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Analysis of lactic acid elevation in whole blood and blood pressure with work fatigue to airport apron work productivity

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ABSTRACT
Introduction: The occupational safety and health of airport apron workers is very important. Occupational safety protection and policies are indispensable.
Methodology: This study aims to analyze the increase in lactic acid in whole blood and blood pressure with work fatigue on work productivity. Analytical observational quantitative research. Sample of 40 people. Lactic acid measurement through blood sampling is measured using an acquired lactate plus lactate meter (mmol/L), and blood pressure is measured using a Tension meter (mmHg). Fatigue and productivity data were collected using a subjective self-rating test questionnaire from the industrial fatigue research committee.
Results: Increase in lactic acid, obtained correlation value (r) 0.623 (0.51-0.75), Increased lactic acid leads to work fatigue. In the relationship of lactic acid to productivity, A correlation of value (r) -0.552 (0.51-0.75) was obtained. Increased lactic acid, does not affect the decrease in work productivity. Increased blood pressure obtained value (r) 0,661(>0,51-0,75), can cause work fatigue. Blood pressure with a negative correlation value (r) - 0.669 (0.51-0.75, does not affect productivity. The relationship between work fatigue and work productivity, there is a positive correlation relationship obtained value (r) 0.638 (0.51-0.75), Work fatigue which will have an impact on reducing work productivity.
Conclusion: Increased lactic acid and blood pressure as a cause of work fatigue, and work fatigue as a cause of decreased work productivity.

Keywords: Blood Pressure; Lactic Acid; Work Fatigue; Worker Productivity.

1. INTRODUCTION

The occupational safety and health of workers on the airport apron have a very important role. The apron is the area where the aircraft operates with complex movements, including maneuvering, refueling, equipment installation, and payload handling. Workers on the apron are exposed to a variety of potentially harmful environmental factors, such as aircraft noise, air pollution, extreme temperatures, and solar radiation. Airplanes are one of the means of transportation that has advantages in terms of speed and cruising range compared to other transportation. The presence of the aviation industry using advanced technology is one of the positive impacts on the public transportation system [1].

The frequency of flights in the country is currently increasing along with the increase in the number of airline operations operating both domestically and internationally. The increasing density of air traffic certainly increases the process of landing (landing) and taking off (take off) from the aircraft. This process is guided by ground handling workers as a ground operating system. Ground handlers must have competence in handling aircraft on the apron, handling passengers and baggage in terminals, and cargo and postal in the cargo area [2]. The risk of danger faced by Apron employees is quite large, ranging from work processes, work tools, and work environments. A high workload will risk high fatigue and have an impact on the productivity of workers [3].

Baggage handling service is ground handling work with high physical loads. Physical fitness is needed to optimally lift and move loads manually. Physical exercise, ergonomics, and adequate rest are important to avoid fatigue and increase work productivity [4]. The main workload is heavy, workers are also exposed to the work

environment including exposure to noise, dust, vibration, radiation and temperatures above normal limits can affect the body in the form of muscle pain due to the process of carbohydrate metabolism that is hampered so that lactic acid accumulation occurs which causes stiffness or pain in the muscles [5]. The activity of the work requires a fit physical condition so that performance can be optimal. Therefore, the physical fitness of a baggage handling service is very important to carry out its work activities properly, so as not to cause fatigue and work productivity remains optimal, and facilitate service at the airport apron work unit.

High Landing Take-Off (LTO) intensity adds responsibility for baggage handling service. Landing Take Off (LTO) is the activity of aircraft landing and taking off. The high intensity of Landing Take Off (LTO) increases the workload for baggage handling service so that it has the potential to increase lactic acid.

Optimal productivity depends on the workload, work capacity, and additional load of the work environment. Good health supports high productivity. Workload involves physical, mental, and social aspects. Work capacity is related to the ability to complete tasks within a certain time. The additional burden comes from physical, chemical, physiological, and psychological factors [6].

Fatigue is one of the causes of decreased work productivity that has an impact on the company. Factors causing fatigue include internal factors (age, gender, psychic state, health, length of service, nutritional status) and external factors (work environment, working time, work attitude, workload). Lack of attention to these factors can lead to decreased motivation, performance, quality, and productivity, and increase errors and the risk of workplace accidents. [7]. The difference between this study and previous research conducted by Okumus et al, that the study aims to determine the impact of work fatigue on work productivity, on airport apron workers.

Fatigue occurs because the body needs recovery after activity. The buildup of lactic acid due to sustained muscle contractions is a contributing factor. Fatigue occurs when the body is unable to compensate for the speed of lactic acid formation with a fairly fast neutralization process, especially in intense activity. Rest is necessary for recovery [8]. The degree of individual work concerning the duration of work or effort to perform work determines the rate of increase in lactic acid. The more activities carried out, the higher the possibility of experiencing fatigue. The large number of flying hours at the airport affects the risk of work fatigue in baggage handling service officers who are required to be fast in providing services as one of the supports of the flight process. The higher the Landing take off aircraft activity that occurs at the airport affects the risk of work fatigue in baggage handling service officers who are required to be precise in providing services as one of the supporting flight processes. Airport apron workers can be one of the causes of flight delays during aircraft LTO, which is assumed to be due to a decrease in worker productivity, so it is considered necessary to conduct an analysis related to problem-solving the smooth running of flight activities and ensuring occupational safety and health for workers, as a basis for decision making in airport authority management governance. This study aims to analyze the increase in lactic acid and blood pressure with work fatigue on work productivity in airport apron workers.

2. METHODS

This study is an analytical observational quantitative survey study. This study measured lactic acid through blood sampling and blood pressure measurement of apron workers to determine the increase in lactic acid and blood pressure that can cause work fatigue to work productivity. A sample of 40 airport apron workers, was determined by a simple random sampling method, based on inclusion criteria that had been set before the research was carried out. Materials and tools used: Blood samples of workers were examined using an Accutrend lactate plus lactate lactate lactate meter(mmol/L), and blood pressure was measured using a tension meter Rossmax X1 (mmHg), Meanwhile, the questionnaire used to measure fatigue and work productivity uses the subjective selfrating test questionnaire from the industrial fatigue research committee. Data analysis using SPSS, spearman, rank correlation, and path analysis to analyze the influence between variables and intervening variables simultaneously. This research was carried out on apron workers of Sultan Hasanuddin Airport Makassar.

3. RESULTS

Table 1. Blood pressure measurement (mmHg) before and after work and Results of lactic acid measurement (mmol / L) before and after work

Blood pressure	Frequency			
	Systole		Diastole	
	N	%	N	%
Before Work	120.4 ± 12.04		78.32 ± 7.58	
Normal	23	57.5	20	50
Abnormal	17	42.5	20	50
After Work	124.40 ± 13.39		82.1 ± 16.9	

Normal	19	47.5	17	42.5
Abnormal	21	52.5	23	57.5
	0.045*		0.140	
*p-value (t-test paired) < 0.05: There are differences				
Results of lactic acid measurement (mmol / L) before and after work				

lactic acid	Number of samples	
	n	%
Before Work	1.66 ± 0.48	
Normal	40	100
Abnormal	0	0
After Work	2.14± 0.71	
Normal	0	0
Abnormal	40	100
	0.001*	
*p-value (t-test paired) < 0.05: There are differences		

Based on the table 1 known differences in blood pressure of respondents before and after work.Systolic blood pressure before work has an average of 120.4 with a standard deviation of 12.04, and diastolic blood pressure has an average of 78.32 with a standard deviation of 7.58 whereas after work the respondents' blood pressure with an average of 123.22 and standard deviation of 12.93 and diastolic blood pressure after work has an average of 82.1 with a standard deviation of 16.9.

It is known that respondents had normal systolic blood pressure before work, namely as many as 23 (57.5%) people with normal diastolic as many as 20 people (50%), and 17 (42.5%) people with abnormal systolic with diastolic 20 (50%) people. After work, there were 19 people with normal systolic (47.5%) and diastolic 17 (42.5) people, the blood pressure of respondents increased where 21 (52.5%) people with abnormal systolic blood pressure and 23 (57.5%) people diastolic abnormal.

The results of testing the difference in blood pressure before and after showed that there was a difference in systolic blood pressure (p-value = 0.045 < 0.05), while diastolic it was stated that there was no significant difference (p-value = 0.140 > 0.05).

Based on the table1, the above measurement results are known differences in lactic acid respondents before and after work. Lactic acid before work had an average of 1.66 with a standard deviation of 0.48, whereas after work the respondents' lactic acid increased by an average of 2.14 and a standard deviation of 0.71. There is an increase in lactic acid in workers after doing work activities.

Table 2. Results of the analysis of the relationship of lactic acid (mmol / L) to work fatigue

Lactic acid	Work Fatigue				
	Normal	Less fatigue	High fatigue	Very high fatigue	Correlation test (r)
After Work					
Normal	0	0	0	0	0,623
Abnormal	0	4	29	7	
Lactic acid	**Work Productivity**				Correlation test (r)
	Excellent		Good		
After Work					
Normal	3		13		-0.552
Abnormal	9		15		

Based on the results of the analysis of the relationship between lactic acid and fatigue in apron workers, it shows that there is an increase in lactic acid in workers after doing work activities, the correlation coefficient obtained a value (r) of 0.623 (0.51-0.75). This means that there is a significant and positive correlation, job fatigue experienced by apron workers is due to an increase in lactic acid due to work activities. The results of this study state that, lactic acid will increase if physical activity, the higher the activity with a high workload, the increase in lactic acid will also increase.

Based on the results of the analysis of the relationship between lactic acid and work productivity in apron

workers, it shows that there is an increase in lactic acid in workers, obtained a value (r) of -0.552 (0.51-0.75). This means that there is a relationship with a negative correlation, an increase in lactic acid in workers does not have an impact on decreasing work productivity.The analysis of the relationship between blood pressure and fatigue is presented in Table 3.

Table 3. Analysis of the relationship of blood pressure with work fatigue

After Work	Work Fatigue			
	Normal fatigue	Moderate fatigue	High fatigue	Correlation test (r)
Normal systolic	3	15	1	0.661
Abnormal Systolic	1	14	6	
Normal diastolic	1	15	1	
Diastolic abnormal	3	14	6	

Blood pressure is the flow of blood into the arterial wall as blood is pumped out of the heart to the rest of the body [8]. Blood flows to all parts of the body to function as a medium for transporting oxygen and other substances needed for the life of cells in the body [8]. Each person has varying blood pressure. Babies and children normally have lower blood pressure than adults. According to Hidayah. blood pressure is also influenced by physical activity, where blood pressure will be higher when someone is doing activity and lower when resting [8]. Blood pressure in the arteries usually changes rhythmically in line with the heart rate which has reached a maximum when the left ventricle ejects blood into the aorta or called systole and back down during diastole which reaches a minimum before the next heartbeat [8].

Based on the results of the analysis of the relationship between blood pressure and fatigue in apron workers after working activities, it shows that there is an increase in blood pressure in apron workers after working activities. Statistical analysis obtained a correlation coefficient (r) of 0.661 (>0.51-0.75). This means that there is a significant relationship with a positive correlation, between increased blood pressure and work fatigue. The occurrence of increased blood pressure in workers will have an impact on job fatigue.Analysis of the relationship between blood pressure and work productivity is presented in Table 4.

Table 4. Analysis of the Relationship between blood pressure with work productivity

After Work	Work Productivity		Correlation test (r)
	Excellent	Good	
Systolic normal	6	13	-0.669
Abnormal systolic	15	6	
Normal diastolic	5	12	
Diastolic abnormal;	7	16	

Based on the results of the analysis of the relationship between blood pressure and work productivity in apron workers after doing work activities, it shows that there is an increase in blood pressure after doing work activities obtained a correlation coefficient (r) of -0.669 (0.51-0.75). This means that there is a relationship with a negative correlation, an increase in blood pressure in workers but does not have an impact on decreasing work productivity. The correlation analysis of the relationship between work fatigue and work productivity is presented in Table 5.

Table 5. Correlation analysis of the relationship between work fatigue and work productivity

Category	Work productivity		Correlation test (r)
	Good	Excellent	
Low fatigue	3	1	0.683
Moderate fatigue	19	10	
High fatigue	6	1	

Based on the results of the analysis of the relationship between work fatigue and work productivity, it shows that there is a significance of a unidirectional positive correlation coefficient relationship of (r) 0.683 (0.51-0.75). This means that there is a unidirectional weak positive correlation relationship. High work fatigue can lead to decreased work productivity. The results of this analysis can be stated that high work fatigue is one of the causes of decreased work productivity.

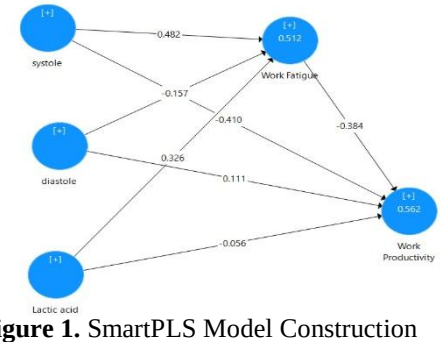

Figure 1. SmartPLS Model Construction

Multivariate analysis was carried out with the aim of analyzing the effect of lactic acid and blood pressure variables with work fatigue on work productivity simultaneously, namely by selecting variables included in multivariate analysis are variables that in bivariate analysis have p < 0.05. This multivariate analysis was conducted using smartPLS.

Figure 1 gives the combined construction of the model. The first direct effect is the variable influence of blood pressure and lactic acid on work fatigue. The second direct effect is the variable influence of systole, diastolic, lactic acid, and work fatigue on work productivity presented in Table 6.

Table 6. Direct Influence

	Original sample (refer to apron workers)	Sample Mean	Standard Deviation	T Statistics	P Values
Lactic Acid → Work Fatigue	0.326	0.322	0.15	2.17	0.03
Lactic Acid → Work Productivity	-0.056	-0.028	0.183	0.304	0.761
Diastole After → Work Fatigue	-0.157	-0.157	0.099	1.584	0.114
Diastole After → Work Productivity	0.111	0.131	0.116	0.954	0.34
systole after → work fatigue	0.482	0.464	0.161	2.987	0.003
systole after → work productivity	-0.41	-0.427	0.178	2.306	0.022
Work Fatigue → Work Productivity	-0.384	-0.382	0.147	2.611	0.009

To determine the significance of the influence of variables, it can be known based on the value of t-count and p-value. A variable is said to affect the dependent variable (accept the hypothesis) if the value of t is calculated > t table or p-value < 0.05, where in this study for an error rate of 5% t table = 1.96.

a. Lactic acid is related to work fatigue obtained p-value of 0.03 < 0.05 which means lactic acid affects work fatigue, where the direction of influence is positive (0.326). We know that lactic acid affects work fatigue, where if lactic acid increases then work fatigue will also increase.
b. Lactic acid is not related to work productivity obtained a p-value of 0.761 > 0.05 which means lactic acid does not affect work productivity.
c. Systole blood pressure is related to work fatigue and obtained a p-value of 0.003 < 0.05 which means blood pressure in the form of systolic measures affects work fatigue, where the direction of influence is positive (0.482). If blood pressure increases then work fatigue will also increase.Blood pressure in the form of diastole size is not related to work fatigue obtained a p-value of 0.114 > 0.05 which means diastole size blood pressure does not affect work fatigue.
d. Systole blood pressure is related to work productivity obtained p-value of 0.022 < 0.05 which means blood pressure in the form of systole measures affects work productivity, where the direction of influence is negative (-0.41). We know that blood pressure affects work productivity, where if blood pressure increases then work productivity will decrease.
e. Work fatigue is related to work productivity obtained p-value of 0.009 < 0.05 which means work fatigue affects work productivity, where the direction of influence is negative (-0.384).We know that work fatigue affects work productivity, where if work fatigue increases, work productivity will decrease.

Based on Table 7, An indirect influence is the effect of lactic acid and blood pressure on work productivity through the intermediary of work fatigue.

Table 7. Indirect Influence

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
Lactic Acid → Work Fatigue → Work Productivity	-0.125	-0.125	0.081	1.553	0.121
Diastole After → Work Fatigue → Work Productivity	0.06	0.059	0.045	1.334	0.183
Systole After → Work Fatigue → Work Productivity	-0.185	-0.178	0.094	1.966	0.05

a. Lactic acid's indirect influence on work productivity through work fatigue obtained a p-value of 0.121>0.05 which means that indirectly lactic acid does not affect work productivity.
b. Blood pressure has an indirect effect on diastole size on work productivity through work fatigue obtained a p-value of 0.183 > 0.05 which means indirectly diastole size blood pressure does not affect work productivity
c. Blood pressure has an indirect effect on systole size on work productivity through work fatigue obtained a p-value of 0.049 < 0.05 which means indirectly systole size blood pressure affects work productivity. The direction of influence is negative (-0.185) which means, that if the blood pressure of systole size increases then indirectly work productivity will decrease.

4. DISCUSSION

Lactic acid against physical work fatigue

Lactic acid is the body's metabolic waste produced in muscle cells and red blood cells. The amount of lactic acid in the body will usually increase when the body is doing a lot of physical activity or exercise. The maximum level of oxygen consumption (VO2max) that a person has is related to the metabolism of compounds that cause fatigue in the body, namely lactic acid. A high level of maximum oxygen consumption (VO2max) can help the process of lowering blood lactic acid levels quickly, and vice versa a low level of maximum oxygen consumption (VO2max) can help the process of lowering blood lactic acid levels slowly [9].

Based on the results of the analysis conducted before and after work on apron workers, it shows that there is an increase in lactic acid in workers after doing work activities obtained a value (r) of 0.35 (0.26-0.50). This means that there is a significant and positively correlated relationship between increased lactic acid and work fatigue. The results of this study state that there is an increase in lactic acid in airport apron workers after doing work activities so that workers will feel job fatigue. Shows that there is an increase in lactic acid in workers after doing work activities, correlation (r) 0.35 (0.26-0.50). This means that there is a significant and positively correlated relationship between increased lactic acid and work fatigue. The results of this study stated that there was an increase in lactic acid in airport apron workers after doing work activities so that workers would feel work fatigue. An increase in lactic acid occurs due to heavy working loads. However, elevated lactic acid can sometimes also be caused by certain medical conditions or diseases.This can cause symptoms of excess lactic acid. If excess lactic acid is severe and not treated immediately, this can cause several complications, such as heart rhythm disorders and acid-base abnormalities in the blood. When doing strenuous activities or sports, lactic acid can indeed accumulate in the body. One of the risks due to the buildup is muscle cramps, this condition will certainly interfere with work productivity.

Research conducted in Malaysia on a group that performs high physical activity found results in high physical activity will be followed by an increase in high vital signs such as increased blood pressure, and pulse, including increased lactic acid [10]. Every human being who does high activity can be sure that there will be an increase in vital signs and an increase in lactic acid. Every human being who does high activity can be sure that there will be an increase in vital signs and an increase in lactic acid, so it is advisable to stretch or take a short break between physical activities or while working.Previous research conducted in Turkey investigating the impact of shipbuilding worker productivity fatigue found valuable performance efficiency, in high positions directed to workers with taller bodies and vice versa in low positions recommended to workers of shorter height to avoid fatigue in managing positions [11]. The results of this study can be used as a reference or reference for office governance managers on apron workers so that shifts are made in rotation between workers who go down the field and those who do not go down the field. Lactic acid must be quickly disposed of, but it cannot be removed quickly through urine or sweat. So if for example accumulates or is excessive, lactic acid will cause cramps. When cramps, the muscles of the condition cannot relax, you could say the muscles of contraction continue. Muscle energy is its function to relax as well, but when lactic acid builds up, it means there is no more energy to take. Finally, cramps appear in the muscles, especially in the lower part [12].

Lactic acid to work productivity

Lactic acid is a remnant of anaerobic energy metabolism that can cause pain in muscles. The accumulation of lactate in the blood becomes a fundamental problem in physical performance because it causes fatigue and

decreases physical performance.Lactic acid is a waste substance of the body's metabolism produced by muscle cells and red blood cells. The amount itself can increase when a person does a strenuous physical activity or exercises excessively [12].

Increasing productivity can help a person produce more quality work.When a person has more time to complete their tasks, they can focus on details and pay more attention to managing time, on every aspect of the work they are working on. Work productivity is very important within the company. Based on the results of the analysis of the relationship of lactic acid to work productivity in workers, after carrying out work activities. An increase in lactic acid was found in workers, obtained p-value = 0.049 < 0.05), and the correlation coefficient obtained a value (r) of -0.31(0.26-0.50). This means that there is a significant and negatively correlated relationship, There is an increase in lactic acid in workers, but does not have an impact on decreasing work productivity for airport apron workers.

Work productivity is a measure of the comparison of the quality and quantity of a workforce in a unit of time to achieve results or work performance effectively and efficiently with the resources used. Work productivity has two dimensions, where the first is effectiveness, referring to the achievement of maximum performance (related to quality, quantity, and time) [13]. Previous research conducted in Shanghai, China concluded that organizing work shifts and calculating workloads is a very important part for workers to avoid high fatigue. The results of his research said there was a significant relationship between pilot fatigue during the working period at airlines would have an impact on pilot work productivity. This condition can result in endangering workers (pilots and cabin crew) individually who force themselves to be optimal at work and can have other consequences from work output. Therefore, it is necessary to calculate the method of allocation of working time with time for rest [14]. The results of this study are in line with previous research, to maintain and maintain worker productivity needs to be designed in such a way with a calculation method using workload analysis with available labor requirements. This is intended so that management can freely manage personnel or human resources following the available workload, namely the change of worker shifts, time rotation, and place rotation so that the circulation of scheduling and placement of personnel runs well.

Previous research concluded that the significance of work fatigue in air traffic control (ATC) due to high workload will have an impact on decreasing work productivity. The results of the study recommend regulating and maintaining diet and intake of nutrients consumed to meet the requirements of good nutrition and take advantage of good rest periods between shifts [15]. This study supports previous research to pay attention to workplace rotation with the provision of sufficient human resources to be employed through workload analysis. This is intended by the availability of sufficient manpower to expedite the process of employee rotation governance so as not to cause a high workload to workers.

Blood Pressure Against Physical Fatigue and Work Productivity

Blood pressure will be higher when doing physical activity and lower when resting[16]. Blood pressure in the arteries generally changes rhythmically in line with the heart rate that has reached its maximum when the left ventricle bleeds into the aorta called systole and back down during diastole which reaches a minimum before the next heart rate.

Based on the results of the analysis of the relationship of blood pressure to work fatigue in workers, before and after doing work activities. It was found that there was an increase in blood pressure in apron workers after doing work activities.Statistical analysis obtained a p-value = 0.017 < 0.05, and a correlation coefficient (r) value of 0.37 (0.26-0.50). This means that there is a significant relationship with a positive correlation, between increased blood pressure and work fatigue. The occurrence of increased blood pressure in workers will have an impact on work fatigue for airport apron workers. This study found a relationship when measuring workers' blood pressure after working on airport apron workers. Researchers predict, that workers when doing work activities are not too heavy, which can be caused by airport activities that are not too busy and low flight intensity, so that workers are more relaxed or experience low work. When taking measurements, workers get a long rest period so that blood pressure decreases or is normal. Blood pressure in high-potential workers or increased during high activity. However, the fact of this study found an increase in bloo3d pressure in apron workers which can be caused by apron workers experiencing high physical fatigue that affects the increase in blood pressure. Some references say that blood pressure affects workers who have a previous history or workers who have suffered from hypertension.Workers with a history of hypertension can trigger higher burnout in workers, so this study found fatigue and increased blood pressure in workers caused because, there is a previous history, but not significant. Previous research explains that people with chronic hypertension can trigger higher fatigue in workers [17]. Previous research on workers at oil and gas companies found an increase in systolic blood pressure [18]. This study supports the findings of previous studies that high blood pressure can cause fatigue.

Productivity Fatigue

Based on the results of the analysis of the relationship between work fatigue and work productivity, it shows a significance value of 0.04 < 0.05. This means that there is a significant relationship that work fatigue can reduced work productivity in workers. Correlation analysis shows a negative correlation coefficient value of (r) -0.58 (0.51-0.75).This means that work fatigue does not reduce work productivity in workers. The results of this analysis stated that work fatigue in workers does not reduce work productivity in workers.

A study in Lebanon about work fatigue experienced by doctors due to high workload and high levels of stress, Similarly, research finds fatigue in the work of airport apron workers, when the LTO of the aircraft is high, the workload of workers will increase, which will have an impact on work fatigue [19]. The study, conducted on PLN employees in Makassar, explained that work fatigue affects work accidents, work fatigue affects unsafe actions, and unsafe actions affect work accidents [20]. This study also explains that high work fatigue in airport apron workers affects worker productivity.

This research conducted in Kuwait related the relationship between the duration of the working day, daily production levels, and the accumulation of worker fatigue and recovery has been overlooked in studies of Research on the implementation of Production Planning and analytical models investigating this rare relationship. The purpose of this study is to revise the widely adopted 8-hour working standard and the second is the determination of the daily production quantity of the economy when the accumulation and recovery of worker fatigue can be considered. An issue closely related to the proposed model is the current debate about the fitness of the four-day workweek. The model observes the impact of maximizing its overall profits on protected workers by imposing limits on their highest levels of burnout. To complete the model, we obtained an efficient algorithm based on the Kar-ush-Kuhn-Tucker theory. Numerical results show that neither the standard 8-hour working day nor the corresponding daily production quantity is optimal. More importantly, the results confirm the suitability of the four-day workweek system for work situations with low or moderate worker fatigue growth factors, which can promote better outcomes [21-25]. This study reinforces the findings of this study which explains the importance of the job rotation system to increase work effectiveness to minimize work fatigue in workers can increase work productivity.

Previous studies explain that the importance of micro-rest including a 1-minute break can significantly reduce muscle fatigue without affecting productivity. The solution recommended for heavy workers is very effective, for handling and restoring muscle fatigue and the need for shift work to reduce the risk of high fatigue and have an impact on decreased work productivity [26-31].

5. CONCLUSION

The results of the study showed that (1) Lactic acid has a significant relationship and is positively correlated with work burnout. This means that the increase in lactic acid found in airport apron workers causes work fatigue in workers after doing activities, the higher the workload, the increase in lactic acid will also be high, and cause high fatigue; (2) Lactic acid has a negative correlation to work productivity. This means that lactic acid is not related to work productivity. The increase in lactic acid found in workers does not directly affect work productivity; (3) Blood pressure is significantly associated and positively correlated with work burnout. This means that the increase in blood pressure found in workers causes work fatigue in workers after doing activities, the higher the workload, the potential for increased blood pressure will also be high; (4) Blood pressure has a negative correlation to work productivity. This means that blood pressure is not related to work productivity. An increase in blood pressure in Anastole was found, but an increase in blood pressure in Diastole was still at the normal threshold. This means that blood pressure does not directly affect work productivity; (5) Work fatigue affects work productivity, indicating the significance of the relationship. This means that high work fatigue can cause a decrease in work productivity in workers; and (6) Increased lactic acid and blood pressure can cause fatigue and high fatigue can reduce work productivity. Lactic acid and blood pressure are not direct causes of decreased work productivity.

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Ethics code

This research has gone through ethical testing with a research ethics letter number: 5455/UN4.14.1/TP.01.02/2023.

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