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The Effect of Room Temperature on Employee Fatigue Levels in Central Sterile Supply Department and Integrated Laundry Installations Klungkung District Hospital

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ABSTRACT

Room temperature is one of the factors that influences the work environment, exposure to heat for hours disrupts the body's balance system where the body produces sweat as a compensation mechanism. Losing a lot of fluids due to sweating causes fatigue. Heat stress is one of the factors that affects the comfort of the work environment. Excessive heat conditions cause fatigue, drowsiness, reduce stability and increase the number of work errors. This research aims to determine the effect of room temperature on employee fatigue levels. This research was quantitative with a cross sectional design conducted at the Integrated CSSD and Laundry Installation. Sampling was taken using a saturated sampling technique with a total of 30 respondents. Research analysis used the Fisher's Exact Test. In this study, the Asymp Sig (2-sided) value was 0.224> 0.05, so it can be concluded that there is no influence of room temperature on employee fatigue levels in the Integrated CSSD and Laundry Installation at Klungkung Regency Regional Hospital. Based on this research, it is hoped that the room temperature will remain according to standards (23oC-26oC).

Keywords: Room Temperature, Employee, Fatigue Level.

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Introduction

Excessive ambient heat conditions will cause fatigue, drowsiness, reduce stability and increase the number of work errors (1) (2) (3) (4) (5). An employee can work efficiently and productively if the work environment is comfortable. According to Agati's research results (6), the air temperature that is comfortable for Indonesian workers is between 24oC-26oC and relative humidity of 30%-70% and air speed of around 0.05-0.2 meters per second. Hot temperatures result in reduced mental performance and the decline is very severe after 32oC. Exposure to heat for hours disrupts the body's balance system where the body produces sweat as a compensation mechanism.

In carrying out their activities, workers can be in various sectors of the work environment, such as the hospital work environment. With this in mind, work environmental factors must receive attention from all parties. The health services provided by the Klungkung District Hospital consist of medical services, nursing and midwifery services, medical support services and non-medical support services. The non-medical service support sector coordinates with the Central Sterile Supply Department (CSSD) Installation and Integrated Laundry. One of the supporting services implemented is the sterilization of medical equipment and materials, as well as laundry service activities. The Integrated CSSD and Laundry installation consists of two units, namely the CSSD unit and the Laundry unit.

Environmental factors in the CSSD unit and laundry unit are also a problem for employees, where the room temperature in the work area is quite hot. This is caused by inadequate supporting infrastructure and lack of air circulation in the room. From the initial survey in November 2023, room temperature measurements carried out by researchers during the morning work shift (07.30-14.00 WITA) showed that the average room temperature was around 24°C-32°C. Meanwhile, according to (7) concerning Occupational Safety and Health in the Work Environment, the threshold value for a comfortable work room temperature is 23oC-26oC. From interviews conducted by researchers with several employees, they stated that they experienced complaints of thirst, dizziness, and even felt tired due to the hot temperature conditions. The aim of this research is to determine the effect of room temperature on employee fatigue levels in the CSSD and Integrated Laundry Installations at Klungkung Regency Regional Hospital.

Research Method

This research uses a quantitative research with a cross sectional design. (8) This research was conducted in two rooms, namely Room A which is equipped with AC, and Room B which is equipped with a fan and exhauster fan. These two rooms are located in the CSSD and Integrated Laundry Installation of the Klungkung Regency Regional Hospital in May 2024. As a population and sample in this study, all 30 employees work in these rooms, and they will be studied while on duty in the morning work shift (at 07.30 - 14.00). In this research, a saturated sampling technique was used. (9) The type of data collected in this research is primary data from temperature measurements in Room A and Room B at the CSSD and Integrated Laundry Installation as well as data from interviews using the Subjective Self Rating Test (SSRT) questionnaire from the Industrial Fatigue Research Committee (IFRC) Japan.. The research instrument was the SSRT questionnaire from IFRC to measure subjective fatigue levels and the HM 16 Beurer Germany Thermo-

hygrometer. Temperature and fatigue measurements were carried out within three days and 4 times a day. Measurement I at 07.30-09.30; Measurement II at 09.30-11.30; measurement III at 11.30-13.00; and measurement IV at 13.00-14.00. After the data is collected, data processing and analysis is carried out by carrying out statistical tests using software (statistical applications).

Results and Discussions

The results of this research can be presented with the characteristics of respondents, the distribution of research variables, and the results of bivariate analysis. The distribution of respondent characteristics can be seen in the following table:

1. Characteristics of Respondents

Table 1 Characteristics of Respondents

Characteristics of Respondents		n	%
Age	20-29 years	13	43,3
	30-39 years	1	3,3
	40-49 years	8	26,7
	50-59 years	8	26,7
Sex	Male	12	40,0
	Female	18	60,0
Workplace	Room A	15	50,0
	Room B	15	50,0
Jumlah		30	100

2. Room Temperature

Table 2. Room A Temperature Measurements in the CSSD and Integrated Laundry Installation

Time Measurement	Room Temperature (^oC)				Conformity to Standards			
	I	II	III	IV	I	II	III	IV
Day I	23.5	23.9	24.8	25,0	fit	fit	fit	fit
Day II	23.9	24.3	24.6	25.1	fit	fit	fit	fit
Day III	24.1	25.5	25.6	25.7	fit	fit	fit	fit

Table 2 shows the results of temperature measurements in room A for three days. The temperature measurement results were between 23.5^{o}C - 25.7^{o}C. From the overall temperature measurement results it was found that the temperature in room A was in the standard category (23^{o}C - 26^{o}C).

Table 3 Room B Temperature Measurements in the CSSD and Integrated Laundry Installation

Time Measurement	Room Temperature (°C)				Conformity to Standards			
	I	II	III	IV	I	II	III	IV
Day I	25.4	26.6	29.9	31.5	Fit	Not fit	Not fit	Not fit
Day II	25.9	29.7	30.8	32.6	Fit	Not fit	Not fit	Not fit
Day III	25.7	28.1	30.3	31.4	Fit	Not fit	Not fit	Not fit

Table 3 shows that the temperature in room B is between 25.4°C - 31.4°C. The results of temperature measurement I obtained 25.4°C - 25.7°C which is included in the standard category (23°C - 26°C). While in measurements II, III, IV obtained temperatures of 26.6°C - 32.6°C and these results are included in the category of not according to standards (> 26°C). It can be said that the temperature in Room B has a tendency to increase room temperature during the day.

The results of room temperature measurements show that measurement I obtained all room temperatures ranging from 23.5°C- 25.9°C. While in measurement II the room temperature ranged from 23.9 °C - 29.7 °C, measurement III the room temperature was 24.6°C - 30.8°C and in measurement IV the room temperature was 25.0 °C - 32.6 °C. In this temperature measurement, the room temperature was recorded according to the standard (23°C-26°C) as many as 50%) and as many as 15 (50%) were not according to the standard (>26°C)

Table 3 shows that the room temperature in the CSSD Installation and Integrated Laundry in measurements II, III, and IV has a room with a temperature that is not in accordance with the standard. This is because at the time of measurement II the activity of using machines that affect the room temperature began to be operated. In Room A, machines for the sterilization process such as high-temperature sterilization machines (steam) and low-temperature sterilization machines (plasma) began to be operated. In Room B, dryers and roll ironing machines also began to be operated.

Hot air temperatures can cause a decrease in mental work performance (a severe decrease at temperatures > 32°C), reduce agility, prolong reaction time and decision-making time, disrupt brain accuracy and disrupt sensory nerve coordination (10). High temperatures can cause hyper pyrexia, miliaria, heat cramps, heat exhaustion, and heat stroke. (10).

Sedarmayanti (11) stated that there are several factors that can influence the formation of a work environment condition associated with employee capabilities, including: temperature in the workplace, lighting in the workplace, delays in the workplace, air circulation in the workplace, noise in the workplace, mechanical vibrations in the workplace, odors in the workplace, color schemes in the workplace, decoration in the workplace, music in the workplace, safety in the workplace, and air conditioning or ventilation.

According to Sarsinta, the definition of temperature is a measure of the coldness or heat of a condition or something else. The unit of measurement of temperature that is widely used in Indonesia is degrees Celsius. While the unit of measurement that is widely used abroad is degrees Fahrenheit. According to Nurdin Riyanto, the definition of temperature is a measure of the average kinetic energy of a molecule. If the temperature is high, the

average kinetic energy will also be large. The temperature in the workspace is a factor that needs to be considered by the management of a company where they work so that employees can use all their abilities to achieve maximum results (12). In addition, air circulation must also be considered. In this case, good air circulation can replace polluted indoor air with clean outdoor air. When talking about air conditions, focus on the following: air circulation, humidity, and temperature (13).

Air circulation in Room A and Room B with a closed building design without room ventilation. Air circulation in Room A with the use of air conditioner (AC) so that the room temperature according to the standard (23ºC-26ºC) is maintained. In Room B after the dryer and ironing roll machine are operated the room temperature becomes not according to the standard (> 26ºC), in room B for air circulation is equipped with two fans and six exhaust fans, only two exhaust fans are not functioning

3. Employee Fatigue Level

Tabel 4 Employee Fatigue Level in Room A in the CSSD and Integrated Laundry Installation

Time Measurement	Employee Fatigue Level			
	I	II	III	IV
Day I	100% low	100% low	100% low	100% low
Day II	100% low	100% low	100% low	100% low
Day III	100% low	100% low	100% low	100% low

Table 4 shows the results of employee fatigue level measurements in Room A for three days of measurement. From the results of measurements I, II, III, IV of respondents in Room A, all respondents in Room A were categorized as having low level fatigue.

Tabel 5 Employee Fatigue Level in Room B in the CSSD and Integrated Laundry Installation

Time Measurement	Employee Fatigue Level			
	I	II	III	IV
Day I	100% low	100% low	100% low	13.3% moderate
Day II	100% low	100% low	100% low	100% low
Day III	100% low	100% low	100% low	6,7% moderate

Table 5 shows the results of employee fatigue level measurements in Room B for three days. The results of fatigue level measurements from respondents in Room B in measurements I, II, III obtained results that all respondents were categorized as experiencing low levels of fatigue, but in fatigue level measurement IV, the results obtained on day I were two respondents (13.3%) with moderate fatigue category. On day III, the results

obtained were one respondent (6.7%) with moderate fatigue level.

Table 6 Employee Fatigue Level in the CSSD and Integrated Laundry Installati

Level of Fatigue	I		II		III		IV	
	n	(%)	n	(%)	n	(%)	n	(%)
Low	30	100	30	100	30	100	27	86,7
Moderate	0	0	0	0	0	0	3	13,3
Total	30	100	30	100	30	100	30	100

The results of the analysis of 30 respondents showed that the level of employee fatigue in the administration of questionnaire I (at 08.00) and questionnaire II (at 10.00) and in the administration of questionnaire III (at 12.00) were all obtained or as many as 30 respondents (100%) in the low category, while in the administration of questionnaire IV (at 14.00) there were 27 respondents (86.7%) in the low category and as many as 3 respondents (13.3%) in the moderate category. It can be said that there were three respondents with a moderate level of fatigue because the respondents worked longer and were in Room B where the room temperature was not up to standard (>26°C).

Fatigue can be interpreted as a mechanism that protects the body from further damage and recovers after a period of rest. Fatigue basically refers to a person's or individual's condition in different ways, but basically leads to poor performance, poor performance and poor endurance (14) (15). Work fatigue is a pattern that arises in a condition that generally occurs in workers, where workers are no longer able to do their work, resulting in decreased work productivity due to work factors (16). Another opinion states that work fatigue is a process of decreasing efficiency, performance, work, and decreasing the body's physical strength/endurance to continue the activities that must be carried out. Decreased worker productivity and work vitality are the results of work fatigue. According to Suma'mur (14) fatigue in this study is characterized by shorter reaction times and fatigue that is often felt by employees. The brain is the central nervous system in the inhibitory system (parasympathetic) and activity (sympathetic) that regulates fatigue. Each person's discomfort appears with different conditions and situations, all of which result in efficient losses and reduce employee endurance and performance. Fatigue due to physical conditions and fatigue is a sensation that accumulates in the body. According to Tarwaka (13), Symptoms of each person with fatigue vary from person to person, but overall, the symptoms are centered on poor performance, endurance, and efficiency.

From the median value of the SSRT questionnaire score results, it was found that the symptoms of fatigue felt by respondents were mostly felt by respondents in measurement IV. While complaints of fatigue in measurements I, II, III were not as many as those felt in measurement IV by respondents. The symptoms of fatigue most often felt by respondents were physical weakness (feeling thirsty) and weakness of activities (often yawning while working, becoming sleepy, wanting to lie down, feeling tired all over the body). Weakening of motivation was not found in the respondents studied.

4. Fatigue Symptoms

Based on the answers to the SSRT questionnaire results, the subjective fatigue symptoms of respondents can be identified based on the total score of each SSRT questionnaire. Where the total score of 30-120 from all questionnaire scores is obtained by a middle value with a value of 75. To find out the symptoms of fatigue that are widely felt by respondents, several questions about fatigue symptoms that are above the median value are as in the table below:

Table 7 Subjective Complaints of CSSD Installation Employees and Integrated Laundry

Symptoms of Weakening	Complaint	Values
Physical weakness	Feeling thirsty	87
Weakening of Activities	Frequent yawning while working	83
	Feeling sleepy	81
	Feel like lying down	80
	Feeling tired all over the body	75

5. Room Temperature and Fatigue Levels

Table 8 Cross Tabulation of Room Temperature Variable with Fatigue Level Variable Employees in

Room Temperature	Fatigue Level		
	Low	Moderate	Total
According to standards	15	0	15
Not up to standards	12	3	15
Total	27	3	30

CSSD Installation and Integrated Laundry

The results of the crosstabulation test between the room temperature variable and the fatigue level variable showed that in a room with a standard temperature (Room A), all 15 respondents complained with low-level complaints. While the other 15 respondents with a room temperature that was not in accordance with the standard (Room B), there were 12 respondents with a low category of fatigue, 3 respondents with a moderate category and no high or very high category of fatigue.

Tabel 9 Statistical Test Results of the Relationship between Room Temperature and Fatigue Levels of Employees at the CSSD Installation and Integrated Laundry

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.333[a]	1	.068		
Continuity Correction[b]	1.481	1	.224		
Likelihood Ratio	4.493	1	.034		
Fisher's Exact Test				.224	.112

Linear-by-Linear Association	3.222	1	.073		
N of Valid Cases	30				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.50.
b. Computed only for a 2x2 table

The results of the analysis showed that there was no effect of room temperature on the level of employee fatigue in the CSSD Installation and Integrated Laundry of Klungkung District Hospital, the Fisher Exact Test results showed an Asymp.Sig (2-sided) value of 0.224> 0.05. This shows that the room temperature in the CSSD Installation and Integrated Laundry does not significantly affect the level of employee fatigue, which is likely to have other factors influencing the level of employee fatigue that were not examined in this study.

The physical work environment is the workplace where employees carry out their activities. The physical work environment affects the enthusiasm and work emotions of employees. These physical factors include the air temperature in the workplace, the size of the work space, noise, density, and crowding. These physical factors greatly affect human behavior. Sarwono (4) stated that an increase in temperature can result in increased work performance but can also decrease work performance. An increase in temperature to a certain limit creates enthusiasm that stimulates work performance but after passing a certain threshold, this increase in temperature has begun to interfere with body temperature which also results in disrupted work performance. Excessive ambient heat conditions will result in fatigue, drowsiness, reduced stability and increase the number of work errors (5)

Conclusion

The results of room temperature measurements in measurements I, II, III. IV in Room A which is equipped with AC show that all room temperatures are in accordance with standards (23oC-26oC). In Room B which is equipped with a fan and exhaust, the temperature measurement I shows the temperature according to the standard (23oC-26oC), but in measurements II, III, IV after the dryer and iron roll are operated, the room temperature is not in accordance with the standard (>26oC). The level of employee fatigue in the administration of questionnaires I, II, III, IV obtained 27 respondents (90%) with a low category and 3 respondents (10%) were found with a moderate level of fatigue. Three respondents with a moderate level of fatigue were found in measurement IV in Room B. The most symptoms of fatigue felt by employees at the CSSD Installation and Integrated Laundry were when the fourth measurement was taken (at 14.00) in Room B, while in employees who worked in measurements I, II, III, there were no symptoms of fatigue as many as those felt by employees who worked during measurement IV. There is no significant effect between room temperature and employee fatigue levels at the CSSD Installation and Integrated Laundry of Klungkung District Hospital.

It is recommended that the Director/Deputy Director of Supporting Services of Klungkung District Hospital pay more attention to supporting facilities and infrastructure that affect the room temperature in the CSSD Installation and Integrated Laundry. As well as re-operating the central AC and repairing two exhaust fans in Room B of the CSSD Installation and Integrated Laundry, so that the room temperature meets the standard (23oC-26oC) so that employees can work comfortably. For subsequent researchers, especially environmental health students, it is hoped

that the results of the study can be used as a reference and can examine other external factor variables and internal factors related to fatigue with a larger number of samples so that more complete data is obtained.

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Conflic of Interest

The author doesn't have conflict of interest to the result of this research

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