Original

Effects of Regular Short Bout Exercise at Workplace during Lunch Break: Two Month Pilot Study

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Abstract

Physical exercise is believed to reduce possible health risks and have a beneficial effect on occupational health. The author examined the effects in workers of physical exercise performed during work breaks. Twenty-five employees of a manufacturing company participated in a 2-month exercise study. They performed various self-directed physical exercises at a gymnasium during their lunch break. The type and duration of exercise was recorded. Self-administered questionnaires assessing health-related lifestyle and GHQ-28 evaluating mental health were completed once a month. Blood samples and BMI were assessed prior to and after the program. All subjects continued until the end of the program and approximately 45% attendance rate per day was observed during the study. The results revealed that physical exercise for the study period was associated with a significant increase in body weight, RBC, ALT, T-CHO and glucose, while a significant decrease was seen in GHQ-28 score. In addition, exercise frequency and exercise strength were significantly related to decrease in GHQ-28 score. These results indicate that short bout exercise during lunch breaks can lead to improvements in mental health in the workplace.

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—Key words—

physical exercise, mental health, occupational health

Introduction

Physical exercise is recommended for occupational health[1]. Regular physical exercise has been found to reduce risks for health[2)~8)], and to have several beneficial effects in the workplace, including the prevention of occupational injury[9)~11)], improving subjective health for workers[12)] and reducing the risk of sickness absence[13)]. As a result, some major companies have introduced regular exercise periods for workers during work time in Japan[14)15)].

Physical exercise in the workplace was performed in 33.1% of companies in 2007 according to the report "The Health Investigation of Workers"[16)]. Furthermore, it was reported that the proportion of adults with regular physical exercise routines in 2008 was 33.3%, according to the "National Health and Nutrition Survey"[17)]. These results indicate that routine exercise is not sufficiently widespread in adults. In general, exercise may be commonly neglected because of a lack of time, space, or reluctance of the worker. Despite this, fact, some workers did choose to exercise during work-breaks such as lunchtime. However, it remains unclear whether such practice has beneficial effects.

The aim of this study is to test the following hypotheses: if workers are provided with adequate equipment and an appropriate exercise space at the workplace, some will choose to regularly exercise in their breaks; regular performance of a short bout exercise during work breaks will contribute to workers' health.

Subjects and Methods

Participants

In September 2007, of almost 1,000 employees at an electronic manufacturing company in central Japan comprising 50% office workers and 50% production workers, 25 (22 men and three women, mean age 45.0 ± 6.4 years) responded to a notice offering an optional 2-month self-directed exercise program to workers with no regular exercise habit. All respondents were office and day workers with no regular exercise routine who worked seated almost all day (from 8:30 to 17:30) with computers in an office.

Physical exercise

Before the program, all participants underwent a medical screening examination in accordance with "A recommendation of Japanese society of clinical sports medicine 2006"[18] to identify ineligible subjects with medical conditions including chronic disease (severe circulatory dysfunction, liver dysfunction, diabetes mellitus and/or renal dysfunction). No subjects were excluded. The participants performed physical exercises, for short or long period as they wished, in a gymnasium at the company site during their lunch breaks (45 minutes) on weekdays. They could choose to perform one of the following six types of exercise each session: badminton, cycle ergometer exercise, gymnastics, jump-rope, table tennis and walking. All equipment was provided by the company. The exercise selected and duration performed (in minutes) for each session was documented by one trained observer. Exercise discontinuance was regarded as exercise participation below once per month for the respective subject.

Physical activity energy expenditure was estimated using standard metabolic equivalent values (MET)[19]. The index of total exercise strength (Ex) was expressed by the following formula: Ex = MET × Time (hours)[19].

Questionnaires

To assess health-related aspects of lifestyle, a structured self-administered questionnaire based on Breslow's lifestyle index, and a 28-item version General Health Questionnaire (GHQ-28) were administered three times (before, one month and two months after commencing the program). The lifestyle questionnaire included the following items: daily sleep quantity (hours), sleep quality (good/poor), drinking habit (everyday/sometimes/never), smoking habit (current/quit/never), subjective home related stress (good/poor), nutritional habit (good/poor), daily work duration (hours) and subjective work-related stress (good/poor). The GHQ-28 evaluation was conducted according to Goldberg's method[20]. The four response options were given scores of 0-0-1-1, and the total score (possible range, 0 to 28) was used for calculation where higher scores indicate greater psychological distress.

Measurements

BMI and blood samples were assessed before, and at 2 months after commencing the program. Blood samples were collected in the morning before breakfast. Samples were drawn into chemically clean tubes, heparinized then immediately evaluated by a commercial laboratory (BML, Tokyo, JAPAN) for serum levels of routine medical check-up markers: white blood cell count (WBC) (/μl), red blood cell count (RBC) (10^4/μl), hemoglobin (Hb) (g/dl), aspartate aminotransferase (AST) (U/L), alanine aminotransferase (ALT) (U/L), gamma glutamyltransferase (GGT) (U/L), uric acid (UA) (mg/dl), total cholesterol (T-CHO) (mg/dl), high-density lipoprotein cholesterol (HDL-CHO) (mg/dl), triglycerides (TG) (mg/dl) and glucose (mg/dl).

Ethics

The study was approved by the Occupational Health and Safety Committee of the manufacturing industry and written informed consent was obtained from all participants.

Statistical analysis

Physical data were not distributed normally, therefore, they were statisticaly analyzed using Wilcoxon signed-ranks test for pre-post differences. Life-style change was analyzed with McNemar's test. Repeated measures ANOVA with Mauchly's test of sphericity were conducted for analysis of GHQ-28 time-course change. Simple regression analysis was used to analyze any association of lifestyle and exercise factors with the GHQ-28 score. Results are expressed as the mean (± SD) or median (25, 75, percentiles). Values of $P < 0.05$ were considered to indicate statistical significance. All statistical tests were performed using PASW statistics

Table 1 Physical exercise participation in the study period of all participants

Exercise	Month 1	Month 2	Average
Participation (sessions/month)	10.1 ± 5.5	9.1 ± 4.8	9.6 ± 4.9
Exercise strength (/month)	11.5 ± 6.7	10.2 ± 6.2	10.8 ± 6.2
Duration (minutes/session)	17.2 ± 3.5	16.7 ± 4.2	17.0 ± 3.6
Participants number (/day)	11.5 ± 2.6	10.8 ± 2.5	11.1 ± 2.5
Exercise chosen (No. total sessions)			
Badminton	47	17	32.0 ± 15.0
Ergometer exercise	29	28	28.5 ± 0.5
Gymnastics	57	94	75.5 ± 18.5
Jump-rope	2	6	4.0 ± 2.0
Table tennis	45	46	45.5 ± 0.5
Walking	64	29	46.5 ± 17.5

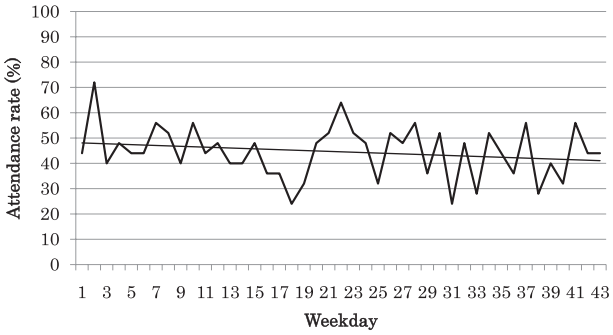

Fig. 1 Change in the proportion of attendance rate of subjects per day during the study period. The overall attendance rate was approximately 45% for the study period. The attendance rate decreased slightly throughout the period. (Excluded weekday was when the company was closed, therefore although the study period was 2 months the scale shows 43 days).

18 for Windows (SPSS Institute Inc, USA).

Results

After the program it was found that all participants had continued performing short bout exercise routines for the duration of the study though the attendance rate of each subject was diverse. Table 1 shows the result of participation of all subjects. Average number of exercise sessions in which subjects participated per month was 9.6 ± 4.9 (sessions per month). The index of total exercise strength was 10.8 ± 6.2 (Ex per month), the duration spent exercising was 17.0 ± 3.6 (minutes per session), and the number of participants was 11.1 ± 2.5 (per day). Of all the exercise types, gymnastics was most commonly selected (75.5 ± 18.5 sessions per month).

Fig. 1 shows the attendance rate per day during the study period. The average attendance rate was 44.6 ± 10.2%. This rate decreased slightly over the period.

Table 2 shows BMI and blood sample data of all participants. There was a significant increase in BMI ($P = 0.001$), and levels of RBC ($P = 0.016$), AST ($P = 0.039$), T-CHO ($P < 0.001$) and glucose ($P = 0.041$) at 2 months after commencing the program.

Fig. 2 shows the time-course of changes in mean GHQ-28 scores of all participants. A significant decrease in the GHQ-28 score was observed during the period ($P < 0.001$). The GHQ-28 scores were decreased from 6.1 ± 3.9 at baseline to 3.4 ± 3.0 at 2 months.

Table 3 shows relationships analyzed by simple regression analysis between factors including lifestyle and exercise strength and GHQ-28 score. There was a significant relationship between GHQ-28 score and exercise frequency ($R^2 = 0.294$; $P = 0.006$) and exercise strength ($R^2 = 0.290$; $P = 0.007$), but not between GHQ-28 score and

Table 2 BMI and chemical blood data of all participants at 2 months

Item		Baseline				Month 2				
		Median	25	–	75%	Median	25	–	75%	*P*-value*
BMI		22.8	20.9	–	24.2	23.4	21.9	–	24.3	0.001
WBC	(/μl)	5,600	4,672	–	6,565	5,220	4,652	–	6,307	0.326
RBC	(10^4/μl)	486	465	–	513	501	471	–	517	0.016
Hb	(g/dl)	15.1	14.2	–	16.3	15.4	14.3	–	16.4	0.078
AST	(U/l)	20	18.8	–	27.5	22	20.0	–	29.3	0.039
ALT	(U/l)	18	15.8	–	28.3	19	17.0	–	33.3	0.198
GGT	(U/l)	40	25.5	–	69.0	44	27.8	–	63.5	0.861
UA	(mg/dl)	6.3	5.9	–	6.7	6.3	5.6	–	6.6	0.307
T-CHO	(mg/dl)	187	171	–	207	201	179	–	228	<0.001
HDL-CHO	(mg/dl)	62	53.3	–	71.3	62	52.8	–	74.3	0.256
TG	(mg/dl)	85	53.5	–	113.8	84	60.5	–	120.3	0.572
Glucose	(mg/dl)	93	89.7	–	96.0	97	89.0	–	100.3	0.041

*Wilcoxon signed-ranks test

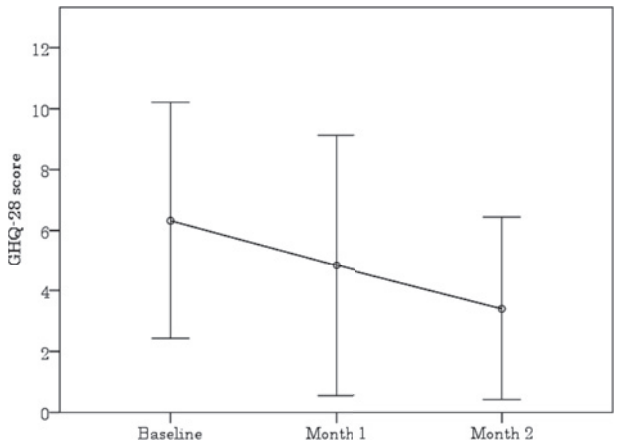

Fig. 2 Time-course change of GHQ-28 score through the 2-month period. A significant decrease in GHQ-28 score was observed (Repeated measures ANOVA, $P<0.001$).

Table 3 Simple regression analysis of the variables associated with GHQ-28 score at 2 months

Variables	R^2	*P*-value
Age	0.048	0.305
Sex	0.000	0.932
Daily sleep	0.097	0.137
Sleep quality	0.055	0.271
Drinking habits	0.001	0.888
Smoking habits	0.126	0.088
Home related stress	0.014	0.585
Nutrition habits	0.002	0.852
Daily working time	0.002	0.852
Work related stress	0.099	0.135
Exercise frequency	0.294	0.006
Ex	0.290	0.007

any of the other factors. It was found that high exercise frequency and strong exercise strength was related to low GHQ-28 score.

During the 2-month period, there was no significant change in the results of lifestyle questionnaires (data not shown).

Discussion

The present pilot study revealed that all participants continued to perform short bout physical exercise during their lunch breaks for 2 months when equipment and exercise space were available. It was found that, on average, each participant exercised 9.6 sessions per month for 17.0 min. per session, over the course of the 2-month period. Furthermore, the physical exercise had a significant relationship with improvement of mental health.

All participants continued performing physical exercise throughout the study period though the attendance rate of each subject was diverse. The attendance rate was approximately 45% per day during the program. In addition, the average exercise time was 17.0 min. during the program. Subjects continued to regularly exercise during the 2-month program even though the exercises had to be performed during their 45 min. lunch break utilizing the equipment and exercise space provided. This result indicates that exercise in the workplace might be voluntarily performed if appropriate provisions are made. Overall, these results indicate that the provision of equipment and exercise space may play key roles in promoting voluntary exercise rou-

tines in the workplace.

The present results revealed that short bout exercise did not reduce body weight or improve blood chemistry measures in workers, and some of these indices, including the RBC, AST, T-CHO, glucose and body weight, actually increased. It is unclear whether the short bout exercise caused these increases. Previous reports have shown that longer bouts and strenuous physical exercise causes greater body weight loss[21] or glucose control[22]. In contrast, some reports show that significant improvement in blood chemical data was seen with very brief exercise trials[22][23], whereas light physical exercise does not reduce body weight[24]~[26] or improve blood lipid or lipoprotein levels[27][28]. Moreover, it is known that physical activity stimulates appetite[29]. From these studies, it would seem that the effects on physical health of short or light physical exercise was not stable and were likely influenced by other factors. Hence, it is supposed that the short bout exercise during lunch break did not reduce body weight or levels of the present blood chemistry indices, and that the observed increase in these indices might have been caused by food intake following stimulation of appetite due to the exercise. Further investigation is needed to clarify the effect of short bout exercise on physical health.

The results of the GHQ-28 questionnaire indicated that mental health was improved through the 2 months physical exercise period. It is known that physical exercise is beneficial for mental health[30]~[32], and socio-psychiatric well-being[33]. This study revealed that even short periods of physical exercise might also result in substantial improvements in mental health for workers. In addition, the number of exercise sessions performed showed a significant relationship with mental health improvement. These findings suggest that short bout exercise at the work place, even if the exercise is performed within 45 min. lunch breaks, may reduce risk of mental health disease in the workplace. Thus, the short bout exercise performed during breaks may have an effect on mental health which is beneficial to occupational health.

This study has several limitations. There was no control group in this pilot study, preventing between-subjects comparisons which may have led to an over- or under-estimation of some of the effects of exercise. Therefore, this study might be best interpreted as a preliminary indication about the effects of short exercise periods in workers. The subjects were recruited voluntarily among workers who expressed a desire to exercise and the sample size was very small. Therefore, whether the observed effects of short bout exercise can be generalized to the general population of workers (including subjects who have no interest in exercise) is unclear. The questionnaires did not measure other potentially important factors in detail, such as daily eating, usual physical activity or job stress. Thus, there may be a possibility that the effects of the exercise were influenced by other factors during the period. Further studies are needed to clarify the specific effects of short bout exercise during work breaks.

Despite several limitations, this pilot study showed the possibility that some workers voluntarily take-up and continue performing short bout exercise when adequate equipment and space is provided and that short bout exercise during work-breaks might contribute to mental health improvement in workers. Further studies are required to elucidate the association between short bout exercise during work breaks and the physical and mental health of workers.

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労働現場における昼休憩時間を利用した運動の展開とその健康影響：2カ月間の予備的研究

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―キーワード―
運動，メンタルヘルス，産業保健

身体的運動は，健康上のリスクを低減させることが分かっており，また労災の予防や欠勤の抑制にも有益であることが知られている．しかし，わが国において成人の運動実施割合は高くなく，労働現場においてもあまり運動は展開されていない．このたびある製造工場の労働者に，昼休憩時間中に自主的な運動を実施してもらい，運動の展開の可能性と健康への影響について検討した．

対象は，本活動に参加することを希望した運動習慣のない労働者25名とした．研究期間は2カ月間とし，対象者には勤務日の昼休憩時間中に各自の裁量で自由に運動してもらった．運動は事業場に併設している体育館で実施され，運動用具は全て会社側で用意した．活動期間を通して，全ての対象者の運動内容と時間を記録した．対象者には，活動開始前と1カ月後，2カ月後の合計3回，生活習慣に関する質問紙と精神的健康状態を評価するGHQ-28質問紙に回答してもらった．また，活動開始前と2カ月後に，身体的健康状態を評価するため，全ての対象者に体重測定と血液検査を実施した．

2カ月の観察の結果，全ての対象者が活動を継続した．1人あたりの運動参加回数は平均9.6回/月，1回あたりの運動参加時間は平均17.0分，また1日あたりの参加者の割合は約45％だった．身体的健康状態を評価した結果，BMI，RBC，ALT，T-CHO，血糖値は，活動前と比較して2カ月後に有意に上昇していた．一方GHQ-28の得点は，経時的に有意に減少していた．また運動回数，運動強度と，GHQ-28の得点との間に有意な負の相関を認めた．

本研究の結果，昼休憩中に自主的な運動を展開することは可能であると考えられた．また，昼休憩中の運動により，労働者の身体的健康の改善は認めなかったが，メンタルヘルスは改善する可能性があると考えられた．今回の予備的研究を基に，さらに昼休憩中の運動の効果について検討する必要がある．

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