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Exercise During Work Hours Improves Fitness: An Evidence-Based Case Report

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ABSTRACT

Relatively tight working hours are problems for employees in urban areas, affecting less time for physical activities. About 59% of office workers in Jakarta are classified as sedentary. The high number of sedentary workers can cause productivity problems due to low fitness. Appropriate interventions are needed to overcome it. We have done literature searches from 7 journal databases in the last 20 years, including ScienceDirect, EBSCOhost, PubMed, ProQuest, Scopus, ClinicalKey, and Cochrane. Inclusion criteria include research design in the form of systematic review/meta-analysis/ randomized controlled trials, outcomes in the form of physical fitness or work performance, and interventions in the form of workplace exercise or stretching. Three selected articles showed a significant relationship (p-value <0.05) between programmed physical exercise at work and several fitness factors, such as decreased body fat and fat mass, increased lean mass, and increased sit-up and push-up fitness test results. Physical activity at work decreased cardiovascular risk as assessed by VO2max. In conclusion, physical activity during working hours effectively improves health-related fitness. The minimal intervention types needed are aerobics, strength training, and muscle endurance. We recommend providing interventions for workplace fitness and education programs (WFEP).

Keywords: office worker, physical fitness, sedentary, workplace exercise, work performance.

According to Badan Pusat Statistik (BPS), the working age population is the population aged 15 years and over. Workers are defined as workers/ employees who work for other people or institutions/ offices/companies on a regular basis by receiving wages/salaries in the form of money or goods. The average hours worked by workers / employees in urban and rural areas in August 2018 is 44 hours per week. Whereas in urban areas, the average hours worked by laborers / employees is 45 hours per week. Relatively tight working hours are a problem for employees in urban areas, because in addition to work, their time is spent on the way home because they have to face traffic jams on the road and also work overtime. As a result, many employees do not have time for physical activities. According to Riskesdas 2013, lack of physical activity is the highest risk factor for non-communicable diseases (PTM) in Indonesia, which has an impact on work productivity.[1]

Physical activity is defined as all body movements due to skeletal muscles that require energy consumption. World health organization (WHO) has recommended the minimum amount of physical activity for people aged 18-64 years in 1 week is 150 minutes to do aerobic physical activity intensity or 75 minutes to do high-intensity aerobic physical activity. People who carry out activities less than WHO's recommendations are classified as sedentary.[2] Based on the Abadini et al study, 59% of office workers in Jakarta are classified as sedentary.[3] The high number of workers categorized as sedentary can cause productivity problems due to low fitness.[4]

One effort to improve and maintain fitness is through physical exercise. Physical exercise is a physical activity that is planned, structured, repeated, and has a specific purpose. The benefits are divided into physical, psychological, and socio-economic aspects. Benefits in physical aspects include strengthening the heart muscle, increasing

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heart capacity, boosting the immune system, and controlling weight. In the psychological aspect, physical exercise can increase self-confidence, control stress, and reduce anxiety and depression. While in the socio-economic aspects, physical exercise can reduce work absenteeism rates, and increase productivity.[2,4]

Appropriate interventions are needed to overcome the low fitness of sedentary workers. One intervention that can be done is light physical exercise between working hours. Therefore, we conducted an evidence based care report (EBCR) to assess the effectiveness of physical exercise conducted between work hours in improving the fitness of sedentary workers. An increase in productivity is expected with an increase in fitness for sedentary workers.

CASE ILLUSTRATION

Mr. A, 40-years old, an office worker came to the doctor for a less productive complaint from his boss. He also felt easily drowsy, lacklustre, and difficult to concentrate. He works from 8:00 to 16:00, 5 days a week, sometimes overtime. The rest period given by the company is only 1 hour a day. He also told that he did not have time to exercise on weekends because of family events. The worker wants his work spirit to re-emerge so that he is more productive. He was advised to do physical exercise between his work hours. But he was still doubtful, then asked how effective physical exercise between work hours was in improving fitness.

METHODS

Literature search from 7 journal databases, namely ScienceDirect, EBSCOhost, PubMed, ProQuest, Scopus, ClinicalKey, and Cochrane. completed on September 19, 2019 using a number of keywords contained in *figure 1*.

Search results are screened for titles and abstracts, and then filtered based on inclusion and exclusion criteria. Inclusion criteria include: published in the last 20 years, research design in the form of systematic review/meta-analysis/randomized controlled trials, outcomes in the form of physical fitness or work performance, and interventions in the form of workplace exercise or workplace stretching. While exclusion criteria included the sick working population, non-English journals, and full-text inaccessibility. The selection process is shown in Figure 1. We used keyword "((sitting worker) OR (employee) OR (office worker) OR (sedentary worker)) AND ((workplace exercise) OR (workplace stretching)) AND ((physical fitness) OR (work performance))". After a comprehensive journal selection and reading is obtained, it will be critically appraised using the Oxford University Center for Evidence-Based Medicine Critical Appraisal Tools (*table 1 and 2)*.[5]

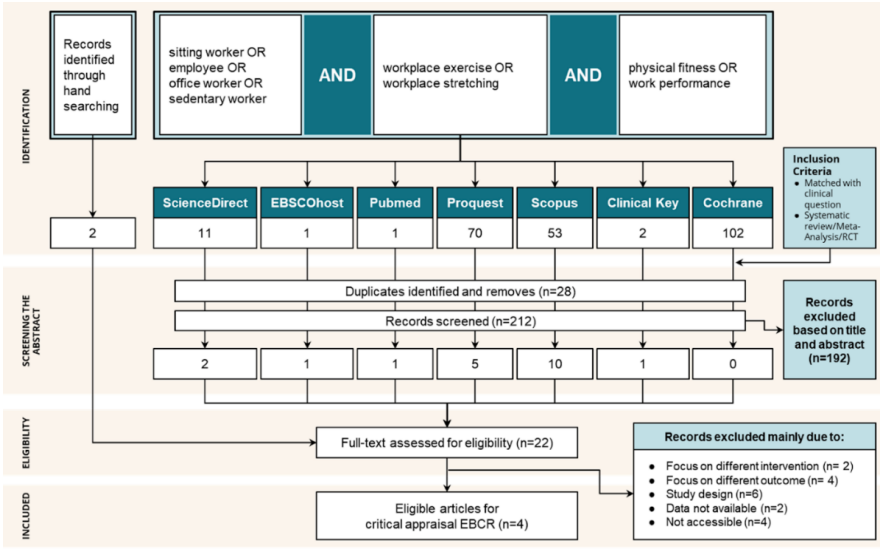

Figure 1. Flowchart of articles searching and selection

Table 1. Critical appraisal of selected articles (Validity and Applicability)[7-9]

Author (year)	Validity						Applicability		
	Randomization	the groups to which	they were randomised Patients and clinicians	kept blind	Groups treated equally	Groups similar at the start of the trial	Level of Evidence*	Patient different from those in the trial	Potential benefit of therapy	patient value and preference
Vilela et al (2015)	+	+	-	+	+	2	+	n/a	+	
Pedersen et al (2009)	+	n/a	-	+	+	2	+	n/a	+	
Atlantis et al (2006)	+	+	-	n/a	+	2	+	n/a	+	
Ben-ner et al (2014)	-	n/a	-	n/a	+	3				

Note: "+" is mentioned in the article, "n/a" is not mentioned in the article, "-" is not done
*Level of evidence obtained from Center for Evidence-based Medicine University of Oxford (accessed from: http://www.cebm.net/index.aspx?o=5653)

RESULTS

The literature search found 212 articles (after removing the duplicates). Only 22 articles met the criteria for full-text assesment. There are four randomized controlled trials (RCT) studies that fit the clinical questions in this EBCR. Based on the results of critical reviews, three articles are categorized as valid because they meet all aspects, but physical activity interventions are not able to be blinded so that the subject must know the interventions obtained. One journal was invalid[6] because randomization was not carried out and the control characteristics were unknown. In the process of assessing importance, there are no dichotomous data in the article being assessed so contingency tables cannot be created. For this reason, the importance value is assessed from the decrease and increase in the average of each study result, the correlation value r, and the p-value.

The Vilela et al study, showed a significant relationship between programmed physical exercise at work with several fitness factors such as decreased body fat, decreased fat mass, increased pure muscle mass, increased sit-up and push-up fitness test results.[7] Pedersen's Study et al, showed a relationship between various treatments of increased physical activity at work with a decrease in cardiovascular risk as assessed by VO_2max.[8] The study of Atlantis et al, showed an increase in fitness marked by an increase in VO_2max as a result of carrying out physical activity in the form of aerobics and weight training with supervision.[9]

Overall interventions in each study have different characteristics that are described according to FITT criteria, namely the frequency of exercise (frequency), intensity of exercise (intensity), duration of exercise (time), and type of exercise (type). These criteria are summarized in Table 3.

Table 2. Critical appraisal of selected articles (Importance) [7-9]

Author (year), Study Design	Primary Endpoint (Δ)	Average (Standard Deviation) Intervention	Average (Standard Deviation) Control	Correlation (r)	p-value
Vilela et al (2015), RCT	- Body Fat (%)	-4,8 (1,8)	+0,8 (2,4)	n/a	0,00
	- Fat mass (kg)	-3,7 (1,7)	+0,7 (1,8)		0,00
	- Lean mass (kg)	+3,7 (2,7)	-0,3 (3,1)		0,00
	- Flexibility (cm)	+4,9 (4,2)	-2,2 (2,9)		0,00
	- Sit-up test (rep)	+7,2 (7,6)	-2,1 (2,6)		0,00
	- Push-up test (rep)	+31,1 (13,7)	+23,5 (6,8)		0,01
Pedersen et al (2009), RCT	- VO_2max ($ml.kg^{-1}.min^{-1}$)	n/a	N/A	+0,134	0,004
	- Body Fat (%)			-0,091	0,037
Atlantis et al (2006), RCT	- Waist Circumference (cm)	-83,8 (10,0)	-87,8 (16,0)	n/a	0,07
	- VO_2max prediction (ml/kg/min)	44	41		0,03

Table 3. Summary of study characteristics[7-9]

	Vilela, et al	Pedersen, et al	Atlantis, et al
Study Population	Chemical plant employees at Cajamar, Sao Paulo, Brazil (n = 60)	Office workers from Danish Public Administration Authority (n = 549)	Employees of Australia's cassino, aged 32 ± 8 yo, 51% overweight/obese, 73% shift-workers, and 52% women (n= 73)
Intervention			
Frequency	WFEP: 5x per week	n/a	3 days/week
Intensity	- Muscular endurance training: 3.5 METs per session - Break: 1.8 METs per session - Stretching: 2.3 METs per session - Recreational sports: 4.0 METs per session	- Total physical activity baseline average 4270 (3971) MET - Vigorous physical activity average 915 (1627) MET	Moderate to high
Time	- WFEP: 15 minutes per session	- SRT: 10-15 repetitions in 20 minutes/session - APE	- 20 minutes (aerobic exercise) - 30 minutes (whole body weight training)
Type	Workplace Fitness and Educational Program (WFEP) - 2x/week: lower limb muscles endurance exercises - 2x/week: upper limb muscles endurance exercises and strengthening abdominal muscles - 1x/week: sports (soccer, volleyball, basketball)	- (SRT): resistance exercise - (APE): all round physical exercise	- Aerobic exercise - Whole body weight training
Outcome	- Body fat - Fat mass - Lean mass - Flexibility - Sit-up test - Push-up test	- VO_2max - Body fat	- Waist circumference - VO_2max prediction

APE: all-round physical exercise; MET: metabolic equivalent of task; SRT: specific resistance training; WFEP: Workplace Fitness and Educational Program.

DISCUSSION

Body fitness is defined as the ability to perform daily tasks with enthusiasm, awareness, and without unnecessary fatigue. Based on guidelines compiled by the American College of Sports Medicine (ACSM), a comprehensive health-related fitness assessment includes 5 components.

The first component is the body composition, namely the relative amount of muscle, fat, bone, and other vital body parts, which consist of body mass index (BMI), waist circumference, percentage of body fat, and pure muscle mass.

The second component is cardiovascular fitness, which is the ability of the circulatory and respiratory system to supply oxygen during ongoing physical activity, which is reflected through maximal oxygen uptake (VO_2max).

The third component is muscle strength, namely the ability of muscles to produce force. The fourth component is muscular endurance, the ability of muscles to keep working without fatigue. The third and fourth component can be assessed through sit-up and push-up tests. And the fifth component is flexibility, which is the space for a joint.[10]

Based on three RCTs that have been critically examined, shows a direct relationship between physical exercise and increased physical fitness, including an increase in the predicted value of VO_2max, a decrease in waist circumference, a decrease in body fat, increase flexibility, and increased push-up and sit-up capabilities (Figure 2).

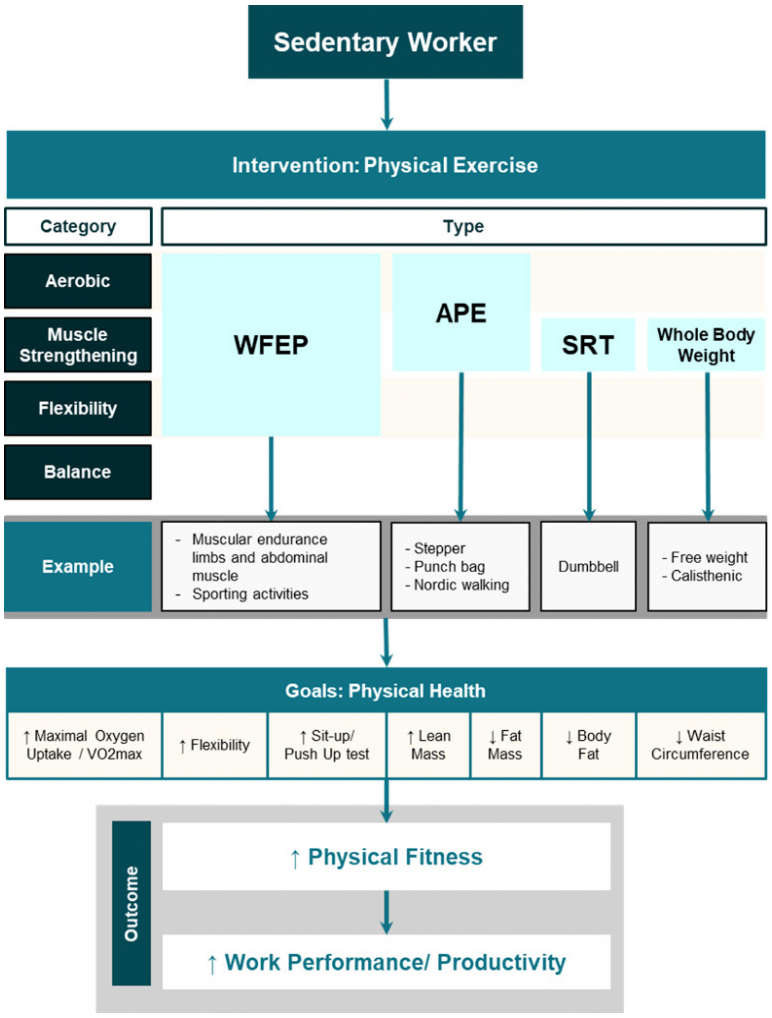

Figure 2. Effects of interventions on sedenter workers on health-related fitness.[7-9]Effect of Physical Exercise on Fitness Components

VO_2max is the speed of oxygen use in maximum aerobic metabolism. Increased VO_2max is due to an increase in myoglobin concentration. Individual exercise can also trigger the creation of chronic adaptation, which is a body's response from time to time to repetitive exercise pressure. These physiological adaptations increase the capacity and efficiency of exercise. Resistance training will strengthen muscles. While aerobic exercise will increase the efficiency of the work of the heart, lungs, and muscular endurance.[11]

Based on the study of Vilela, et al, subjects in the experimental group showed improvement in body composition, characterized by a decrease in fat percentage and an increase in pure muscle mass. Significant reduction in fat mass (-3.7 kg) is not a direct result of WFEP. From the results of the energy expenditure calculation, the reduction in fat mass which is the effect of the intervention is only 1.1 kg. However, research subjects may feel encouraged to adopt a more active and healthy lifestyle, and the number of these factors may have contributed to positive changes in body composition. In this study there was no weight loss, but previous research showed a weight loss of 16%. These different results are determined by differences in the duration and intensity of physical exercise associated with diet and individual counseling.[7]

Relation between Fitness and Productivity Indicators

An indicator of productivity that is often used as a benchmark in various studies is presenteeism, a condition that forces workers to continue to do their work despite a decline in work-related health conditions.[12] Presenteeism can occur if there are limitations to the conditions of the workers. The Walker et al study states a link between aerobic physical activity and decreased work limitation. The reduction in work limitation occurs because of the reduced risk of chronic disease in physically active people.[13] Although there has not been found a direct relationship between physical exercise between work hours and increased productivity, a number of studies suggest that various aspects of body fitness, including cardiovascular health, have associated with increasing the performance of workers who are getting better, reducing presenteeism and permission rates due to illness.[14,15] So it is expected that with increased physical fitness, the productivity of workers will also increase.

Different Types of Physical Exercise Interventions

In the Vilela et al study, the intervention carried out was the WFEP which is a combination of physical training and knowledge education. The type of physical exercise chosen by this study is fairly easy to do, because it focuses on increasing endurance and stretching muscles. The intervention was also followed by sports games such as soccer or volleyball. Aside from its easy strategy, Vilela stated that this strategy has advantages in economic aspects. WFEP has been proven to be able to significantly increase the number of clinical parameters so as to improve the quality of life and productivity of workers.[7]

In the Pedersen study, et al, the chosen intervention was Specific Resistance Training (SRT), which is a traditional stretching exercise using barbells. SRT specific doses of exercise follow ACSM recommendations to increase muscle strength in untrained individuals. In addition to the SRT, there is also an All-round Physical Exercise (APE) which consists of placing a stepper tool near the copier, punch bags in the hall, Nordic walking group sessions, and giving step counters to several subjects. The intervention carried out requires a tool so it relatively costs more than the other two studies.[8]

In the Atlantis et al study, the interventions chosen were a combination of 20 minutes of aerobic exercise and 30 minutes of whole body weight training, so that the total physical exercise would be around 150 minutes / week with additional dietary counseling / health education. The dosage is recommended to be divided into 2020 minutes / day in a week with 3 days aerobic allocation and 3 days full body weight. The combination of interventions is known to be superior to aerobic exercise alone, especially in reducing body fat. This intervention is easy to do, except for whole body weight which requires machine weight (weeks 1-8) and followed by free weight (weeks 8-24). Unfortunately physical exercise time scheduling is not standardized, so subjects are free to choose between 7 and 11 hours, 13 and 15 hours, or hours 5 and 7.[9]

Limitation of study

There are several limitations of the 2 studies examined. In the study of Pedersen, et al, the use of the IPAQ questionnaire was considered by the author to be less able to detect changes in small physical activity. In addition, the subject's compliance was also low and the drop-out rate was high where only ⅔ of the participants completed the follow-up questionnaire, causing a decrease in statistical power. Compliance assessments were also not carried out in real-time.[8] In the Atlantis study, et al, there was a loss of study participants from time to time because casino shift workers included populations that were difficult to intervene in, randomization was not confidential, there was no placebo management for the waiting-list group.[9]

The difficulty in making this critical study is caused by the absence of research that directly addresses the effect of routine physical exercise interventions on work hours on work performance. So the authors use physical fitness outcomes to bridge these two things, with the assumption that increasing physical fitness can improve work performance. In addition, the use of physical fitness terminology between each study does not have the same operational definition, making it difficult for authors to conclude the results of all existing studies.

CONCLUSION

Based on clinical questions, we conclude that physical activity during working hours is effective in improving health-related fitness. The minimal types of intervention needed are aerobics and strength training and muscle endurance. In this case, we recommend providing interventions such as workplace fitness and education programs (WFEP) that have proven their effectiveness. The advantage of this intervention is that it is easy to do because the movements are simple and do not require a long time, are economical, and are proven to be able to significantly increase body fitness. Productivity is expected to increase along with the increase in fitness of workers after doing WFEP.

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