

Work Shift Analysis by Using Psycho-physiological Method

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Abstract. This paper presents a study of work shift analysis on security workload. Six security employees were involved in this study for two work-shift periods (morning and night). T - test was used to determine the differences of psycho-physiological fatigue before and after working. The survey was conducted to identify some complaints. Physical fatigue, pulse, blood pressure (systolic and diastolic), and skin temperature were also checked to determine the physiological fatigue. In addition, motivation, psycho - social, and psychological complaints were identified to define the psychological fatigue by using an independently developed questionnaire. The results then shows some differences about the physical fatigue aspect in which the averages are 32.2 before and 28.2 after working. The average pulse aspects are 65.6 beats/min before and 93.2 beats/min after working respectively, the average blood pressures are 121.8 mm Hg before and 127.7 mm Hg after working for systolic aspect. For diastolic aspect, the average blood pressures are 71 mm Hg before and 75.9 mm Hg after working. Skin temperature is 34.8 C before working and 34.6 C after working. The result of this study also shows some differences on psychological fatigue where the mean work motivation was 21.5 before working and 24.7 after working, psycho-social was 13,5 before working and 14.3 after working, and psychological complaint was 50.8 before working and 40.83 after working.

Introduction

Human daily life cannot be separated from the issue of work as one manifestation of activities involving both physical activity and mental one. Here, high productivity can be achieved through a balance among work load, work capacity, and work environment (Riyadina, 1995, Suma'mur, 1993). Performance and its results meanwhile are strongly influenced by the comfort of the workers in the workplace. Barnes (1980) states that, in addition to the sound, lighting, and the temperature, it is deemed essential to consider work hours, the period of break-time for comfort to enable employee to achieve a better productivity.

In the work environment of BRI (Bank Rakyat Indonesia) on Katamso street, in the field of security as a job involving quite a high mental workload, many problems exist. This is because this job requires a high level of accuracy to ensure the safety of the environment. Based on the problems, a survey was performed in this field is related to the two-work shifts application period (morning and night), which triggers a lot of complaints from the security personnel. The reason given by the aversion of the shift period is related to the limited time for family and social life, lack of sleep, and the onset of fatigue. In other words, there is a need to create a balanced interaction among the demands of the task, the work environment and the ability of workers in order to prevent overstress and under stress (Grandjean, 1993)

Naturally, the human body has a self-timer (internal time keeper) that regulates various body activities such as working, sleeping, and digestion of food. During the day, there are the increasing pulse and blood pressure, which will encourage the increase of activity during the day. At night, all the functions of the body will be reduced then resulting in sleepiness. This indicates that the condition of the human body is naturally patterned and is difficult to change. Hence, if the body is required to work at night, there, of course, would be necessary adjustments and appropriate settings for work schedules to allow workers to be able to perform optimally (Grandjean, 1993). Later, in

the working time some arrangements should be really attempted to create a balance between the demands of the task, the work environment and the ability to work (Grandjean, 1993 and Manuaba, 2000)

In a study conducted by Sutjana, DP; Widana, K (2004) it has been explained that the setting shifts to his own circumstances - each hotel operation and the shock out of Bali hotels can reduce the operating costs. As a result, the operations can be maintained and the hotel employee layoffs could be avoided. Another study also points out that the change of work shift from 8 hours per day to 12 hours per day can affect accident rates, labor productivity, production failures and job satisfaction (Suprajono, 2005).

This, then, indicates the complaints on poor scheduling work shifts, which bring out the effect on the bad physical and psychological conditions. Therefore, a research on the analysis of work shift arrangements to safeguard the work stability is essential. In this study the researchers focus on physical and psychological condition of work, which include physical fatigue, pulse, blood pressure, skin temperature, psychological fatigue, motivation, and psycho-social condition every day. The purpose of this study is to determine the difference between physical and psychological complaints before and after work at BANK BRI Katamso using psycho-physiology method.

Hypothesis

H_0 : No significant differences before and after working

H_1 : Significant differences before and after working

Level of significance: $\alpha = 5\%$

Terms testing χ^2 counting, those are:

H_0 accepted if $\chi^2 \text{ counting} \leq \chi^2 \text{ table}$

H_0 rejected if $\chi^2 \text{ counting} > \chi^2 \text{ table}$

Research Method

Subject. Subjects in this study involved six security workers at the BRI (Bank of Indonesia Republic) Katamso. All of the workers are males at 33 years old in average. The data used in this study, furthermore, include pulse data, blood pressure data (systolic and diastolic), skin temperature data, physical fatigue, worker psychology data. The data were identified during one week for the six respondents, in which each respondent worked in two different shifts (morning and night). They were grouped into two groups where two respondents work in the morning and 3 respondents in the night. So that the data collected involved 30 shift for one week.

Apparatus. In this research, there are several questionnaires developed. They are as follows:

1. Psychological fatigue questionnaire to measure the psychological working fatigue
2. Motivation questionnaire to measure the extent of employee motivation
3. Social psychological questionnaire to measure the psycho-social worker
4. *Nordic Body Map* questionnaire to measure the extent of musculoskeletal complaints.
5. Microtoise Staturmeter is to measure height
6. Weight scales to measure weight
7. Tensi-meter to measure pulse, and blood pressure (systolic and diastolic)
8. Skin thermometer to measure body's skin temperature.

Data Collection Method. The research methods include the following procedures:

- a. Selecting the object and the subject of research as well as providing the tools used.
- b. Conducting a research towards 6 respondents working in their shift. The morning shift starts at 07.00 consisting of two subjects. Meanwhile, the night shift consists of 3 subjects who start working at 19.00. It is due to the safety demand level that is higher at night.

- c. Taking data before doing any activities before working, height measure, filling the personal data of the subject, filling the questionnaire as well as the measurement of pulse rate, blood pressure, and skin temperature.
- d. Retrieving data after working by measuring the height, weight measurement, filling questionnaires, and pulse measurement, blood pressure, and skin temperature

Data Processing Method. The findings of research will be analyzed using statistical test as follows:

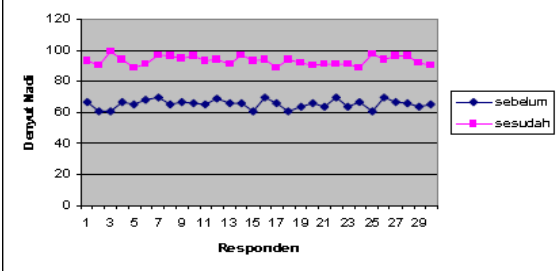
- a. Normality test for pulse, blood pressure, temperature of the skin, and data from questionnaires for all conditions using *Shapiro-Wilk* (S-W) test.
- b. Different test to observe the difference between health conditions before and after work using paired sample of T-Test and *Wilcoxon*
- c. Calculating the mean of pulse measurements, blood pressure, skin temperature, and data from questionnaires

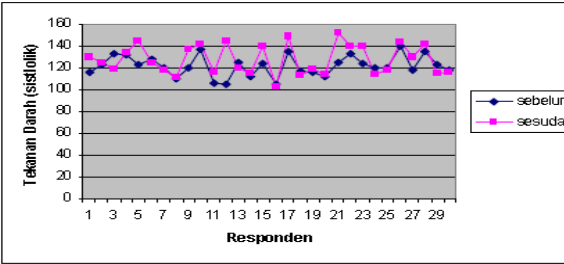
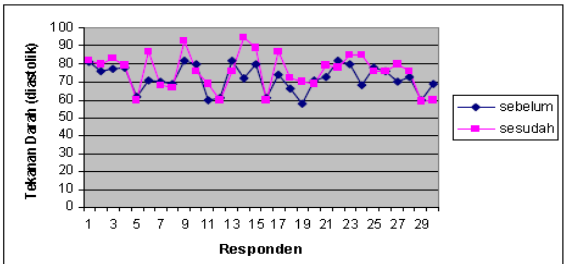
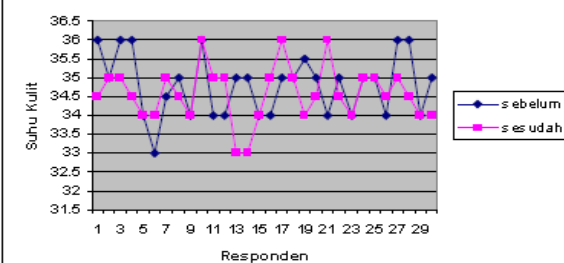
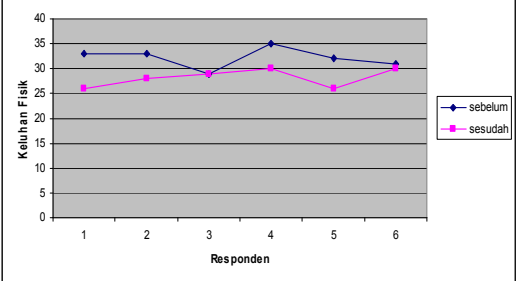
Result and Discussion

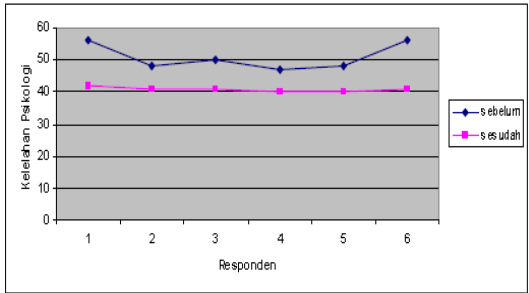
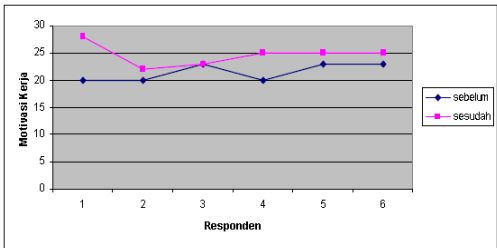
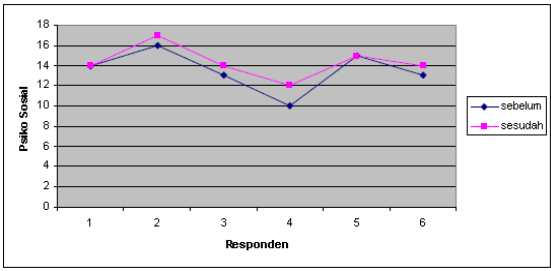
Table 1. Different test using *T - test* and *wilcoxon test*

Variable	Before	After	SE		T	Critical limit	Decision	explanation
			Before	After				
workers pulse aspect	65.6	93.2	2.77	2.84	37,16	$t < -2,045$ and $t > 2,045$	H_0 rejected	Increase
Workers' Blood pressure (systolic) aspect	121.8	127.7	9.50	9.50	2,805		H_0 rejected	Increase
Workers' Blood pressure aspect (diastolic)	72	75.9	7.46	7.46	2,805		H_0 rejected	Increase
Skin temperature aspect	34.8	34.6	0.82	0.82	-1,192		H_0 rejected	Decrease
Physical fatigue aspect	32,2	28,2	2.04	2.04	3,464		H_0 rejected	Decrease
Workers' psychological fatigue aspect	50.8	40.83	4.12	4.12	6,84		H_0 rejected	Increase
Workers' motivation aspect	21.5	24.7	1.64	1.64	2,714		H_0 rejected	Increase
Psycho social aspect	13.5	14.3	2.07	2.07	2,709		H_0 rejected	Increase

Table 2. Calculation aspects including pulse, blood pressure, skin temperature, physical aspect, motivation, psycho-social, and psychological complaints.

Graph Figure	Explanation
 <p>Figure 1. Workers' pulse</p>	<p>Variable comparisons between the pulse data before and after working obtained the average of 65.6 beats / min and 93.2 beats /min, and it can be concluded that workers pulse before and after working is different. Graph 1 shows that work shift for the moment is not really good because it resulted increased pulse rate that will have an impact on the higher activity of the body. This then makes the needs of the larger O₂ and pulse frequency increase (Adiputra, 2002).</p>

Graph Figure	Explanation
 <p data-bbox="248 640 695 678">Figure 2. Blood pressure (<i>systolic</i>)</p>  <p data-bbox="239 1025 705 1064">Figure 3. Blood pressure (<i>diastolic</i>)</p>	<p data-bbox="786 304 1414 925">The comparison of variable between pleasure blood (<i>systolic</i>) of the worker before and after working was obtained in the average of 121,8 mmhg and 127,7 mmhg. While, the comparison of variable between blood pleasure (<i>diastolyc</i>) of the worker before and after work obtained the average of 72 mmhg and 75,9 mmhg. Thus, the inferential systolic and diastolic blood pressure conditions before and after working is different. Figure 2 and Figure 3 show that the work shift for the moment is not really good because it causes increase of the blood pressure. According to Tarwaka (2004) more activities and works increase the impulse, tightened muscles, increasing blood circulation to the organs of body work, deeper breathing, and increased heartbeat and blood pressure.</p>
 <p data-bbox="300 1395 646 1433">Figure 4. Skin temperature</p>	<p data-bbox="786 1133 1414 1503">In the comparison of variable between skin temperature data before and after working, it is obtained the average of 34,8⁰ C and 34,6⁰ C. Thus, the inferential is no different between skin temperature before and after working. Figure 4 shows that working shift right now does not change the skin temperature significantly. It then caused different variable between every part of body (Minors and Waterhouse, 1981; Folkard and Monk, 1985).</p>
 <p data-bbox="303 1809 643 1848">Figure 5. Physical Fatigue</p>	<p data-bbox="786 1547 1414 1980">The comparison between physical fatigue data before and after working obtained the average of 32,2 and 28,2. So, the inferential condition of physical fatigue before and after working is different. Figure 8 shows that the subject work shift for the moment has been a physical fatigue. According to Grandjean (1993) the factors for the musculoskeletal complaints include unnatural working attitude because of the characteristics of the task, work tools and work station inappropriate with the workers capabilities and limitations.</p>

Graph Figure	Explanation
 <p>Figure 6. Psychological fatigue</p>	<p>The comparison of variable between psychological fatigue data before and after working obtained average 50,8 and 40,83. So, the inferential psychological fatigue before and after working is different. Furthermore, Figure 5 shows that work shift for the moment has affected psychological fatigue.</p>
 <p>Figure 7. Motivation</p>	<p>The comparison between work motivation data before and after working is obtained in the average of 211,5 and 24,7. Thus, the inferential condition of work motivation before and after working is different. Figure 6 shows that different motivation can be influenced by some factors derived from the individual.</p>
 <p>Figure 8. Psycosocial</p>	<p>Furthermore, the comparison between psychosocial worker data before and after working obtained the average of 13,5 and 14,3. So, the inferential condition of psychosocial worker before and after working is different. Figure 7 shows some differences in social psycho before and after working. This explains that work shift for the moment could affect the subjects to be unable to participate in social activities by the reason of no time and tiredness after working.</p>

Conclusion

From the analysis, some following conclusions are taken:

1. There are physical complaints that occur before and after working :
 - a. Pulse on the average before working is at 65,6 beats/min and after working is at 93,2 beats/min.
 - b. Blood pressure (*systolic and diastolic*) on the average before working (*systolic*) 5,9 mmhg and after working (*diastolic*) 3,9 mmhg.
 - c. Skin temperature on the average before working 34,8 C and after working 34,6 C
 - d. Physical fatigue on the average before working 32,2 C and after working 28,2 C
2. Some differences in psychological complaints include :
 - a. Psychological complaints before and after working are at $6,84 > 2.045$
 - b. Fatigue motivation before and after working is at $2.714 > 2.045$
 - c. Social psychological fatigue before and after working is at $2.709 > 2.045$

Recommendation

The study showed a significant different between physical and psychological condition before and after working with 2-shift work (morning and night) at Bank BRI Katamso, so that The company should pay attention to employees especially security department for the current work shift 2 shift (12 hours) to 3 shift (8 hours) and should add personnel, especially security department to improve employee welfare and to increase labor productivity.

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