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RESEARCH **Open Access**

Work Fatigue Due to the Use of High Heels on Promotion Girls Workers

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Abstract
During working hours, Sales Promotion Girl (SPG) is standing in a shopping center, which can cause work fatigue. The objective of this study was to examine the work fatigue of SPG who wore high heels in various variations. The research design was cross-sectional, with the research subjects being 60 employees from the SPG in Pontianak Indonesia Mall. The L 77 reaction timer was employed to measure fatigue before and after work. The findings revealed that workers who wore 7 cm heels experienced higher levels of fatigue than those who wore 5 cm or 3 cm heels. The study results revealed no significant difference in fatigue before and after working various variations of high heels ($p \leq 0.001$). When wearing high heels, the average level of fatigue increases. However, there was no statistically significant difference in heel height variation on fatigue level (p=0.173). When working in a standing position, wearing shoes with low heels increases comfort and reduces worker fatigue. The results of this study can be used as a starting point for future research by other researchers. Moreover, the findings of this study can also serve as a starting point for other researchers to conduct additional research.

Keywords: Variation, Shoe Heel, Work Fatigue, Sales Promotion Girl.

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1. INTRODUCTION

Workers must pay close attention to Occupational Health and Safety (OSH). Occupational Safety and Health Efforts aim to keep workers' health, welfare, and safety in the workplace, both in the formal and informal sectors. Its goal is to create healthy and productive workers by providing a safe and healthy industrial work environment (International Labor Organization, 2011), (Khan, et al., 2014). Malls are one of the trade sectors where certain standards and occupational health and safety requirements must be met. According to observations at the Pontianak mall trade centre, many SPGs work standing and walking in high heels. Standing for an extended period of time causes leg pain (Hughes, et al., 2011). Standing too long is also associated with chronic venous insufficiency, discomfort and fatigue, particularly in the back and legs, high risk for Chronic Venous Disorders (CVD) (Sudol-Szopinska, et al., 2011; Bae, et al., 2015; Mahbubi, et al., 2016; Edwards, et al., 2008).

The use of high heels may cause knee pain (Filho, et al., 2012). The ammeter venous pressure is higher than those who apply low heels (Xiong & Hapsari, 2014). Instability of the balance system in its use results in falls and injuries (Emmanouil, & Rousanoglu, 2018; Silva, et al., 2013).

When walking and standing for an extended period of time, wearing high heels can cause changes in posture, body balance, and pressure in the metatarsal area of the foot, which can affect abnormal gait patterns, footsteps, and walking speed (Ebelling, et al., 1994; Afzal & Manzoor, 2017). Heels can interfere with balance and increase the likelihood of musculoskeletal injuries. Its effect on balance can cause a woman to trip and fall. Thus, women should avoid using it indefinitely (Mika, et al., 2016), as high heels also impair the effectiveness of muscle pumps (Filho, et al., 2012).

Based on the foregoing, efforts should be made to prevent and overcome fatigue and accidents caused by the use of high heels. Control efforts are performed by wearing shoes with high heels that have been adjusted to meet applicable standards. In connection with this, the authors conducted an experimental study on SPG workers, in which they used three different heel heights (3 cm, 5 cm, and 7 cm). The objective of this study was to examine work fatigue among SPGs who wore shoes with varying heel heights.

2. RESEARCH METHOD

This type of research was experimental which was an activity used to determine the treatment of research subjects (Tanner, 2018). Determining the research subjects in this research design was chosen at simple randomness. The research was conducted at the Pontianak Mall Shopping Centre, West Kalimantan Province, Indonesia. The research population was 60 female employees there. Each group consists of 20 people. The criteria for research subjects were women who have worked for at least a year, use work shoes and were present at research activities as indicated by the willingness of the subject or respondent (informed consent). All research procedures were carried out in accordance with the Helsinki Declaration guidelines and were approved by the Poltekkes Kemenkes Pontianak Ethics Commission (No. 136/KEPK-PK/IV/2019).

Data collection began with fatigue before work to determine the initial state of the research subject. Then the research subjects were treated with the use of work shoes with 3 kinds of heel height variations, namely group A (3 cm), group B (5 cm) and group C (7 cm). After work, research done in overcoming fatigue in groups A, B and C, so that the differences in fatigue before and after working in the 3 groups of fatigue can be known.

The procedural activities were carried out through a preparatory stage which consisted of collecting secondary data, field observations, obtaining research permits, meeting the research team and field officers to share tasks and equalize perceptions. The implementation phase consists of; 1) survey and inventory of the types of work shoes used by SPG, 2) field

activities consisting of meetings with companies to explain the aims and objectives of the research, 3) making research subjects, 4) providing the shoes used, 5) work fatigue (pre-test) namely measurement before work, 6) intervention of shoes used with various heights (3cm, 5cm, 7cm), intervention carried out for 2 weeks, 7) measurement of final work fatigue (post-test), after work. Work fatigue data used a reaction timer L 77. The working principle of the tool measures the reaction speed to a given light or sound stimulus. In this research activity used measurements with light stimulation. The unit of measurement was milliseconds (ms). The measurement officer was a standardized Occupational Safety and Health functional examiner, originating from the Occupational Safety and Health Unit (OSH) of West Kalimantan Province. The tools used have been calibrated, so that the validity and reliability of the measuring instruments can be justified. The data on the use of shoes based on the heel variation were obtained by means of observation using a checklist. Its characteristics obtained by interview using a questionnaire.

Data analysis was carried out by descriptive analysis (univariate analysis) to see the distribution characteristics of each dependent variable and independent variable. The description of the data is presented in tables and graphs, the calculation results are presented in the form of percentages, averages and ratios. Inferential analysis was performed using statistics to test hypotheses. The Anova test was conducted to test the hypothesis, to test the average difference of more than two treatments (heel height, 3 cm, 5 cm and 7 cm). The test was carried out at the significance level ($\alpha = 5\%$), if $p < 0.05$ then the results were significant.

3. RESULTS AND DISCUSSION

Table 1. Respondents Characteristics Based on Age and Working Period.

Respondent Characteristics	Category	N	%
Age	<20 years	13	21.7
	20-25 years	33	55.0
	>25 years	14	23.3
Working Period	1-3 years	41	68.3
	4-6 years	12	20.0
	>6 years	7	11.7
Total		60	100.0

Table 1 demonstrates that respondents were mostly aged 20-25 years as many as 33 people (55%) and a maximum of 1-3 years of service as many as 41 people (68.3%).

Table 2. Age and Working Period Factors toward Work Fatigue.

Respondent Characteristics	Category	Min ± Max	Mean ± Sd	p-value
Age	< 20 years	6±118	47.31±36.47	0.195
	20-25 years	12±152	65.79±39.35	
	>25 years	3±171	74.71±47.32	
Working Period	1-3 years	6±171	62.20±39.88	0.701
	4-6 years	24±135	71.42±43.32	
	>6 years	3±152	60.71±49.71	

Table 2 illustrates that work fatigue in SPG increased in respondents who were getting older and have 8 working hours, but statistically, there was no significant difference between work fatigue in the age group p=0.195. The working period of respondents to the increase in SPG fatigue revealed a difference, with 4-6 years being longer than 1-3 years. There was no

statistically significant difference in the level of work fatigue based on years of service p = 0.701.

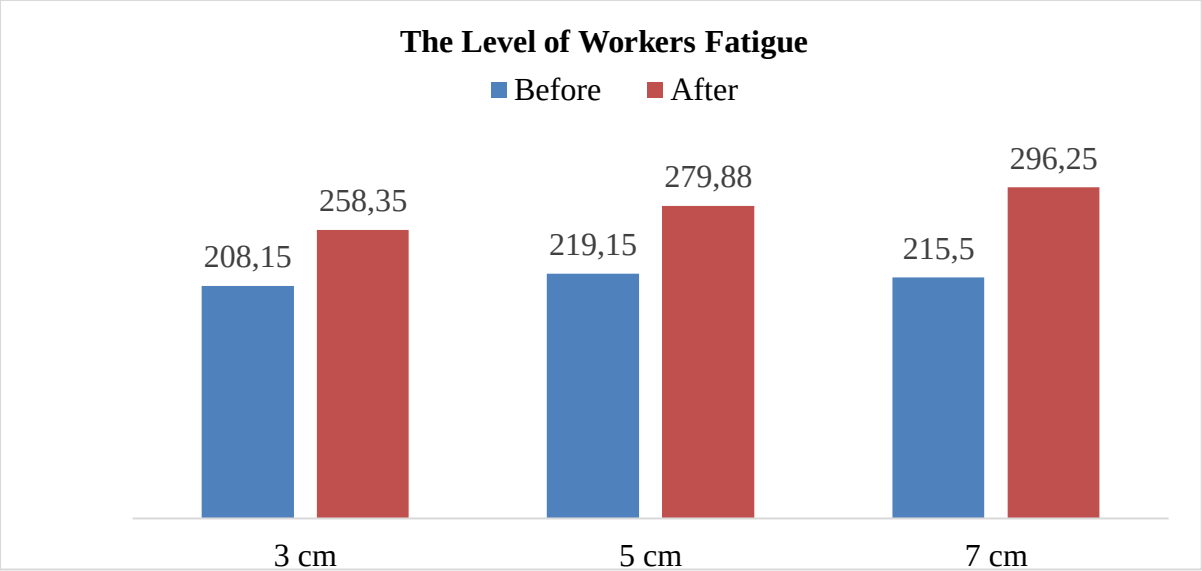

Figure 1. The Level of Workers Fatigue Before and After Work Height on Variations Shoes

Figure 1 shows that the increase in work fatigue before and after working in shoes with 3 cm high heels was 50.20 ms, 5 cm was 60.73 milliseconds/ms, and 7 cm was 80.75 milliseconds/ms. With increasing heel height, the level of fatigue increased.

Table 3. Work Fatigue Level Before and After Work

Category	Min ± Max	Mean ± Sd	p[a]
Before	150±325	214.28±33.164	0.000*
After	200±371	278.15±39.73	

Table 3 demonstrates that the level of fatigue before and after work, the difference was significant, p=0.000.

Table 4. An Analysis of Shoes Height toward Work Fatigue.

Height Heels	Min ± Max	Mean ± Sd	p[a]
3 cm Heels	12±94	50.20±25.28	0.173
5 cm Heels	3±132	60.15±39.07	
7 cm Heels	6±171	81.25±50.66	

Table 4 evidences that workers who wore 7 cm heels had a higher fatigue level. Workers who wore it experienced greater fatigue than those who wore 5 cm or 3 cm heels. However, statistical analysis revealed no significant difference (p = 0.173) between the increase in work fatigue and variations in heel height.

Work fatigue can be affected by environmental and work factors. In the long term, work fatigue that occurred due to continuous working effects on the health of workers. Moreover, the use of shoes with higher heels owns a risk of work fatigue (Gefen, et al., 2002). The use of high heels can cause ankle pain, which can lead to an increase in worker fatigue (Tojo, et al., 2018). This was due to an abnormality in the heel position. The use of high heels when SPG works will result in an increase in heel height, as well as tibial anterior EMG, lower back EMG vertical movement from the center of body mass increases significantly when walking with high heels (Lee, et al., 2001). The use of high heels can also cause changes in the kinematics of the foot's joints (Ng, et al., 2014).

Fatigue was influenced by age factors. As time passes, the function of body organs and muscles begins to deteriorate. Users of high heels may overwork their muscles due to an increase in the lumbar erector spinae muscles and a decrease in stride length due to decreased ankle joint strength (Kerrigan, et al., 1998; Hageman & Blanke, 1986). When compared to adults, older people were more likely to fall due to decreased mobility, suboptimal postural changes, and decreased responsiveness (Freitas, et al., 2005). Young people can adapt postural changes to the lumbar spine when wearing high heels, whereas older people react to changes in the thoracic spine with age, which may result in an increased risk of falling (Afzal & Manzoor, 2017; Schroder, et al., 2019). The findings revealed that there was no significant relationship between age and an increase in work fatigue because the majority of participants (76.6%) were between the ages of 18 and 25.

There was no significant difference between the length of work and the level of fatigue after work, as most (96.6%) of the participants had a recent tenure of less than 6 years. The working period was associated with the length of the workforce in performing work activities. The working period for SPG workers had to receive more attention, as at work required a standing position for a long time in providing services to consumers. Hence, it caused discomfort, pain and muscle fatigue (Halim & Omar, 2012). Working period and hours were associated with the amount of time the worker was standing and the use of high heels. The longer the working hours, the more time the worker spent standing and wearing high heels. Prolonged standing was correlated with adverse health outcomes such as muscle fatigue and discomfort (Halim, et al., 2014). The Center for Occupational Health for Workers of Ontario recommends limiting working standing, pregnant women to a maximum of 2 hours of standing work (Caw Health & Safety Department, 1993). Standing for 2 hours is recommended in the perioperative setting (Association of PeriOpeative Registered Nurses, 2007).

There was a significant difference ($p= 0.000$) on work fatigue using high heels with various variations in heel height before and after work. The use of high heels caused the tissue in the lumno pelvic area to became more rigid (Mika, et al., 2012) and the kinetic function of the extremity joints (Esenyel, et al., 2003). It indicates that the longer the worker used high heels, the longer the duration of stiff tissue in that area. The use of high heels for a long time also reduced the strength of the ankle joint (Kim, et al., 2015; Cronin, et al., 2012). Increasing the load on the toes, changing foot shape and gait patterns, cause lordosis and back pain (Silva, et al., 2013). The use of high heels on a regular basis can cause muscle fatigue and injury (Mika, 2012).

Preventing injury and fatigue can be accomplished by focusing on the comfort of wearing shoes with cushioning materials and stability (Nigg, et al., 2015). High heels were recognized to influence the biomechanics of human movement and cause work fatigue, particularly by increasing forefoot plantar pressure. Because of the influence of fashion to show femininity without considering the impact on health, SPG frequently used high-heeled shoes in the cosmetic sales department (Burcar, 2019). Efforts to overcome the clinical problem of using high heels can be performed by using pads to redistribute the plantar load on the top of the forefoot and improve comfort (Mercieca, 2017) and utilize good supportive footwear 3. According to the Canadian Centre for Occupational Health and Safety (CCOHS), the requirements for comfortable shoes were those that did not pose a risk when standing for long periods of time; has a strong heel grip, so there was no slip; more stable and comfy to wear shape according to the user's natural foot or shape according to the user's foot Shoes with closed toes that were not too narrow so that there was enough room for the toes; soft shoe soles with arches (Canadian Centre for Occupational Health and Safety, 2022). The use of shoes with various sizes of heels must be adjusted to the type of work and duration of work activities as

well as the characteristics of the user. The use of high heels can be applied if the heel height was proportional to the shoe.

The use of high heels at work was adjusted to the type of work being performed. SPG workers should use shoes with low heels (< 3 cm), in their work to reduce work fatigue, as they stand and walk to serve buyers during work. Working time was setting just 8 hours as it was in accordance with government regulations.

4. CONCLUSION

Variations in shoe heel height have an effect on the level of worker fatigue. The greater the worker's heel, the greater the level of fatigue. Selecting an ergonomic shoe height is highly recommended for workplace comfort. High heels cause fatigue, particularly when used in jobs that require workers to stand for long periods of time. As a result, when working in a long-standing position, it is critical to wear low heels to increase comfort and reduce worker fatigue.

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