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RESEARCH ARTICLE

Effect of Structured Workers Physical Exercise, Individual Factors, and Work-related Factors on Physical Fitness of Security Officers

Dony Septriana Rosady,[1,2] Listya Tresnanti Mirtha,[2] Amilya Agustina,[2] Dewi Sumaryani Soemarko,[2] Agus Sugiharto[2]

[1]Department of Industrial Community Medicine, Faculty of Medicine, Universitas Islam Bandung, Bandung, Indonesia, [2]Department of Community Medicine, Faculty of Medicine, Universitas Indonesia, Central Jakarta, Indonesia

Abstract

Security officers require good physical fitness to perform their duties effectively. Maintaining this level of fitness often involves structured exercise programs that consider the frequency, intensity, duration, and type of activity. This study aims to examine the relationship between a structured physical exercise program, individual factors, and work-related factors on the physical fitness of security officers. This study was conducted in July 2023 and utilized company program data from March to June 2023, focusing on 67 security officers at PT X. Physical fitness data was collected using the Cooper test method and analyzed using SPSS. Data normality was assessed using the skewness/standard error method, with values <2 considered normally distributed. A paired sample t-test revealed a significant relationship between Cooper test distances before and after participation in the structured exercise program ($p<0.001$). Further analysis demonstrated relationships between changes in physical fitness and several factors: work fatigue ($p<0.001$), work stress dimensions (specifically work overload, role conflict, quantitative and qualitative workload excess, career development, and responsibility to others, all with $p<0.014$), and sleep quality ($p<0.001$). The coefficient of determination (r^2) was 0.496, indicating that work fatigue, role conflict, and sleep quality collectively explain 49.6% of the variance in physical fitness changes. The remaining variance is likely influenced by factors not included in the model. Multivariate analysis confirmed that work fatigue ($p<0.001$), role conflict ($p=0.036$), and sleep quality ($p=0.015$) were predictors of changes in physical fitness. In conclusion, a structured physical exercise program has a positive influence on the physical fitness of security officers. Furthermore, work fatigue, work stress (particularly role conflict), and sleep quality are associated with changes in physical fitness among these officers.

Keywords: Individual factors, occupational medicine, physical exercise, physical fitness, work-related factors

Introduction

Unfit workers are at higher risk of being absent from work due to illness. Recognizing the detrimental impact of poor employee health on productivity and costs, companies are increasingly prioritizing workplace fitness programs. Studies show these programs boost productivity, with participants outperforming their non-participating peers.[1–4] Workers who follow the company's fitness program have higher productivity compared to workers who do not follow the company's fitness program.[1,2,5,6]

Embracing the World Health Organization's definition of health as a state of complete well-being, companies are increasingly prioritizing employee wellness.[7,8] While workplace fitness programs can boost overall productivity, further research is needed to understand their specific impact on various professions.[9–11]

This study, therefore, investigates the effects of a structured physical exercise program on the physical fitness of security officers at PT X, considering the demanding physical requirements of their role as defined by Chief of Police Regulation.[12,13] This study aims to examine the relationship between a structured physical exercise program, individual factors, and work-related factors on the physical fitness of security officers.

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Correspondence: Dony Septriana Rosady, dr., M.B.A., M.H.Kes., M.K.K., M.Sc., M.Tr.A.P. Department of Industrial Community Medicine, Faculty of Medicine, Universitas Islam Bandung. Jln. Tamansari No. 22, Bandung 40116, West Java, Indonesia. E-mail: dony.septriana@unisba.ac.id

Methods

This study employed a one-group pretest-posttest design to investigate the impact of a structured physical exercise program on security officers at PT X. Conducted in July 2023, the research utilized company program data from March to June 2023, focusing on 67 officers aged 18–60 who participated in the program. Exclusion criteria included medical contraindications to exercise, changes in employment status during the study, and incomplete data.

This study utilized secondary data on a structured physical exercise program for workers obtained from the company's human resources department, following approvals from the Bandung City Government's Political and National Unity Agency, the Bandung City Government's Manpower Office, and the company itself. The Figure illustrates the recruitment process for this study.

Of the 81 initial participants in the structured physical exercise program, 67 completed the full three-month program. Data from these 67 participants, including demographics, health behaviors, and physical fitness measures, were analyzed descriptively using the Statistical Package for the Social Sciences (SPSS).

Analysis of physical fitness data employed a paired sample t-test ($p<0.05$, 95% CI). Confounding variables (smoking, job stress, and work fatigue) were analyzed using one-way ANOVA, while Pearson correlation was used for age and body mass index (BMI), given their normal distribution. Sleep quality was assessed via an independent t-test. Multiple linear regression was conducted to determine the effect of independent variables (age, BMI, smoking, work fatigue, work stress, sleep quality) on changes in physical fitness.

Results

Respondent characteristics are presented in Table 1. The normality test, using the skewness value divided by its standard error, confirmed a normal distribution for all variables, as the resulting values were ≤2. Given this normal distribution, a paired sample t-test was conducted, with the results described in Table 2.

Table 2 demonstrates that the structured physical exercise program significantly increased Cooper test distances by an average of 161.94 meters/12 minutes (from 1,751.64 meters pre-program to 1,913.58 meters post-program). This improvement is statistically significant ($p<0.001$), indicating a substantial positive impact of the program on worker fitness.

Table 3 reveals no significant relationship between changes in worker physical fitness and either age ($p=0.915$) or BMI ($p=0.423$). However, ANOVA analysis demonstrated a significant relationship between changes in physical fitness and work fatigue ($p<0.001$), as well as several

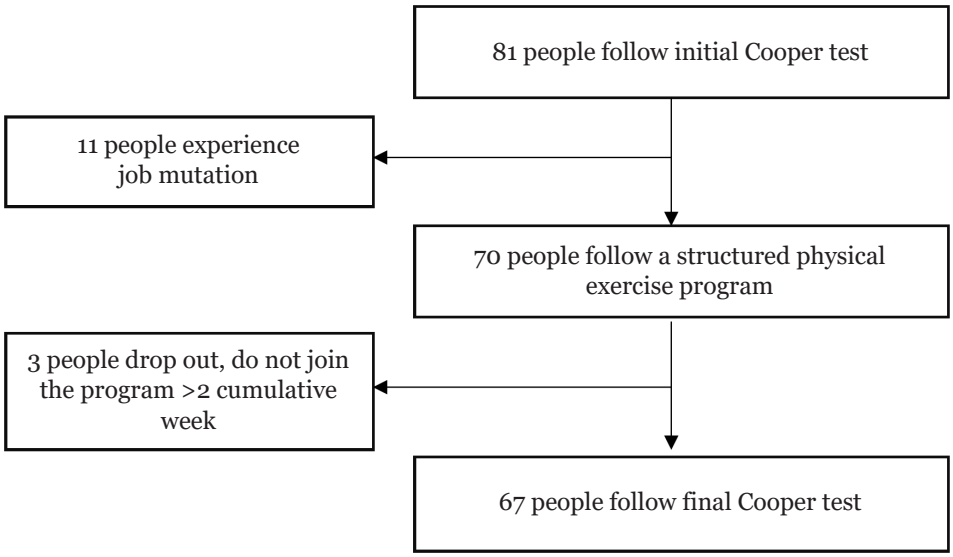

Figure Recruitment Flow of Research Subjects

Table 1 Measurement Results of Cooper Test Distance

Physical Fitness	Initial n=67 (%)	Final n=67 (%)	Delta (Δ)
Good	2 (3)	6 (9)	4
Average	7 (10)	15 (22)	8
Bad	39 (58)	39 (58)	0
Very bad	19 (28)	7 (10)	12

dimensions of work stress: work overload (p=0.001), role conflict (p=0.014), quantitative workload (p<0.001), qualitative workload (p<0.001), career development (p=0.001), and responsibility to others (p<0.001). Additionally, an independent t-test revealed a significant relationship between sleep quality and changes in physical fitness (p<0.001).

As shown in Table 4, work fatigue, work stress (specifically, role conflict), and sleep quality collectively explain 49.6% of the variance in physical fitness changes among PT X security officers (r^2=0.496). The remaining variance is likely attributable to factors not included in the model.

Multivariate analysis confirmed that work fatigue (p<0.001), role conflict (p=0.036), and sleep quality (p=0.015) were significant predictors of changes in physical fitness. Notably, role conflict emerged as the strongest predictor, with the highest beta value (β=0.61224).

Discussion

The 67 security officers at PT.X averaged 29.4 years old (range: 19–46 years), with most being

Table 2 Effect of a Structured Physical Exercise Program on Physical Fitness

Variables	Mean (SD)	p
Cooper test distance		<0.001*
Pre	1,751.64 (337.47)	
Post	1,913.58 (348.18)	
Difference in pre-post Cooper test distance	161.94 (109.035)	

Note: n=67, paired-sample t-test, *significance p<0.05

Table 3 Bivariate Analysis of Individual Factors and Work-related Factors to Difference of Physical Fitness Pre-post Structured Workers Exercise Program

Variables	Physical Fitness (Δ)	
	r/Mean	p
Age	0.013	0.915[p]
Body mass index	0.099	0.423[p]
Smoking behavior		
Light	172.6	0.713[a]
Moderate	149.2	
Heavy	157.1	
Work fatigue		
Light	239.6	<0.001[a*]
Moderate	138.3	
Heavy	65.4	
Stress—role ambiguity		
Low	106.5	0.001[a*]
Moderate	93.7	
High	84.5	
Stress—role conflict		
Low	110.3	0.014[a*]
Moderate	99.6	
High	84.8	
Stress—role overload qualitative	230.0	<0.001[a*]
Low	122.0	
Moderate	35.0	
High		
Stress—role overload quantitative	218.9	<0.001[a*]
Low	132.1	
Moderate	46.0	
High		
Stress—career development	220.4	0.001[a*]
Low	135.7	
Moderate	84.3	
High		
Stress—responsibility to others	224.2	<0.001[a*]
Low	133.1	
Moderate	46.1	
High		
Sleep quality		
Good	215.7	<0.001[t*]
Bad	109.7	

Note: [p]Pearson correlation, [a]ANOVA analysis, [t]independent t-test, *significance p<0.05

Table 4 Multivariate Analysis of Individual Factors and Work-related Factors to Difference of Physical Fitness Pre-post Structured Workers Exercise Program

Variables	β Coef.	Beta (β)	p	r^2
Age	−0.036	−0.506	0.805	0.496
Body mass index	−0.023	−0.054	0.834	
Smoking behavior	0.098	15.765	0.480	
Work fatigue	−0.455	−67.336	<0.001*	
Stress—role ambiguity	0.219	43.040	0.231	
Stress—role conflict	0.302	61.224	0.036*	
Stress—role overload qualitative	−0.056	−9.958	0.883	
Stress—role overload quantitative	0.073	13.309	0.699	
Stress—career development	−0.098	−16.669	0.574	
Stress—responsibility to others	−0.341	−61.051	0.433	
Sleep quality	−0.289	−62.505	0.015*	

Note: *significance p<0.05

married (83.6%) and having attained a secondary education level (16.4%). Their average work experience was 3 years (0–10 years). While some studies suggest a link between work experience, musculoskeletal issues, fatigue, and fitness, this can vary depending on job demands.[14]

The 67 security officers at PT X averaged 29.4 years old (range: 19–46 years), with most being married (83.6%) and having attained a secondary education level (16.4%). Their average work experience was 3 years (ranging from 0 to 10 years). While some studies suggest a link between work experience, musculoskeletal issues, fatigue, and fitness, this can vary depending on job demands.[15]

This study revealed a 95.5% improvement rate in Cooper test results (measuring fitness) following the structured exercise program. The program explained 49.6% of the variance in fitness improvement (r^2=0.496), highlighting the substantial impact of structured exercise on key physiological systems. However, other factors beyond the scope of this program also contribute to overall changes in fitness.

Regular physical activity offers numerous benefits, including enhanced cardiovascular and respiratory function, increased muscle capillary density, and a higher threshold for lactate accumulation and disease symptoms during exercise. Furthermore, it has been linked to improved mental health, cognitive function, and overall well-being, as well as a reduced risk of falls and age-related decline.[16–18]

This study demonstrated a significant increase (p<0.001) in worker fitness (measured by Cooper test distance) following a structured exercise program. Distance improved by an average of 161.94 meters/12 minutes (from 1,751.64 meters to 1,913.58 meters). While this post-program average remains below the standardized fitness target of 2,400 meters, the substantial improvement underscores the importance of continued efforts by both companies and individuals to prioritize and enhance worker fitness.

This study's findings align with previous research, which demonstrates the positive impact of regular physical exercise on fitness levels. Studies involving various populations (high school students, medical students, and research subjects) using different exercise modalities (circuit training, stationary cycling, and general fitness programs) have consistently shown significant fitness improvements.[19–21]

The benefits of regular physical activity extend beyond fitness, encompassing a reduced risk of chronic diseases such as hypertension, stroke, diabetes, and certain types of cancer, as well as improved mental health and cognitive function.[22]

Effective exercise programs should be tailored to individual health conditions, goals, and abilities, incorporating recommended frequency, intensity, time, and type of activity. A comprehensive program includes warm-up, conditioning, cool-down, and stretching components to optimize benefits and minimize the risk of injury.[23]

This study found no correlation between

age and changes in workers' physical fitness (p=0.915), likely due to the influence of other contributing factors. While fitness potential generally peaks between 25 and 30 years old, with a gradual decline thereafter, the average age of participants in this study was 29.4 years (range: 19–46 years), suggesting a relatively homogeneous age range that may have limited the ability to detect age-related differences.[14]

Similarly, no correlation was observed between body mass index and fitness changes (p=0.423). Although excess body fat can negatively impact fitness, this study found that most participants (35.8%) had a normal body mass index (BMI), which potentially limits the ability to discern an association.

This study also revealed no correlation between smoking behavior and changes in fitness (p=0.713). This contrasts with previous research indicating a moderate negative correlation between smoking habits and $VO_{2\ max}$ (a measure of cardiovascular fitness). The discrepancy in findings highlights the complex interplay of factors influencing fitness and the importance of considering population-specific characteristics when interpreting study results.[24]

This study found that moderate work stress was prevalent among respondents, with significant associations observed between all work stress dimensions (role ambiguity, role conflict, quantitative overload, qualitative overload, career development, and responsibility to others) and changes in physical fitness. These findings are consistent with previous research that has linked work stress to reduced cardiorespiratory fitness and muscle strength.[25,26]

Similarly, a relationship was identified between work fatigue and changes in physical fitness, with poor sleep quality also emerging as a significant factor. These findings highlight the interconnection between work-related stressors, fatigue, sleep, and physical health.[27]

While this study supports the negative impact of poor sleep quality on fitness, aligning with research that demonstrates a positive correlation between sleep quality and cardiorespiratory fitness, it's also essential to acknowledge conflicting findings in other studies. This discrepancy underscores the need for further investigation into the intricate relationship between sleep and physical fitness, taking into account potential moderating factors, including population characteristics and sleep measurement methods.[28]

Conclusions

This study reveals that a structured physical exercise program has a positive influence on the physical fitness of security officers at PT X. Furthermore, work fatigue, work stress (particularly role conflict), and sleep quality are significantly associated with changes in physical fitness among these officers. The remaining variance is attributable to other factors not examined in this study.

Conflict of Interest

The authors declare no conflicts of interest.

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