A written agreement with the individuals were made before the research started. In the agreement were stated information about the research and what was to be done with their data, where it was to be stored and who could access it. The participation was

based solely on voluntary. The agreement also covered exceptional situations; for example, if a person of the research group would have wanted to discontinue their participation to the study. A written agreement was also done with the company research was conducted at as being the stakeholder in this research. As stated, I am currently working at the same company as the researched individuals; however, I stayed objective towards the study.

5 RESULTS

The research was conducted for eight (8) people, two were either left out or discontinued the study themselves, due to Covid infections. In this paper the results represent the data from six (6) participants. In the next chapters the data is presented with tables and writing.

The participants were two females and four males, ages between 23-53, average age being 40. All the participants work in IT sector in different positions. Group report is Appendix II for this paper and full table of results in Appendix III.

5.1 Numerical data

Numerical data is divided into three main categories supported by Firstbeat. Categories are stress and recovery, sleep, and physical activity. Though the research group was small, the data is abundant, therefore the data is presented in the following subchapters.

The changes presented in the upcoming charts were created from the regular, first week's assessment and compared to the second Firstbeat assessment when the active breaks were involved. Full table of anonymized results are in appendix III. All the individual level Firstbeat assessment results in this report are average results of a three-day assessment period – meaning that Firstbeat reports daily results in each variable and calculates an average based on the three-day data.

5.1.1 Stress and recovery

There are six variables in this category in Firstbeat assessment:

- Stress and recovery balance
- Amount of stress reactions /day, hours
- Amount of stress reactions/day, %
- Amount of recovery (day and night), hours
- Amount of recovery (day and night), %

- Recovery during daytime, min

Reoccurring terms in this category are stress and recovery. Firstbeat defines that the term stress in stress-related variables "—means an elevated activation level in the body, and it can be positive or negative" (Firstbeat, 2018). Firstbeat defines the term recovery as "calming down of the body. Important recovery periods include sleep and peaceful moments during the day" (Firstbeat, 2018).

In table 3 can be seen the values from both week's assessments and individual changes in each variable among the participants. The changes are calculated between the first assessment on a regular work week and the second assessment on a work week with two active breaks.

Table 3. Detailed results of Stress and Recovery -category

Variables	Stress & recovery balance	Amount of stress reactions /day, hours	Amount of stress reactions/day, %	Amount of recovery (day & night), hours	Amount of recovery (day & night), %	Recovery during daytime, min
A	29,0	10,9	48,0	3,5	15,7	45,0
A Active	37,3	12,4	51,0	4,6	18,3	38,7
A change	29 %	14 %	6 %	31 %	17 %	-14 %
B	21,0	14,3	66,7	2,5	11,0	32,7
B Active	39,3	15,1	62,3	5,5	22,7	28,0
B change	87 %	5 %	-7 %	119 %	106 %	-14 %
C	39,7	15,8	66,0	5,7	23,7	17,3
C Active	23,7	15,5	68,0	3,9	17,0	0,0
C change	-40 %	-2 %	3 %	-32 %	-28 %	-100 %
D	69,3	12,6	53,0	7,7	32,7	20,3
D Active	65,7	12,5	52,3	7,4	30,7	36,0
D change	-5 %	-1 %	-1 %	-5 %	-6 %	77 %
E	99,3	8,6	36,0	11,1	46,3	176,3
E Active	99,3	8,6	35,7	11,6	48,7	226,3
E change	0 %	0 %	-1 %	5 %	5 %	28 %
F	92,0	6,8	28,3	11,9	50,0	354,7
F Active	91,0	8,6	36,0	10,4	43,3	311,7
F change	-1 %	26 %	27 %	-12 %	-13 %	-12 %

The first column, stress and recovery balance, is the main variable in this category. The individual's changes were between -40 and +87 percent between regular week's assessment and active break week's assessment in the main category of stress and recovery. Not all variables are unambiguous in this category, since positive change is not unequivocally good result. Below are the variables, and how the outcome should be interpreted.

- Stress and recovery balance → measured value increases, better result
- Amount of stress reactions /day, hours → measured value increases, possibly worse result
- Amount of stress reactions/day, % → measured value increases, possibly worse result

- Amount of recovery (day and night), hours → measured value increases, better result
- Amount of recovery (day and night), % → measured value increases, better result
- Recovery during daytime, min → measured value increases, better result

To point out the deviant variables, they are the variables regarding stress reactions. However, more stress reactions (either per amount or per percentage of day) does not clearly imply that there was more negative stress. Stress can be either positive or negative. For example, a straining exercise causes positive stress. Values under 60% in the daily amount are in a good level (Firstbeat, 2018).

Stress and recovery balance is rated by Firstbeat so that results between 60 – 100 points are good, between 30 to 59 is moderate and less than 29 is poor (Firstbeat 2018). According to Firstbeat assessment history the average score is 58. Three out of six participants reached good level during active break week and two moderate level, one was poor; during the first week two were low level, one moderate and three in a good level. The individual changes varied between -40% and +87% between normal week and active break -week.

Variables regarding stress reactions (%) in active break -week varied from 35,7% to 68%. Numbers under 60% is seen as normal level according to Firstbeat. During the first week two were over the normal limit, during active break -week the same two were over the normal limit. The individual changes varied between -7% and +27% between normal week and active break -week.

Variables regarding recovery amount (%) in active break -week varied from 17% to 48,7%. Firstbeat rates the results so that under 20% is poor, 20-29% moderate and over 30% good. During the first week two were in poor category, one in moderate and three in good level. During active break -week the results are the same though not the same individuals on same levels. The individual changes varied between -28% and +106% between normal week and active break -week. Recovery during daytime is measured in minutes. This varied in active break -week from 0 to 311 minutes – the scale was wide. The individual changes varied from -100% to 77%.

A group level change percentage was also calculated. It was done by calculating average points in group level for both assessment periods per variable and then calculating the change percentage from these values, see table 4 below for details. In the whole category "Stress and recovery" the average changes between regular week and active break week in group level were:

- Stress and recovery balance: +1,7%
- Amount of stress reactions per day, hours: +5,2%
- Amount of stress reactions per day, %: +2,5%
- Amount of recovery (day & night), hours: +2,3%
- Amount of recovery (day & night), %: +0,7%
- Recovery during daytime, minutes: -0,9%

Table 4. Average results in Stress and Recovery -category.

	Stress & recovery balance	Amount of stress reactions /day, hours	Amount of stress reactions/day, %	Amount of recovery (day & night), hours	Amount of recovery (day & night), %	Recovery during daytime, min
A, regular week	29	10,8833333	48	3,5	15,6666667	45
A, active week	37,3333333	12,4	51	4,6	18,3	38,7
B, regular week	21	14,3333333	66,6666667	2,5	11	32,6666667
B, active week	39,3333333	15,0666667	62,3333333	5,46666667	22,6666667	28
C, regular week	39,6666667	15,7666667	66	5,7	23,6666667	17,3333333
C, active week	23,6666667	15,4666667	68	3,86666667	17	0
D, regular week	69,3333333	12,6333333	53	7,73333333	32,6666667	20,3333333
D, active week	65,6666667	12,5	52,3333333	7,36666667	30,6666667	36
E, regular week	99,3333333	8,63333333	36	11,0666667	46,3333333	176,333333
E, active week	99,3333333	8,6	35,6666667	11,6	48,6666667	226,333333
F, regular week	92	6,8	28,3333333	11,8666667	50	354,666667
F, active week	91	8,6	36	10,4333333	43,3333333	311,666667
Regular week, average points	58,3888889	11,5083333	49,6666667	7,06111111	29,8888889	107,722222
Active week, average points	59,3888889	12,1055556	50,8888889	7,22222222	30,1055556	106,783333
Difference, points	1	0,59722222	1,22222222	0,16111111	0,21666667	-0,93888889
Difference, %	**1,7 %**	**5,2 %**	**2,5 %**	**2,3 %**	**0,7 %**	**-0,9 %**

5.1.2 Sleep

There are five variables in this category in Firstbeat assessment:

- Restorative effect of sleep
- Length of sleep, hours
- Amount of recovery during sleep, hours
- Amount of recovery during sleep, %
- Quality of recovery (heart rate variable, HRV)

Firstbeat explains restorative effect of sleep as a variable, that is based on person's sleep cycle and the "amount and quality of recovery during sleep" (Firstbeat 2018). In table 5 can be seen the values from both week's assessments and individual changes in each variable among the participants. The changes are calculated between the first assessment on a regular work week and the second assessment on a work week with two active breaks. Individual's average changes in this category varied from -9% to +7%.

Table 5. Detailed results of Sleep category

Variable	Restorative effect of sleep	Length of sleep, hours	Amount of recovery during sleep, hours	Amount of recovery during sleep, %	Quality of recovery (heart rate variable)
A	35,0	6,3	2,8	42,3	35,3
A Active	52,3	7,4	3,9	52,3	44,0
A change	49 %	17 %	41 %	24 %	25 %
B	14,3	5,6	1,9	46,0	20,3
B Active	51,7	7,0	5,0	72,0	22,0
B change	260 %	26 %	160 %	57 %	8 %
C	65,0	6,6	5,4	83,3	108,3
C Active	48,7	6,8	3,9	56,0	68,7
C change	-25 %	3 %	-29 %	-33 %	-37 %
D	97,7	8,0	7,4	92,3	44,7
D Active	96,5	8,0	6,8	85,3	45,0
D change	-1 %	-1 %	-9 %	-8 %	1 %
E	100,0	9,3	8,1	87,0	47,3
E Active	100,0	8,6	7,8	91,0	45,0
E change	0 %	-8 %	-4 %	5 %	-5 %
F	74,7	7,3	5,9	80,0	86,7
F Active	63,3	6,9	5,2	79,0	86,3
F change	-15 %	-6 %	-12 %	-1 %	0 %

Restorative effect of sleep is the main variable in this category. The results varied between 48,7 and 100 during the active break -week. According to Firstbeat assessment database, the average result is 61. Firstbeat rates result as good if between 60 – 100, moderate if between 30 – 59 and poor when 29 and under. (Firstbeat, 2018). During first week one participant was poor, one in moderate and four was rated good. During active break -week three were moderate and three good; no one got poor.

Firstbeat states that only the length of sleep should not be used to make conclusion, since it is highly personal of how much sleep is enough. Therefore, the length itself is not analyzed further on.

Variables regarding recovery amount during sleep (%) in active break -week varied from 52,3% to 91%. Firstbeat rates the results so that under 50% is poor, 50-74% moderate and over 75% good. During the first week two were in poor category and four in good level. During active break -week the three were in moderate level and three in good. The individual changes varied between -33% and +57% between regular week's assessment and active break week's assessment.

The last variable in sleep category Is the quality of recovery, also known as heart rate variable or HRV. Heart rate variable is not comparable between people of different ages, because the scale depends on person's age. Since this research had participants of different ages, comparison is not made. Heart rate variable is a good meter to scale stress since it decreases during stress and increases when relaxing (Firstbeat 2018). Individual changes in heart rate variable varied from -37% to +25%.

A group level change percentage was also calculated. It was done by calculating average points in group level for both assessment periods per variable and then calculating the change percentage from these values, see table 6 below for details. In the whole category "Sleep" the average changes between regular week and active break week in group level were:

- Restorative effect of sleep: +6,7%
- Length of sleep, hours: +3,4%
- Amount of recovery during sleep, hours: +3,2%
- Amount of recovery during sleep, %: +1,1%
- Quality of recovery (heart rate variable): -9,2%

Table 6. Average results in Sleep -category.

	Restorative effect of sleep	Length of sleep, hours	Amount of recovery during sleep, hours	Amount of recovery during sleep, %	Quality of recovery (HRV)
A, regular week	35	6,333333333	2,766666667	42,33333333	35,33333333
A, active week	52,3	7,4	3,9	52,3	44
B, regular week	14,33333333	5,6	1,933333333	46	20,33333333
B, active week	51,66666667	7,033333333	5,033333333	72	22
C, regular week	65	6,6	5,433333333	83,33333333	108,3333333
C, active week	48,66666667	6,8	3,866666667	56	68,66666667
D, regular week	97,66666667	8,033333333	7,4	92,33333333	44,66666667
D, active week	96,5	7,966666667	6,766666667	85,33333333	45
E, regular week	100	9,3	8,133333333	87	47,33333333
E, active week	100	8,6	7,833333333	91	45
F, regular week	74,66666667	7,333333333	5,933333333	80	86,66666667
F, active week	63,33333333	6,866666667	5,2	79	86,33333333
Regular week, average points	64,44444444	7,2	5,266666667	71,83333333	57,11111111
Active week, average points	68,74444444	7,444444444	5,433333333	72,60555556	51,83333333
Difference, points	4,3	0,244444444	0,166666667	0,772222222	-5,277777778
Difference, %	**6,7 %**	**3,4 %**	**3,2 %**	**1,1 %**	**-9,2 %**

5.1.3 Physical activity

There are four variables in this category in Firstbeat assessment:

- Health effects of physical activity
- Light exercise, hours
- Moderate exercise, hours
- Vigorous exercise, hours

Physical activity is defined by Firstbeat as “Physical activity means physical loading during which energy expenditure is significantly increased. Vigorous physical activity > 60%, moderate 40–60% and light < 40% of maximal capacity” (Firstbeat 2018). In table 7 can be seen the values from both week’s assessments and individual changes in each variable among the participants. The changes are calculated between the first assessment on a regular work week and the second assessment on a work week with two active breaks.

In this category, four variables were measured by Firstbeat; note that fourth category, vigorous exercise, did not get enough data to to make conclusions or even calculate averages.

Table 7. Detailed results of Physical Activity -category

Variable	Health effects of physical activity	Light exercise, hours	Moderate exercise, hours
A	52,7	1,1	0,3
A Active	71,7	1,9	0,6
A change	36 %	81 %	80 %
B	38,0	2,1	0,1
B Active	63,0	1,7	0,4
B change	66 %	-19 %	267 %
C	2,7	0,3	0,0
C Active	29,0	1,6	0,1
C change	988 %	370 %	0 %
D	32,0	1,2	0,0
D Active	43,0	1,3	0,2
D change	34 %	5 %	0 %
E	4,0	0,3	0,0
E Active	20,7	0,7	0,1
E change	417 %	133 %	0 %
F	41,3	1,1	0,0
F Active	41,7	1,0	0,0
F change	1 %	-9 %	0 %

Health effects of physical activity is the main variable in this category. The results varied between 20,7 and 71,7 during the active break -week. According to Firstbeat assessment database, the average result is 41.

The other two variables were light and moderate exercise measured in hours. These are the categories the effect of active breaks is seen the most. Individual changes in light exercise were between -9% and 370% and individual changes in moderate exercise were between 0 and 267%. Combining all preceding chapters, it can be stated that by far most significant changes were detected in the category of physical activity.

A group level change percentage was also calculated. It was done by calculating average points in group level for both assessment periods per variable and then calculating the change percentage from these values, see table 8 below for details. In the whole category “Physical activity” the average changes between regular week and active break week in group level were:

- Health effects of physical activity: +57,6%
- Light exercise, hours: +33,7%
- Moderate exercise, hours: +207,7%

Table 8. Average results in Physical Activity -category.

	Health effects of physical activity	Light exercise, hours	Moderate exercise, hours
A, regular week	52,66666667	1,05	0,333333333
A, active week	71,7	1,9	0,6
B, regular week	38	2,066666667	0,1
B, active week	63	1,666666667	0,366666667
C, regular week	2,666666667	0,333333333	0
C, active week	29	1,566666667	0,066666667
D, regular week	32	1,233333333	0
D, active week	43	1,3	0,2
E, regular week	4	0,3	0
E, active week	20,66666667	0,7	0,066666667
F, regular week	41,33333333	1,1	0
F, active week	41,66666667	1	0,033333333
Regular week, average points	28,44444444	1,013888889	0,072222222
Active week, average points	44,83888889	1,355555556	0,222222222
Difference, points	16,39444444	0,341666667	0,15
Difference, %	**57,6 %**	**33,7 %**	**207,7 %**

5.2 Subjective data

Subjective, written data was collected by written interview. To be noted, the quotations have been translated from Finnish to English for this report.

The journal entries were – as they were supposed to – short, and mainly described the daily events, that might have affected the day's Firstbeat data, such as "intensive meeting with client", "doing chores", "management meeting", "spending time with children". The entries can be analysed with theme design, main themes, and journal entries under them were

- Meetings at work with clients
    - "Intensive meeting"
    - "Tough meeting"
- Meetings and other interactions at work with colleagues
    - "Management meeting"
    - "Coffee break"

- House chores / home life
    - “Cooking”
    - “Cleaning, vacuuming”
    - “Spending time with kids”
- Physical activity
    - “Ice hockey training”
    - “Exercise class”
    - “Walking the dog”

The journal entries were used in combination when analysing the Firstbeat numerical data, these were the most useful as supporting data for numerical variables and were not useful when taken out of context. As seen above, the entries were a few words long, since Firstbeat has a character limitation to the journal entries.

When the participants’ individual assessment reports were combined, the assessed days were explored one day at a time and at the same time examining the journal entries. The entries were a good way to reach understanding of the subject’s day in general – give an oversight of the occurrences and schedule. For study purposes, the value was minimal. Only one participant was physically very active, when attending ice hockey training. This was intensive enough to disturb sleep quality and recovery the following night. In this case, it was useful to see from the journal entry the reason for deviant values.

The open-ended interview was conducted after the research. As well as the questions, also the received answers were in Finnish, hence they are translated here. As previously elaborated in the data collection chapter, the answers were gathered via email. Since the study group was small, the amount of material was easy to administrate. The answers were reviewed and after that grouped under connective themes. In the next text chapters the quotations are all from the interview material.

Ability to start break and forget work during breaks was one reoccurring theme forming the first main category.

- “Leaving for break was not always so easy – depended on the work at hand”
- “I did not think about work that much”
- “Forgetting work was someday easier than other, depended on the task at hand”

- “Once started break when I was expecting a call from the client so that made recovering during break harder”
- “Started to eagerly wait for breaks especially when we did them together with a colleague”
- “Leaving for break was easy, since I would have walked the dog anyway”
- “At times when it was a busy day it was harder to take the break in general or without these prescheduled active breaks, I would skip breaks in total especially when working remotely”
- “Usually was able to forget work, but if the work at hand was especially hard that was in mind during breaks, too”
- “Starting active break was easy and something I was expecting, it was nice to go especially when the weather was nice, and I was specifically *allowed* to take an active break”
- “Spending break outdoors helped forget work”

As can be seen, the active breaks were mutually an activity, the participants were waiting and happily conducting. Having pre-scheduled breaks also helped participants to conduct them and also gave the feeling that it was more allowed than during a regular work week even though at times taking break (in general) felt harder. Creating a supportive environment for breaks (active or not) is to be elaborated later in discussion chapter.

Feelings of improvement in vitality was also a reoccurring theme, forming the second main category.

- “Walking outside felt refreshing”
- “Taking active break was refreshing especially during afternoons”
- “After active break I felt spry and able to concentrate better”
- “Days seemed to pass faster with active breaks in it which led to the feeling of being spryer in the afternoons to work better”
- “I felt that taking active breaks made me feel spryer during the last part of workday”
- “I felt the positive change in vitality”
- “Right after starting the active break, I was happy I get to it”
- “Being outdoors during daytime alone was energizing”

These answers were particular important, since it covers the key element of subjective wellbeing, how the participant themselves interpreted their sensations. These are something that Firstbeat assessments were not able to measure hence particularly valuable when weighing the results of this research. All the participants mentioned the feelings of vitality and spry owing to active breaks. None felt the active breaks strenuous or an aspect reducing subjective wellbeing.

When conducting breaks (active or not) it is important to feel the ease returning back to work after the break. The participants felt that it was easy to return to work tasks at any given time.

- "Getting back to work after active break was very easy for me"
- "Returning to work tasks felt easy, definitely easier than after lunch break"
- "Usually returning to work was easy, a few times it took a bit longer"
- "I had no issues returning back to work after active break"

An interesting point was made by one participant, who felt that the returning to work happened easier than after lunch break. The answer was not elaborated, but one can wonder if it was due to the fact that active break's duration was capped to 15 minutes. Overall, the return was seen easy.

Lastly, the overall motivation to continue active breaks in some level in the future was detected. All participants were interested into continuing active breaks at least at times.

- "I would be happy to continue active breaks"
- "I will definitely take at least one active break every now and then because it felt so refreshing"
- "I will definitely continue active breaks"
- "Yes, I will, especially when the outdoor circumstances are better"
- "My everyday life doesn't allow me to lengthen my workday, meaning two active breaks a day on my own time is not possible in the long run but if the life situation were to be different, I would definitely do so. I will however try to fit an active break to my everyday every now and again."

Challenges were also raised how to incorporate active breaks to everyday life when not conducting them during workhours. To be noted, the research was made in February and March, so the weather conditions were not optimal for outdoor activities, like one participant noted. When the weather improves and the snow gear is not needed

anymore, the threshold to take active breaks might get lower as preparation does not take time as much during spring/summertime.

6 DISCUSSION

Based on the existing theory presented in the previous chapters, this chapter discusses wellbeing changes at work when incorporating active breaks based on this research. In this chapter the main objective is to discuss the results in the light of established literature. The questions were:

RQ1: Per research, does active breaks during the workday effect on individual's wellbeing?

RQ2: Per research, what are the seen effects on individual's wellbeing?

6.1 Physical activity: changes and effect for work wellbeing

The change in physical activity was the category with significantly largest change. As the conducted research was short-term, the long-term effects of physically active lifestyle were unable to report in this research due to the time span of observation period. The effects of physical activity and its benefits have been researched at length – it is coherently agreed that the benefits for wellbeing are significant (Glazer et al., 2013; Taylor et al., 2014). Not only because physical activity category had the greatest increase, but because it has indisputable benefits for wellbeing in both short- and long-term, it is seen as major result of this research. The average change in Health effects of physical activity -variable was 58%.

Per Seuri, living a physically active lifestyle is the key factor of maintaining wellbeing – overall and at work (Seuri, 2013). When reviewing the articles about the benefits of exercise, it comes clear that physical activity might be the key factor to chasten poor work wellbeing. The facts are so unambiguous that physical activity has benefits both short and long term in overall wellbeing as well as factors especially studied in this research: stress, recovery, and sleep. Having a major improvement in this category due to active breaks, in light of existing studies the meaning of physically active lifestyle

is key element in human wellbeing (Finnish Institute for health and welfare, 2021; Firstbeat n.d.-a; Seuri, 2013).

UKK Institute, abbreviated UKK, in Finland has research physical activity and its many aspects since 1980's and it has a firm reputation of expertise. According to UKK, the short-term benefits of physical activity include increase in focus, feeling more vitality, after exercise the parasympathetic nervous system relaxes, which might ease falling asleep. For our muscular system the benefits include reviving blood circulation which causes more oxygen, sugar, and peptides to burn in muscles which leads to higher energy consumption and positive effect on fat- and glucose level. Exercising regularly will improve mental state, reduce stress and mild depression or anxiety symptoms. Also sleep might get longer and more congruent. For physical work wellbeing, active lifestyle also eases symptoms of musculoskeletal system disease. In longer run, according to UKK, the benefits include aspects such as: improved brain function and wellbeing, lower resting heartbeat, and blood pressure, most importantly the ability to tolerate stress increases. Activity also lowers risk for diseases such as cardiovascular diseases, type 2 diabetes, musculoskeletal system diseases and even some cancers. (UKK, n.d.)

In concurrence with UKK, Finnish Institute for health and welfare (2020) listed the benefits of active lifestyle, also adding the benefit exercise has when aging: "physical exercise helps to maintain functional capacity and improve muscle condition, which in turn is linked to a better balance and a lower risk of tripping accidents. Physical exercise also prevents memory disorders." Both institutes support the fact that adults should endure at least 2 hours 30 minutes of moderate exercise per week. When conducting the active breaks as in this research, this amount would be achieved just during weekdays. The interview material concurs with discussed knowledge. The short-term effect was seen, and participants reported changes in their vitality, feelings of spry and improved ability to focus.

Researchers at Finnish Institute of Occupational Health (2021) remark, that it is also important that everyone finds the physical activity suitable for their needs: as an example, the researchers raise a person in a physically straining work; their heartbeat levels might stay higher after a day's work, hence in this case the person might benefit

activity with lower heartbeat, such as walking outdoors or swimming. This takes into consideration the overall recovery and not only the amount or straining of the exercise.

Finnish Institute for health and welfare (2020) concludes the comprehensive effects of physical activity: it has in abundance of positive effects on our physical, mental, and social wellbeing. These beforementioned perks of physical activity was seen in the interview answers from the participants. The participants felt the active break as refreshing, some felt especially so in the afternoons and feelings of spry and better concentration. Especially the change in the mood and vitality was seen in the afternoon; feeling that the day went faster was also mentioned. This complements beforementioned Kühnel et al. (2017) study where was stated what breaks in the afternoon enhanced work engagement. In conclusion, the short-term advantages of physical activity were clearly seen in this research, especially for the mental wellbeing. This concurs with Fritz et al. (2013) study where they detected similar results after walks of other physical activities: increase in positive mood and vigor, increased work motivation and task performance.

Living an active lifestyle is one of the corner stones in our overall wellbeing and seeing extensive increase especially in this category is assuring that in the long run the active breaks would benefit holistically as well. Firstbeat suggests a second assessment to be done depending on the situation in 6-12 months, 2-6 months or even in a month if assessment results are worrying. (Firstbeat, n.d.-a) For future research, it would be beneficial to explore, if active breaks of this kind would start showing more improvement in other variables after 2-6 months. Considering established studies (Finnish Institute for health and welfare, 2021; Firstbeat n.d.-a; Seuri, 2013), it is presumably so.

6.2 Stress and recovery: changes and effect for work wellbeing

The results in the sense of stress and recovery are one of the hardest ones to interpret. As explicated earlier, stress cannot be generalized being neither merely good nor bad. People experience stress in tight, traditionally called stressful situations. A fair amount of stress is good for us: it thrives us to exceed our abilities and makes us survive in

inconvenient situations. It is when these kinds of stressful situations become continually, the stress becomes harmful. In principle, good stress occurs for example during and after an exercise. Firstbeat points out, that the goal is not to de-stress people's lives – it is to make sure that people recover when it is most suitable by circumstances, for example during breaks, other relaxing moments and especially during sleep. (Firstbeat, 2018)

The disadvantages of long-term stress are wide-ranging. Continuous stress causes memory and sleep impairment and bolster grumpy mood. Constant stress has effect on people's physiological attributes, too. These include hormone imbalance (for example, hypersecretion of cortisol and adrenaline), lower immune system so that people are less prone to get infected. Stress also causes digestion and metabolism to appear symptoms which can lead into obesity and a risk of getting type 2 diabetes. Mental issues are also a risk for long-term stress: when the brain is constantly signalling the body of stress, the slightest of stress signs are seen threatening, this leads to mental health issues, worst case to depression. (Aivoliitto, 2021). Looking at the attributes needed in work life and in this case especially in IT work, stress also lowers reasoning ability in addition to memory impairment, both extremely important factors in IT field (Aivoliitto, 2021).

The ability to handle stress differs between people. According to Aivoliitto (2021), the ability to cope comes partly from childhood and partly from temper; one can also learn to tolerate heavier stress when experiencing it. As discussed before, physical activity has a great reducing effect on stress.

Aivoliitto points out, as well as Firstbeat, that comparing stress and recovery rate between individuals is not fruitful, since the variables are highly personal. More important is to see, if recovery starts when it is mostly supposed to, i.e., during sleep. Recovery should start even before or right after falling asleep. If there are signals that recovery is not starting or is getting delayed, that is a clear sign of weakened recovery and elevated stress levels. In Firstbeat assessments, this situation affects the sleep recovery variable and therefore is easier to detect. (Aivoliitto, 2021; Firstbeat, 2018)

Also, Aivoliitto highlights the importance of physical activity to endure stress. During exercise the cortisol levels lower and when exercising, the physical effects of stress on metabolism decrease. Aivoliitto states that where exercise is important, one should do it while listening themselves and their bodies signals. (Aivoliitto, 2021)

The Firstbeat assessment did not give a clear consensus if active breaks effected wellbeing in the observation period from stress and recovery point of view. However, in the interviews can be found positive signals of better recovery. Many stated, that they felt improvements of vitality during active break week. The participants felt that the workday went faster with active breaks and that the breaks were energizing, and the participants felt spryer. Most of the participants also mentioned, that they were able to forget work during breaks, which is also a great way to recover during workday. These are encouraging views as all these factors have an impact on stress levels and recovery according to earlier referred, established, research data. As a conclusion, long lasting stress and weak recovery causes wide range of issues for both physical and mental health. Since this research was conducted short-term, the long-term effects are not reportable. According to previously discussed studies (Finnish Institute for health and welfare, 2021; Firstbeat n.d.-a; Seuri, 2013), it can be presumed that continuing active breaks for a longer period of time, it could have a positive effect on stress and recovery that would show in numerical data as well.

6.3 Sleep: changes and effect for work wellbeing

As with stress related variables, sleep rating is also very personal, hence comparing to other individuals is not reasonable; better to compare individuals own changes between assessments and that's what was done in this research. For work wellbeing perspective, the most important factor of sleep is the recovery time (Firstbeat, 2018). The overall recovery happens mostly during sleep; hence the recovery rate is very important because it radiates also towards stress variables and in real life, the stress management. Restorative effect of sleep is a combined value from five different variables: amount of recovery during sleep, length of sleep, the portion of recovery, the quality and the time person went to bed. The greatest weight is the amount of recovery.

As seen in the results earlier, the scale in values were large, but as mentioned, it is not fruitful to compare individuals to each other but to focus on change. The average change in restorative effect of sleep was 7%. Due to the short time span of the research, it cannot be unequivocally note, that this can be merited merely for the active breaks. As previously said, many factors influence on this variable, and it could be the slightest change in individual's life to do change as such. In the interview, one participant stated they felt better quality of sleep of the nights that preceded workday with sufficient breaks. Non other commented on the improved sleep quality, though one stated that sleep was "as good as always".

The meaning of good sleep is one of the corner stones of human wellbeing. High quality sleep allows people to recover physically from day's activities and maintain metabolism and hormone balance, as stated previously. Sleep is also a great way to prevent stress, improve immunity and stay healthy. Mentally, sleep recovers mental ability, vibrancy and helps people to handle emotions. From work wellbeing point of view, one of the most important aspects is that sleep enables good memory and learning abilities. (The Centre for Occupational Safety. n.d.)

Sleep deprivation has many impacts on individual's overall and work wellbeing: memory, learning abilities, mood, control of issues, lack of focus, attention span and creativity, and narrow-minded thinking. All very important aspects of employees in IT, such as the participants in this research. (The Centre for Occupational Safety. n.d.)

Unfortunately, insomnia and other sleep related issues are common in Finland and according to FinTerveys2017-research, they concern nearly three million adults. Generally, women tend to have more issues with sleep than men and the amount of people getting enough sleep has lowered between the observation period of years 2011 and 2017. (Koponen et al., 2018, p.42) Harmful daytime tiredness was experienced ¾ of adults conducting to 2,7 million people affected (Koponen et al., 2018, p.43-44).

Koponen et al. states that most of the Finnish adults sleep well. At the same time different issues with sleep are common; issues impair wellbeing and slowly weaken ability to work. Usually with sleep issues comes physical and mental issues, as well. Hence, according to Koponen et al. concurring with issue discussed in introduction,

sleep issues have a significant meaning in the sense of public health. (Koponen et al., 2018, p.44)

In the Firstbeat assessment data there was seen a slight improvement on sleep quality between assessments. Based on the established knowledge, it can be presumed, that by continuing more active lifestyle, the improvements will show even more in the course of time in sleep quality too.

6.4 Validity of the research

The validity of the study itself was assessed also beforehand, refer to chapter 4.2 Data collection. The study and the measurements were conducted as planned – two of the participants aborted due to illness. No issues affiliated with Firstbeat were encountered; the devices functioned as expected.

When a study is about wellbeing and physical activity, it is reasonable to think whether the participants applying are already the group who is interested in wellbeing and possibly already living an active lifestyle. Partly this applied to this research – participants were interested in their overall wellbeing, but not all were able to act accordingly in everyday life as of yet.

The results can be affected with multiple variables. Life in IT rarely is quiet and calm and sometimes days can get particularly hectic. Even though the assessment days were kept the same (Monday to Wednesday), the weeks are not similar and therefore the comparability is difficult. Especially the variables in stress and recovery and sleep -categories are prone to take effect on matters happening *to* the participant, not *by* the participant. For example, the physical activity category is something that can be affected on individual level and by individual's own actions – to simplify all is needed was the motivation to do it. These other two categories are not so linear – stress can be caused by so many factors (such as clients, in-house matters, general hectic schedule, troubles at home, a child living "terrible-two's") and not all can be affected by taking active break or any other own means. Many factors effecting stress are also affecting

sleep and its quality; some participants have children and that alone is a floating variable to affect all assessed aspects.

As previously elaborated, the research group ended up being relatively small, six people. However, in the company's point of view, this is almost 14% of employees of Pori office employees, so in that context, the sampling was reasonable. The results are able to give sentiment and direction as to where it would be beneficial to guide break practice and everyday work life in general, but generalization cannot be made. Overall, the results concur with existing research.

6.5 Implications of active breaks

As stated in the previous chapters, active breaks have founded, positive effect on wellbeing. In the beginning of this paper was discussed the responsibility of work wellbeing in total. As noted, it is a joint effort of the employer and the employees (Chen & Cooper, 2014, p. 198-199; Työterveyslaitos, n.d.). In the sense of having breaks during the day that differ from the norm, it is important to remark the actions needed to make active breaks possible. In the employer's perspective, it is important to create a setting where active breaks are allowed and admitted. In some cases, it needs to start from the fact that breaks in general are admitted and encouraged. By leading with example, the mind setting also grows to the work community; it is hard to support something as an employee if it does not have support from the company or the management.

In general, employers' also need to enable and preserve environment where breaks in general are possible. In practise this means that the workload needs to be on a reasonable level. As in the employee's responsibility is take care of their overall wellbeing with healthy lifestyle choices and seize an opportunity when active breaks are enabled in the company. Employees can also spread positive attitude towards active breaks and inspire colleagues to join them. As companies are gradually returning to office after a long period of remote work, free form active breaks might also be a great way to support unity and collegial liaison. Timewise active breaks do not consume time more than any other "regular" break. As previously stated, in the

company the research was conducted, regular coffee breaks typically last around 15-20 minutes. Active breaks in this research were 15 minutes each, so timewise it is possible to compensate at least another break with active break without spending more time offline.

To conclude previous chapters, contemplate on the research questions. The questions were:

> RQ1: Per research, does active breaks during the workday effect on individual's wellbeing?
>
> RQ2: Per research, what are the seen effects on individual's wellbeing?

After the observations reviewed in this discussion, it can be stated that yes, active breaks during the workday have an effect on individual's wellbeing. To summarize the seen effects: feelings of vitality, slightly better sleep, and significantly higher physical activity, which, according to existing knowledge, leads to multiple positive effects in the long run.

7 CONCLUSION

The results show, that having active break as a part of workday leads to significant increase in physical activity, and slightly better sleep quality. As discussed before the general challenges of people in the IT field, concluding these results it is encouraging to see that with small actions individuals can in fact have an impact on their wellbeing. The atmosphere was also positive – most of the participants will continue active breaks as a part of their daily or weekly work life. Moving just half an hour a day results in 2,5 hours of activity just during the work week, so it is an action not to be understated.

The results of this study were encouraging and based on them, active breaks are an aspect to be considered when building better wellbeing at work. In the studied company, these results will be presented to HR and management and hopefully enable active breaks as a part of everyday life. Working in hectic and stressful, schedule strain environment, stress can become dominant condition and actions mastering stress and improving overall work wellbeing are highly welcomed. Having researched data supporting active breaks in everyday life eases justifying for implementing active breaks. Especially IT sector has a shortage of talented employees nowadays. Adding active breaks into company's' values might improve the image as a company who cares for employees' wellbeing and hence help uplift reputation and elicit new talents and take good care of the existing ones.

The spark for the study came from personal experiences, having witnessed stress, tiredness, and burnout in my close circle of colleagues over the past decade or so. There was a need and interest to explore actions, that are easy to carry out and realistic moving forward. The study itself went well, after some hiccups in the beginning – some scheduling issues and the overall situation with Covid complicated things a bit.

This study would be interesting to repeat in the future: having more participants and different study groups. If there would have been more participants, they would have been formed into two groups where one group would have had one active break a day and another two. It would also be interesting to see results comparing to another type of activity: for example, 15 minutes of meditation, circuit training or yoga a day

comparing to 15 minutes of walking. Having longer time span, it would be beneficial to study active breaks for a longer period of time to assess the long-term benefits.

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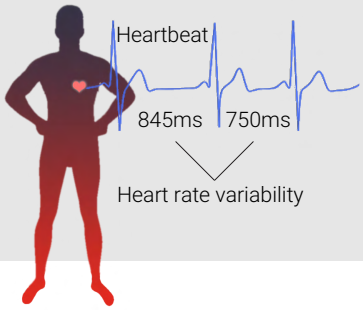
Firstbeat Lifestyle Assessment

2018 Case

WHAT DOES THE LIFESTYLE ASSESSMENT TELL?



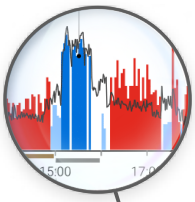
The Lifestyle Assessment will help you to manage stress, recover better and exercise right. The assessment is based on analysis of heart rate variability (HRV).

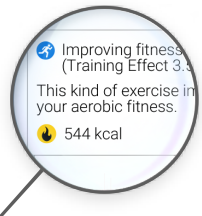
The goal is to find a balance between work and leisure and between activity and rest, and to identify one's strengths and development areas. It is not essential to eliminate stress, but to ensure sufficient recovery and find a manageable rhythm to life.

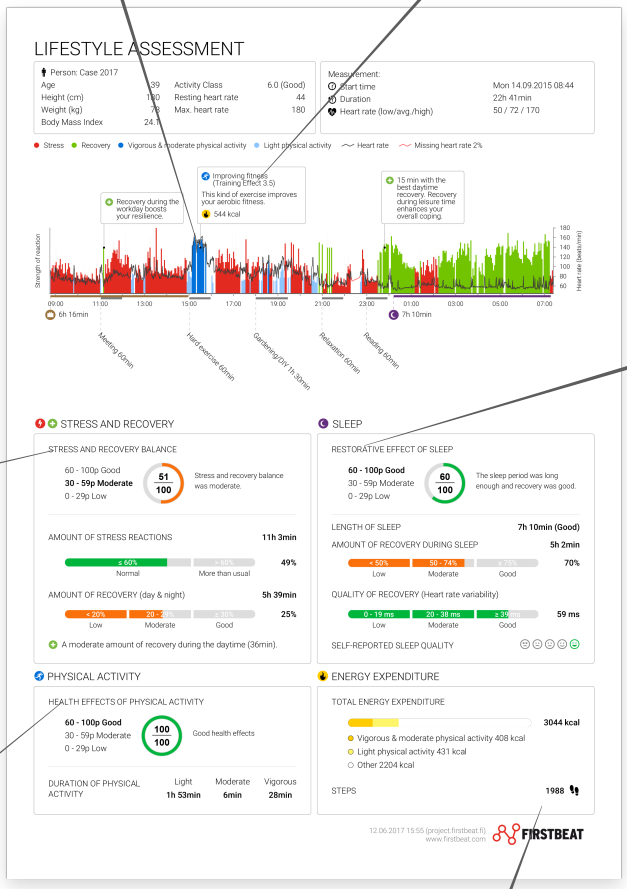
Stress means an elevated activation level in the body, and it can be positive or negative.

Recovery means a calming down of the body. Important recovery periods include sleep and peaceful moments during the day.

Physical activity means physical loading during which energy expenditure is significantly increased.
- Vigorous physical activity > 60%,
- moderate 40–60% and
- light < 40% of maximal capacity.







Training Effect tells the effect of an exercise session on personal fitness development (on a scale of 1-5).

.0	Temporary overloading
.0 >	Highly improving
3.0 >	Improving
.0 >	Maintaining
.0 >	Easy recovery

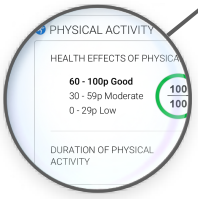
Restorative effect of sleep is influenced by sleep duration and the amount and quality of recovery during sleep.

Length of sleep is the period recorded in the journal, from going to bed to waking up.

Amount of recovery means the share of recovery during the sleep period.

Quality of recovery means the amount of heart rate variability during sleep. Age and heredity influence HRV, and age is considered in the reference values.

Stress and recovery balance consists of the total amount of stress and recovery, as well as recovery during the awake time.



The health effects of physical activity are based on the duration and intensity of aerobic physical activity. According to recommendations, for example 30 mins of moderate or 20 mins of vigorous physical activity produce good health effects.

Steps are recognized from the movement data and they accumulate during walking and running. Steps do not accumulate for example during cycling or very light movement. 10,000+ steps per day characterize a very active day.

PRE-QUESTIONNAIRE REPORT

Profile

2018 Case

Measurement start date

28.03.2018

QUESTIONNAIRE RESULTS

I think I am physically active enough to get health benefits.	Partially agree
I think my physical activity is intensive enough to improve my fitness.	Partially agree
In my opinion, my eating habits are healthy.	Cannot say
I feel that my alcohol consumption is not excessive.	Completely agree
I don't generally feel stressed.	Partially disagree
My days include breaks that allow me to recover.	Partially agree
I usually feel rested and energetic.	Partially disagree
I feel that I sleep enough.	Cannot say
I feel that I can influence the things that affect my health.	Completely agree
In my opinion, I feel well at the moment.	Partially agree

Scale of answers:
Completely agree
Partially agree
Cannot say
Partially disagree
Completely disagree

LIFESTYLE ASSESSMENT

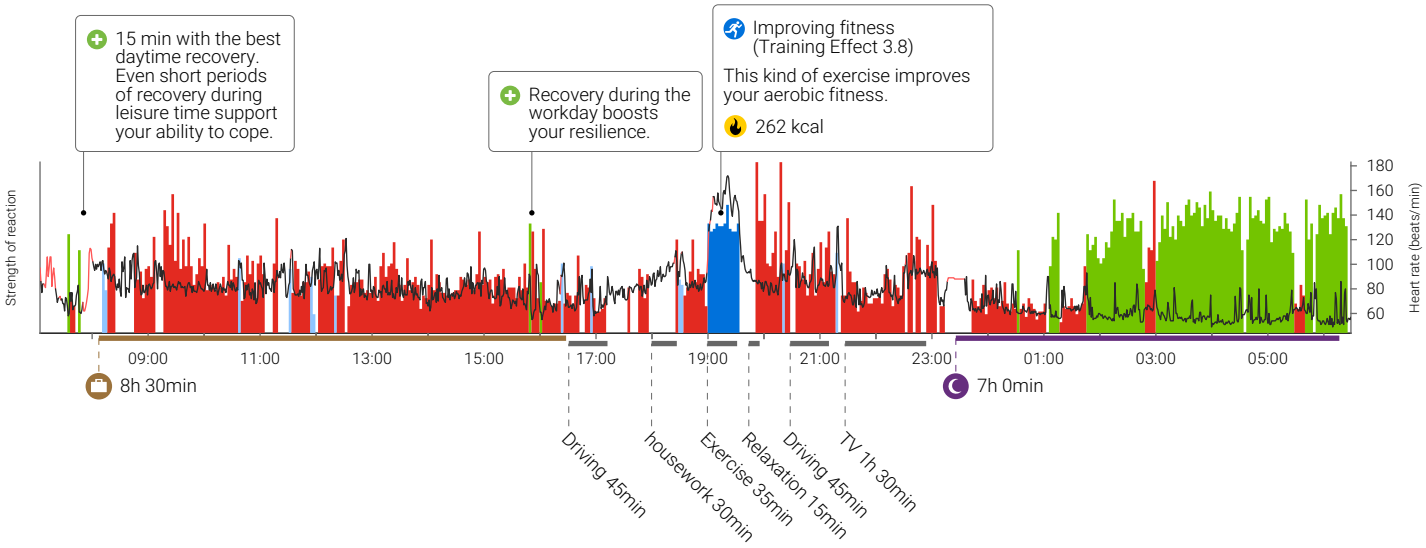
Person: 2018 Case

Age	39	Activity Class	2.0 (Poor)
Height (cm)	171	Resting heart rate	44
Weight (kg)	76	Max. heart rate	183
Body Mass Index	26.0		

Measurement:

Start time	Wed 28.03.2018 07:04
Duration	23h 26min
Heart rate (low/avg./high)	45 / 73 / 172

Stress · Recovery · Vigorous & moderate physical activity · Light physical activity · Heart rate · Missing heart rate 4%



STRESS AND RECOVERY

STRESS AND RECOVERY BALANCE

60 - 100p Good
30 - 59p Moderate
0 - 29p Low

27 / 100

Stress and recovery balance was poor.

AMOUNT OF STRESS REACTIONS — 12h 50min

≤ 60%	> 60%	
Normal	More than usual	**55%**

AMOUNT OF RECOVERY (day & night) — 4h 20min

< 20%	20 - 29%	≥ 30%	
Low	Moderate	Good	**19%**

A small amount of recovery during the daytime (10min).

SLEEP

RESTORATIVE EFFECT OF SLEEP

60 - 100p Good
30 - 59p Moderate
0 - 29p Low

49 / 100

The sleep period was long enough, but recovery was only moderate.

LENGTH OF SLEEP — 7h 0min (Good)

AMOUNT OF RECOVERY DURING SLEEP — 4h 10min

< 50%	50 - 74%	≥ 75%	
Low	Moderate	Good	**60%**

QUALITY OF RECOVERY (Heart rate variability)

0 - 19 ms	20 - 38 ms	≥ 39 ms	
Low	Moderate	Good	**50 ms**

SELF-REPORTED SLEEP QUALITY

PHYSICAL ACTIVITY

HEALTH EFFECTS OF PHYSICAL ACTIVITY

60 - 100p Good
30 - 59p Moderate
0 - 29p Low

75 / 100

Good health effects

DURATION OF PHYSICAL ACTIVITY

Light	Moderate	Vigorous
26min	**29min**	**5min**

ENERGY EXPENDITURE

TOTAL ENERGY EXPENDITURE — 2249 kcal

- Vigorous & moderate physical activity 271 kcal
- Light physical activity 96 kcal
- Other 1882 kcal

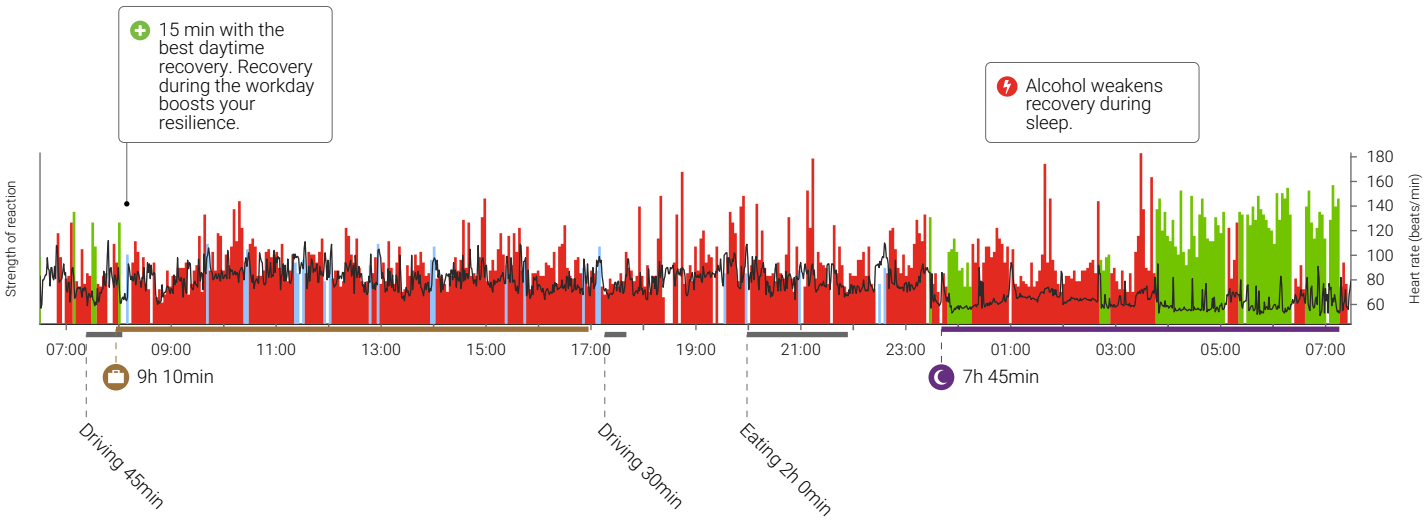
STEPS — 7987

LIFESTYLE ASSESSMENT

Person: 2018 Case			
Age	39	Activity Class	2.0 (Poor)
Height (cm)	171	Resting heart rate	44
Weight (kg)	76	Max. heart rate	183
Body Mass Index	26.0		

Measurement:	
Start time	Thu 29.03.2018 06:30
Duration	25h 0min
Heart rate (low/avg./high)	48 / 70 / 112
Additional information: Alcohol 4 units	

Stress · Recovery · Vigorous & moderate physical activity · Light physical activity · Heart rate · Missing heart rate 0%



STRESS AND RECOVERY

STRESS AND RECOVERY BALANCE

60 - 100p Good
30 - 59p Moderate
0 - 29p Low

20 / 100

Stress and recovery balance was poor.

AMOUNT OF STRESS REACTIONS — 17h 59min

≤ 60%	> 60%	
Normal	More than usual	72%

AMOUNT OF RECOVERY (day & night) — 3h 30min

< 20%	20 - 29%	≥ 30%	
Low	Moderate	Good	14%

A small amount of recovery during the daytime (13min).

SLEEP

RESTORATIVE EFFECT OF SLEEP

60 - 100p Good
30 - 59p Moderate
0 - 29p Low

38 / 100

The sleep period was long enough, but recovery was only moderate.

LENGTH OF SLEEP — 7h 45min (Good)

AMOUNT OF RECOVERY DURING SLEEP — 3h 18min

< 50%	50 - 74%	≥ 75%	
Low	Moderate	Good	42%

QUALITY OF RECOVERY (Heart rate variability)

0 - 19 ms	20 - 38 ms	≥ 39 ms	
Low	Moderate	Good	39 ms

SELF-REPORTED SLEEP QUALITY

PHYSICAL ACTIVITY

HEALTH EFFECTS OF PHYSICAL ACTIVITY

60 - 100p Good
30 - 59p Moderate
0 - 29p Low

9 / 100

Minor health effects

DURATION OF PHYSICAL ACTIVITY

Light	Moderate	Vigorous
49min	**1min**	**0min**

ENERGY EXPENDITURE

TOTAL ENERGY EXPENDITURE — 2098 kcal

- Vigorous & moderate physical activity 6 kcal
- Light physical activity 175 kcal
- Other 1917 kcal

STEPS — 3937

LIFESTYLE ASSESSMENT

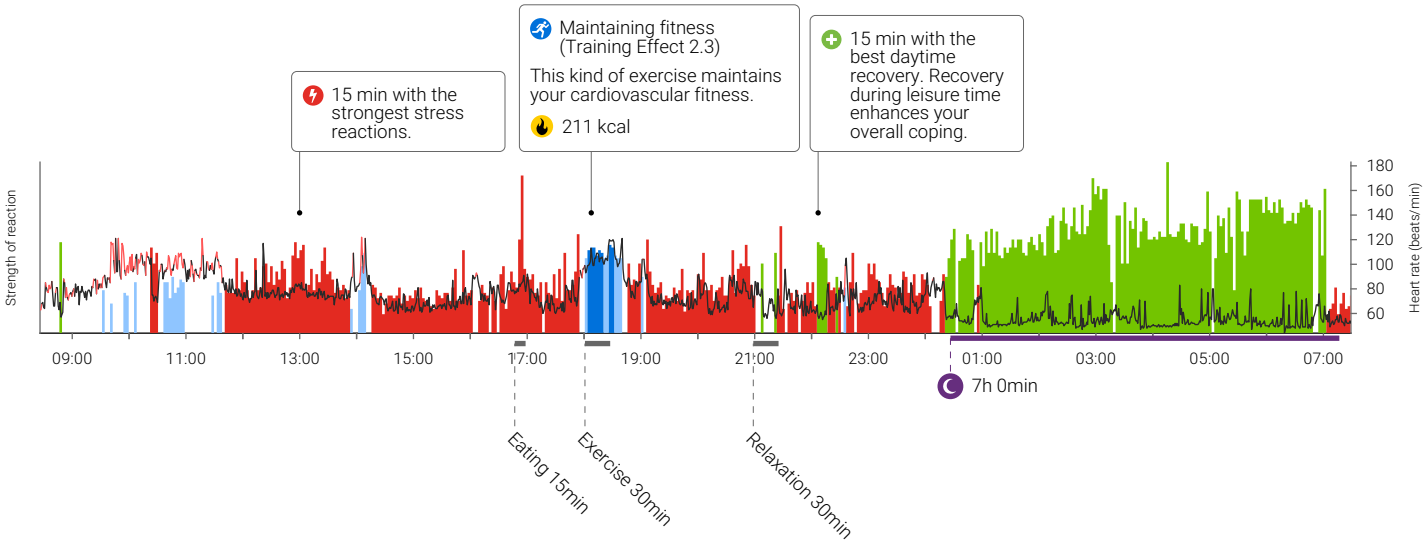
Person: 2018 Case

Age	39	Activity Class	2.0 (Poor)
Height (cm)	171	Resting heart rate	44
Weight (kg)	76	Max. heart rate	183
Body Mass Index	26.0		

Measurement:

Start time	Fri 30.03.2018 08:26
Duration	23h 4min
Heart rate (low/avg./high)	44 / 66 / 124

Stress · Recovery · Vigorous & moderate physical activity · Light physical activity · Heart rate · Missing heart rate 8%



STRESS AND RECOVERY

STRESS AND RECOVERY BALANCE

60 - 100p Good
30 - 59p Moderate
0 - 29p Low

60/100

Stress and recovery balance was good.

AMOUNT OF STRESS REACTIONS — 10h 13min

≤ 60%	> 60%	
Normal	More than usual	44%

AMOUNT OF RECOVERY (day & night) — 6h 28min

< 20%	20 - 29%	≥ 30%	
Low	Moderate	Good	28%

A small amount of recovery during the daytime (29min).

SLEEP

RESTORATIVE EFFECT OF SLEEP

60 - 100p Good
30 - 59p Moderate
0 - 29p Low

74/100

The sleep period was long enough and recovery was good.

LENGTH OF SLEEP — **7h 0min (Good)**

AMOUNT OF RECOVERY DURING SLEEP — 5h 59min

< 50%	50 - 74%	≥ 75%	
Low	Moderate	Good	86%

QUALITY OF RECOVERY (Heart rate variability)

0 - 19 ms	20 - 38 ms	≥ 39 ms	
Low	Moderate	Good	56 ms

SELF-REPORTED SLEEP QUALITY

PHYSICAL ACTIVITY

HEALTH EFFECTS OF PHYSICAL ACTIVITY

60 - 100p Good
30 - 59p Moderate
0 - 29p Low

55/100

Moderate health effects

DURATION OF PHYSICAL ACTIVITY	Light	Moderate	Vigorous
	1h 6min	**20min**	**0min**

ENERGY EXPENDITURE

TOTAL ENERGY EXPENDITURE — 2099 kcal

- Vigorous & moderate physical activity 118 kcal
- Light physical activity 248 kcal
- Other 1732 kcal

STEPS — **5425**

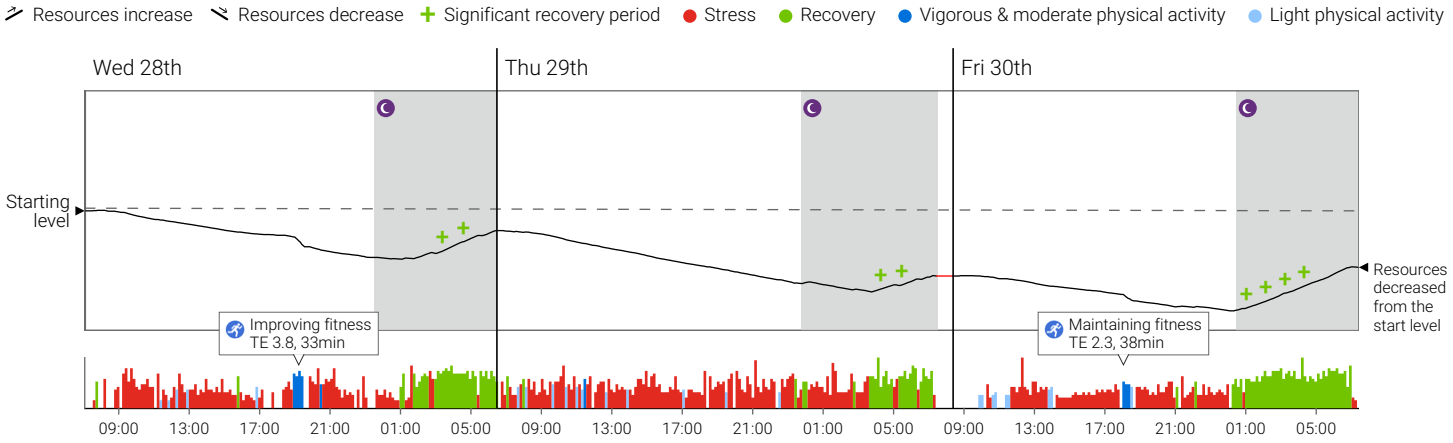
LIFESTYLE ASSESSMENT SUMMARY

Person: 2018 Case

Age	39	Activity Class	2.0 (Poor)
Height (cm)	171	Resting heart rate	44
Weight (kg)	76	Max. heart rate	183
Body Mass Index	26.0		

Assessment: 28.03.2018 - 30.03.2018
Additional information:
Alcohol: Thu 29th (4 units)

BODY RESOURCES



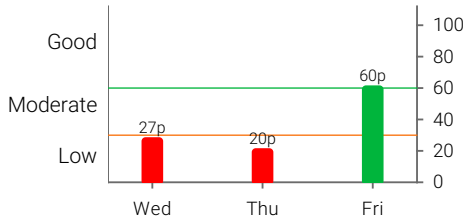
LIFESTYLE ASSESSMENT SCORE

The score is based on your combined stress and recovery, sleep and physical activity result. By improving these areas, you can promote your well-being and improve your Lifestyle Assessment score.

85 - 100p	Excellent
60 - 84p	Good
30 - 59p	**Moderate**
15 - 29p	Low
0 - 14p	Very low

The average score of all Lifestyle Assessment participants is 55p.

STRESS AND RECOVERY BALANCE

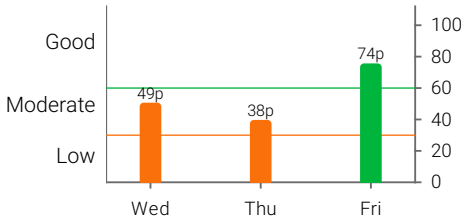


Your result

MODERATE

In your age group average is 55p.

RESTORATIVE EFFECT OF SLEEP

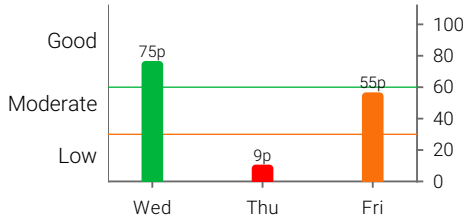


Your result

MODERATE

In your age group average is 59p.

HEALTH EFFECTS OF PHYSICAL ACTIVITY



Your result

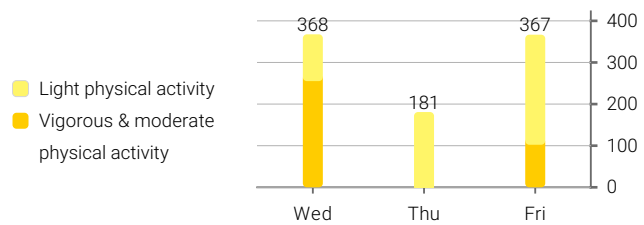
MODERATE

The measurement included one workout with a fitness-improving Training Effect.

The health effects produced by physical activity were good on 1 day.

ENERGY EXPENDITURE

ACTIVE CALORIES (kcal)



TOTAL	2249	2098	2098
STEPS	7986	3936	5425

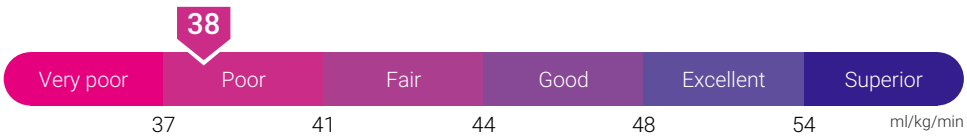
FITNESS LEVEL

Person: 2018 Case

Age	39	Activity Class	2.0 (Poor)
Height (cm)	171	Resting heart rate	44
Weight (kg)	76	Max. heart rate	183
Body Mass Index	26.0		

Assessment: 28.03.2018 - 30.03.2018

FITNESS LEVEL (VO2max)



Your VO2max result is **38** ml/kg/min.

According to your age and gender your fitness level is **Poor.**

Maximal oxygen uptake (VO2max) – A measure of aerobic fitness

Maximal oxygen uptake (VO2max) describes the ability of the cardiorespiratory system to deliver oxygen to working muscles and the ability of the body to utilize oxygen to produce energy during exercise. High maximal oxygen uptake means good endurance, which research has shown to be associated with better health and performance and smaller mortality risk.

Maximal oxygen uptake is traditionally measured in the laboratory by analyzing respiratory gases, and its unit is milliliters of oxygen per minute per kilogram of body weight (ml/kg/min). Firstbeat Lifestyle Assessment estimates the maximal oxygen uptake by comparing the body's load to walking speed during walking segments detected in the measurement. The result is compared to people of the same age and sex. Typically, maximal oxygen uptake ranges between 20-70 ml/kg/min.

**VO2max reference values used with permission from the Cooper Institute, Dallas, Texas*

GOALS

Please set some personal goals for making changes in your lifestyle.

Stress management

- [x] I will set a realistic work schedule.
- [ ] I will take regular short breaks during the work day.
- [ ] After the workday, I will try to disengage from work by doing things that I enjoy.
- [ ] I will learn to say "No".

Recovery and sleep

- [ ] I will continue to engage in my hobbies because positive experiences enhance my well-being.
- [ ] I will try to relax on a regular basis (e.g. relaxation techniques, music, TV, reading).
- [ ] I will avoid stressful things just before bedtime (e.g. alcohol, work and electronic devices).
- [ ] I will attempt to go to bed early enough to get enough sleep.

Physical activity

- [x] I will find an enjoyable form of exercise to engage in regularly.
- [ ] I will increase the amount of light physical activity, e.g. by using the stairs, walking short distances and avoiding uninterrupted sitting.
- [ ] I will attempt to engage in physical activity at least ____ times per week.
- [ ] I will take care of my muscles by including stretching as part of my weekly exercise routine.

Nutrition

- [ ] I will maintain a regular meal rhythm.
- [ ] I will pay attention to the quality of what I eat, e.g. avoid products that contain excessive fats, sugar or salt.
- [ ] I will lose weight ____ kg.
- [ ] I will remember to drink and eat regularly, even when I'm busy.

Own goals

Firstbeat Lifestyle Assessment

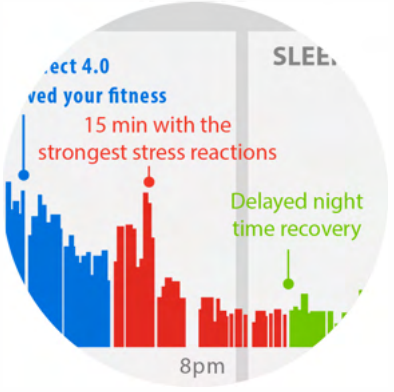
FIRSTBEAT LIFESTYLE ASSESSMENT

HEARTBEAT MEASUREMENT

6

people underwent the assessment between

14.03.2022 - 19.03.2022



PERSONAL REPORT

The participants learned to recognize factors that affect their personal and occupational well-being.

SPECIALIST FEEDBACK

9

goals were set to improve well-being and performance.

LIFESTYLE CHANGES

The participants got concrete recommendations to improve their well-being.

FOLLOW UP

A follow-up measurement allows you to see if the changes are lasting.

STRESS – MEASUREMENT RESULTS

Self-reported stress

50% Feel stressed.

Stress and recovery

50% Had good balance between stress and recovery

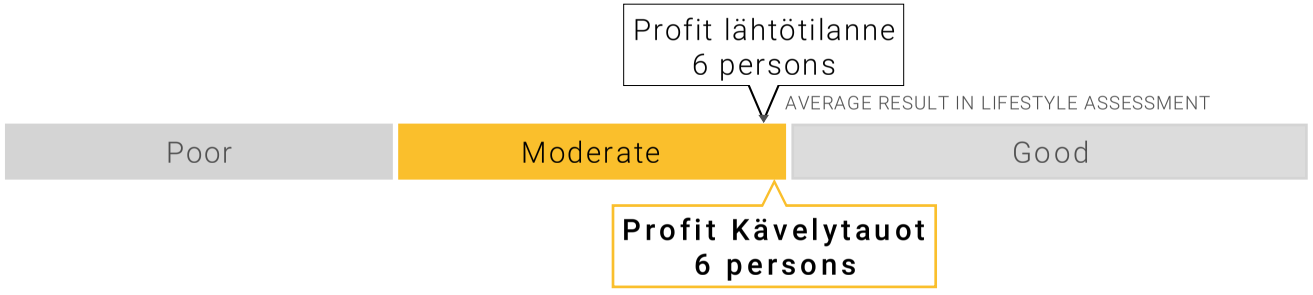
33% Had moderate balance between stress and recovery

17% Had poor balance between stress and recovery

Action Points

17% Of the participants set a goal related to stress management

Stress and recovery - Group result



An employee who knows how to manage stress and balance it with recovery is more efficient and makes less mistakes. Sufficient recovery supports coping, improves resilience and decreases the risk of overload.

SLEEP – MEASUREMENT RESULTS

Self-reported sleep

67% Feel that they sleep enough

Measured sleep

50% Had good recovery during sleep

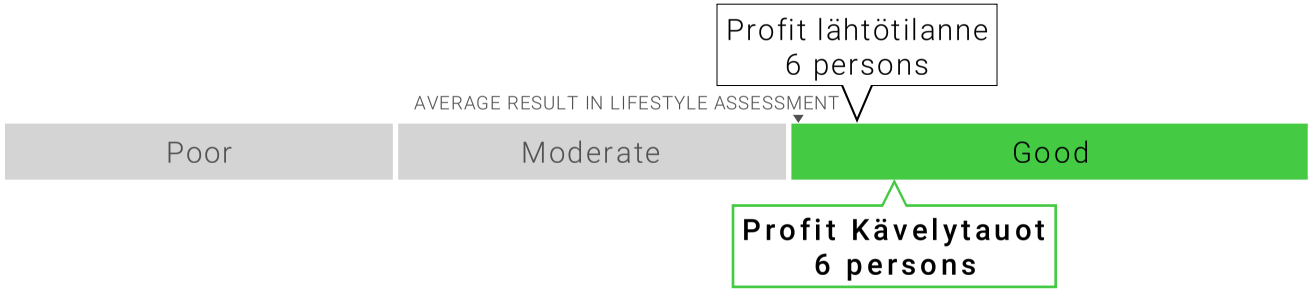
50% Had moderate recovery during sleep

0% Had poor recovery during sleep

Action Points

17% Of the participants set a goal related to sleep and recovery

Measured sleep - Group result



Sufficient sleep and good recovery during sleep improve the employee's ability to cope with stress and heavy workload. By improving recovery, we can build resilience for the days ahead.

EXERCISE – MEASUREMENT RESULTS

Self-reported physical activity

50% Feel that they are physically active enough to get health benefits

Measured physical activity

34% Were physically active enough to get health benefits

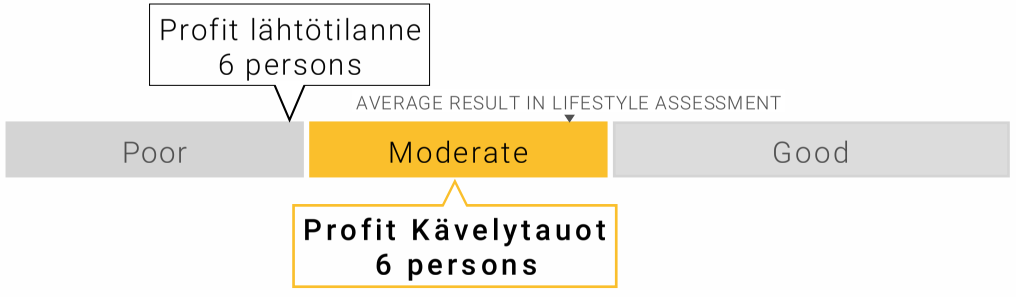
33% Were moderately physically active

33% Were not physically active enough

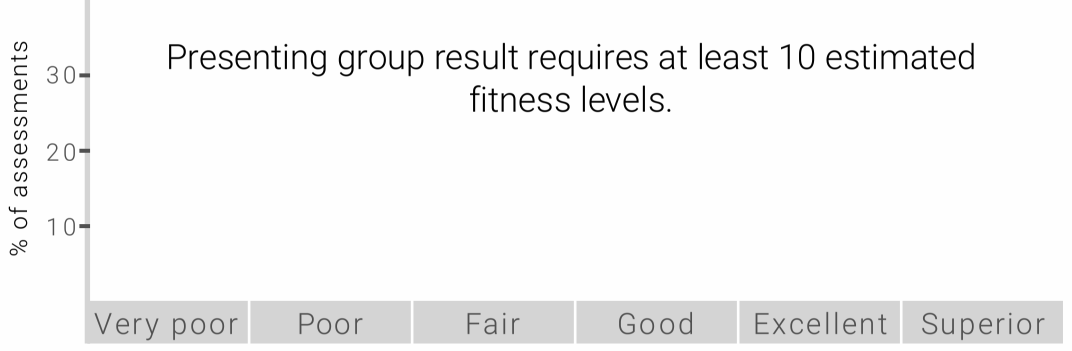
Action Points

17% Of t he participants set a goal to increase exercise and light physical activity.

Measured physical activity - Group results

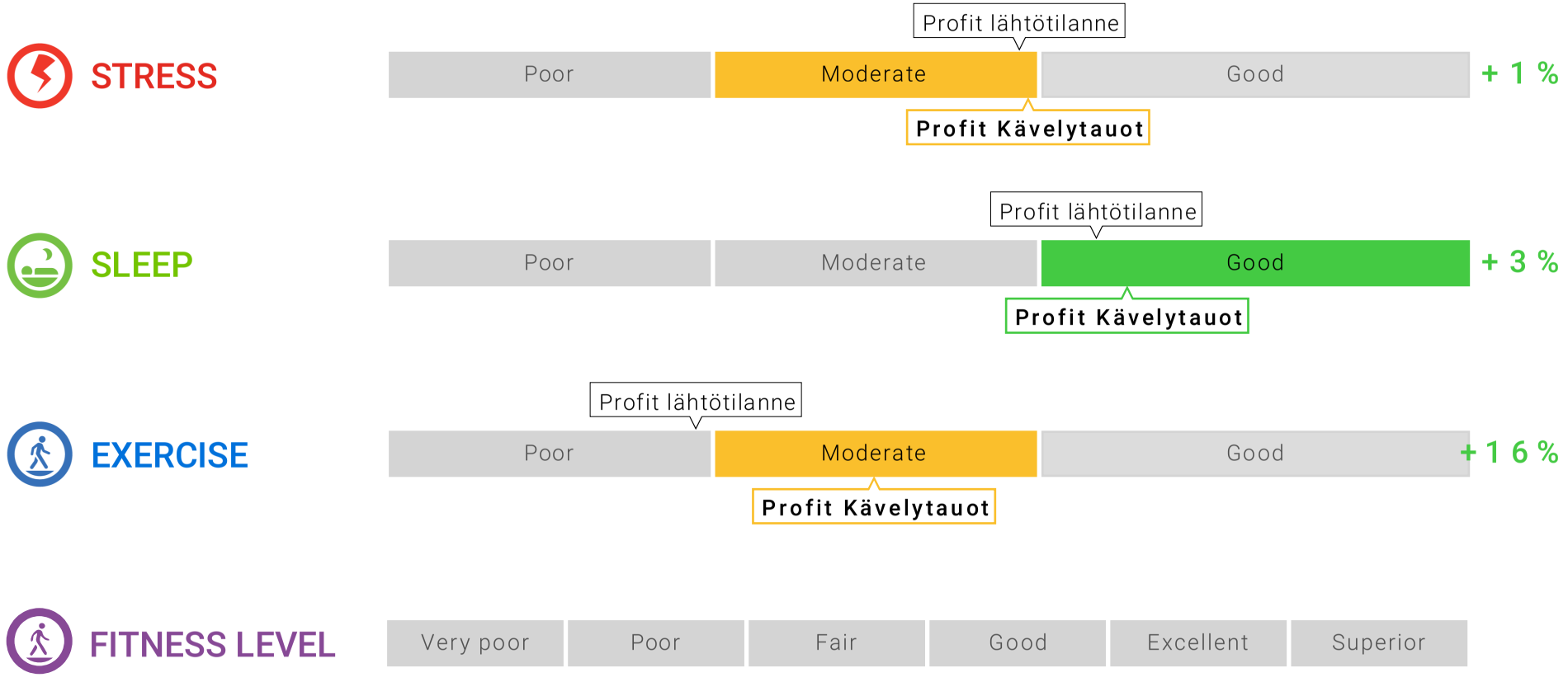


Estimated fitness level - Group results



GROUP-LEVEL CHANGES BETWEEN MEASUREMENTS

This comparison includes all people who took part in both measurements.



THANK YOU!

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FIRSTBEAT

*VO2max reference values used with permission from the Cooper Institute, Dallas, Texas

APPENDIX III

Full table of anonymized results

Variable	A	A Active	A change
Stress and recovery balance	29,0	37,3	29 %
Amount of stress reactions /day, hours	10,9	12,4	14 %
Amount of stress reactions/day, %	48,0	51	6 %
Amount of recovery (day and night), hours	3,5	4,6	31 %
Amount of recovery (day and night), %	15,7	18,3	17 %
Recovery during daytime, min	45,0	38,7	-14 %
Restorative effect of sleep	35,0	52,3	49 %
Length of sleep, hours	6,3	7,4	17 %
Amount of recovery during sleep, hours	2,8	3,9	41 %
Amount of recovery during sleep, %	42,3	52,3	24 %
Quality of recovery (heart rate variable)	35,3	44	25 %
Health effects of physical activity	52,7	71,7	36 %
Light exercise, hours	1,1	1,9	81 %
Moderate exercise, hours	0,3	0,6	80 %

Variable	B	B Active	B change
Stress and recovery balance	21,0	39,3	87 %
Amount of stress reactions /day, hours	14,3	15,1	5 %
Amount of stress reactions/day, %	66,7	62,3	-7 %
Amount of recovery (day and night), hours	2,5	5,5	119 %
Amount of recovery (day and night), %	11,0	22,7	106 %
Recovery during daytime, min	32,7	28,0	-14 %
Restorative effect of sleep	14,3	51,7	260 %
Length of sleep, hours	5,6	7,0	26 %
Amount of recovery during sleep, hours	1,9	5,0	160 %
Amount of recovery during sleep, %	46,0	72,0	57 %
Quality of recovery (heart rate variable)	20,3	22,0	8 %
Health effects of physical activity	38,0	63,0	66 %
Light exercise, hours	2,1	1,7	-19 %
Moderate exercise, hours	0,1	0,4	267 %

Variable	C	C Active	C change
Stress and recovery balance	39,7	23,7	-40 %
Amount of stress reactions /day, hours	15,8	15,5	-2 %
Amount of stress reactions/day, %	66,0	68,0	3 %
Amount of recovery (day and night), hours	5,7	3,9	-32 %
Amount of recovery (day and night), %	23,7	17,0	-28 %
Recovery during daytime, min	17,3	0,0	-100 %
Restorative effect of sleep	65,0	48,7	-25 %
Length of sleep, hours	6,6	6,8	3 %
Amount of recovery during sleep, hours	5,4	3,9	-29 %
Amount of recovery during sleep, %	83,3	56,0	-33 %
Quality of recovery (heart rate variable)	108,3	68,7	-37 %
Health effects of physical activity	2,7	29,0	988 %
Light exercise, hours	0,3	1,6	370 %
Moderate exercise, hours	0,0	0,1	0 %

Variable	D	D Active	D change
Stress and recovery balance	69,3	65,7	-5 %
Amount of stress reactions /day, hours	12,6	12,5	-1 %
Amount of stress reactions/day, %	53,0	52,3	-1 %
Amount of recovery (day and night), hours	7,7	7,4	-5 %
Amount of recovery (day and night), %	32,7	30,7	-6 %
Recovery during daytime, min	20,3	36,0	77 %
Restorative effect of sleep	97,7	96,5	-1 %
Length of sleep, hours	8,0	8,0	-1 %
Amount of recovery during sleep, hours	7,4	6,8	-9 %
Amount of recovery during sleep, %	92,3	85,3	-8 %
Quality of recovery (heart rate variable)	44,7	45,0	1 %
Health effects of physical activity	32,0	43,0	34 %
Light exercise, hours	1,2	1,3	5 %
Moderate exercise, hours		0,2	0 %

Variable	E	E Active	E change
Stress and recovery balance	99,3	99,3	0 %
Amount of stress reactions /day, hours	8,6	8,6	0 %
Amount of stress reactions/day, %	36,0	35,7	-1 %
Amount of recovery (day and night), hours	11,1	11,6	5 %
Amount of recovery (day and night), %	46,3	48,7	5 %
Recovery during daytime, min	176,3	226,3	28 %
Restorative effect of sleep	100,0	100,0	0 %
Length of sleep, hours	9,3	8,6	-8 %
Amount of recovery during sleep, hours	8,1	7,8	-4 %
Amount of recovery during sleep, %	87,0	91,0	5 %
Quality of recovery (heart rate variable)	47,3	45,0	-5 %
Health effects of physical activity	4,0	20,7	417 %
Light exercise, hours	0,3	0,7	133 %
Moderate exercise, hours		0,1	0 %

Variable	F	F Active	F change
Stress and recovery balance	92,0	91,0	-1 %
Amount of stress reactions /day, hours	6,8	8,6	26 %
Amount of stress reactions/day, %	28,3	36,0	27 %
Amount of recovery (day and night), hours	11,9	10,4	-12 %
Amount of recovery (day and night), %	50,0	43,3	-13 %
Recovery during daytime, min	354,7	311,7	-12 %
Restorative effect of sleep	74,7	63,3	-15 %
Length of sleep, hours	7,3	6,9	-6 %
Amount of recovery during sleep, hours	5,9	5,2	-12 %
Amount of recovery during sleep, %	80,0	79,0	-1 %
Quality of recovery (heart rate variable)	86,7	86,3	0 %
Health effects of physical activity	41,3	41,7	1 %
Light exercise, hours	1,1	1,0	-9 %
Moderate exercise, hours		0,0	0 %