PENGARUH SISTEM KERJA *SHIFT* TERHADAP GAMBARAN ENZIM FUNGSI HATI (SGOT DAN SGPT) PADA KARYAWAN PABRIK PELEBURAN ALUMINIUM PT INALUM (PERSERO) KUALA ANJUNG TAHUN 2017

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ABSTRACT

This study was conducted to measure the effect of the shift work system on liver dysfunction characterized by elevated of liver function enzymes SGOT (Serum Glutamic Oxaloacetic Transminase) and SGPT (Serum Glutamic Pyruvate Transaminase) in the employees of the PT Inalum (Persero) Kuala Tanjung smelting plant. The research method was descriptive which derived from primary and secondary data. Primary data is a direct examination of the levels of SGOT and SGPT liver function enzymes which are expressed in Unit units per liter of blood serum (U/L) which was the result of periodic examinations of two period employees who were examined by the Inalum Health Center Laboratory. Whereas secondary data came from PT Inalum (Persero) section of the Smelter Public Relations which is part of the Public Relations and Smelter Administration and Walfare which is part of staffing to obtain employee work shift schedules. The data obtained were analyzed using paired t-test data analysis techniques by comparing the results of SGOT and SGPT enzymes between 324 shift and non-shift workers. The results showed that there were significant differences in SGOT and SGPT values average for 162 employees with shift work from the average SGOT Period I value of 34.4 U/L rising to 42.0 U/L in period II and the average SGPT value for the Period I is 62.5 U/L to 73.4 U/L in period II. While the average SGOT and SGPT values for 162 non-shift employees also increased, but still within normal limits, namely SGOT is <35 U/L and SGPT <45 U/L. Employees with a shift work system experienced an elevated of SGOT and SGPT levels which resulted impact on liver dysfunction caused by fatigue and lack of rest time. Whereas non-shift employees experienced an elevated of SGOT and SGPT levels but did not affect liver dysfunction.

Keywords: employee, work shift, SGOT, SGPT, and liver function.

CHAPTER I

INTRODUCTION

1.1 The Background of the Study

Recently, industrialization is growing rapidly. To further ensure the success of the industrialization, a high level of efficiency is required in the use of production sources and the productivity of the labor involved in it. Labor is the backbone in the industrial sector which will determine the success or failure of an effort to increase production and work efficiency. To continue the increasing of productivity and save costs, the company makes efforts to change the working hours of its employees, namely by implementing a work shift system. Shift work is a division of labor within 24 hours covering morning, afternoon and evening which is carried out to utilize existing resources with the aim of fulfilling and increasing production. For companies, work shift arrangements are carried out aimed at maintaining the smoothness and fulfillment of production targets, while for workers it is a workload that must be borne as workers (Suma'mur, 2013).

PT Indonesia Asahan Aluminum (Persero) which is abbreviated as PT Inalum is a company that was formerly managed by Japan (1972 - 2012), but has officially become a State-Owned Enterprise (BUMN) November 1, 2013 which is engaged in hydroelectric power generation. (PLTA) in Paritohan, Tobasa Regency and an aluminum smelting plant in Kuala Tanjung, Batubara Regency.

Based on the initial survey conducted by the writer on labors in smelting operations working with a shift system, which is divided into three shift work groups, namely shift I starting with working hours at 00.00-08.00 WIB, shift II starting with working hours at 08.00-16.00 WIB, shift III starts with working time at 16.00-24.00 WIB. For employees who work in smelting operations, the company applies a 3-3-3

shift work system. This system is made where each work shift lasts 3 days.

At the end of shift II, you are given 2 days off and at the end of shift III you are given 1 day off. Employees who work using shifts are divided into 4 teams and work 3 shifts. Despite implementing the 3-3-3 system with 4 teams, there are still complaints felt by employees due to working with the shift system such as muscle disorders, drowsiness and appetite disorders, especially for employees in the reduction operation subsection.

The human resource desired by the company is a healthy, efficient and productive workforce. However, with the workload that is too heavy and the shift work system, it can cause various problems for these workers. Research conducted by Koller explains that various psychosocial problems and psychosomatic symptoms of shift and non-shift workers (day workers) in an oil refinery company. One of the results of this study is that complaints such as fatigue and weakness are found more in workers who experience shifts (Kuswadji, 1997).

In terms of health, working at night does affect the health of the body. Because, theoretically the cycle or body clock (circadian rhythm) human activities at night should not be equal to the day. A circadian rhythm is a change in body functions in humans that occurs twenty-four hours a day where changes in body functions follow a certain rhythm (also known as a cyrcadian rhythm). The body functions in question include body temperature, metabolic rate, alertness, heart work, heart rate, blood pressure, sleep-wake patterns, mental abilities, and certain chemical compositions of the body. These body functions will increase or be very active during the day but will decrease or be inactive at night. The period during the day is referred to as the ergotropic phase where human performance is at its peak, while the night period is called the trophotropic phase where there is a process of rest and energy recovery (Rosa

and Colligan, 1997).

According to Suma'mur (2013) cited by Ramayuli states that the night shift needs to get good attention and management because the human circadian rhythm is disturbed, the body's metabolism cannot adapt, the digestive organs do not function normally, lack of sleep, slow psychological reactions occur. gradually will cause psychopathological disorders (Ramayuli, 2004). The same opinion also says that a person's circadian rhythm will be disrupted if there is a change in the activity schedule such as a change in work shifts. Disruption of the circadian rhythm in the worker's body will have an impact on workers such as gastrointestinal disorders, disturbed sleep patterns and other health problems (Tayyari and Smith, 1997; Kurinawan, 2013).

Lack of sleep frequency in night shift workers is one of the causes of liver damage, because the liver works optimally at night in the process of removing toxins (detoxification), for that humans are recommended to sleep at these hours. Because with sleep red blood cells will collect in the liver and there is a process of regeneration of liver cells. Therefore, sleeping at these hours is very important so that liver function is not disturbed. If the function is disturbed, it can cause damage to liver cells so that the defense against germs becomes weak (Tilong, 2015; Sudoyo, et al., 2009).

Damage to liver cells (liver) can be detected early using liver function tests. One of the liver function tests is to measure the level of the aminotransferase enzyme in serum. The aminotransferases measured were SGOT (Serum Glutamic Oxaloacetic Transminase) and SGPT (Serum Glutamic Pyruvate Transaminase) (Sridianti, 2016). SGOT and SGPT are enzymes that are mostly produced in the liver and produced to a lesser extent in the heart and skeletal muscles, whose function is to catalyze the transfer of -amino groups from aspartate and alanine to -keto groups of ketoglutaric acid, forming oxaloacetate and pyruvate acids.

Specifically, SGOT is also known as Aspartate Aminotransferase (AST) which is divided into medium and low concentrations. Moderate concentrations are found in skeletal muscle, kidneys, and pancreas. Conversely, low concentrations are in the blood. With regard to liver disease that levels will increase as much as 10 times over a long period of time. On the other hand, SGPT or Alanine Aminotranserase (ALT) as an enzyme found in liver cells to diagnose hepatocellular destruction. In general, the test scores on the SGPT were higher than the SGOT (Widjaja, 2009: 15).

These enzymes play a role in the gluconeogenesis process by facilitating the synthesis of glucose from non-carbohydrate materials (namely amino acids, lactic acid, non-ester fatty acids and glycerol (Reza and Rachmawati, 2017: 2). If there is cell damage or an increase in the permeability of the liver cell membrane, the enzyme a lot of this will go out into the extra cell space and into the bloodstream, so that the increase in enzymes can be used as a means to help diagnose liver disease (Boyer TD, et al., 2012; Luklukaningsih, 2014)

In addition, increased levels of SGOT and SGPT enzymes mostly occur in all diseases. The effects include liver injury, severe viral hepatitis, and prolonged circulatory collapse. The entry of enzymes into the blood is caused by damage to the liver cell membranes. In this context, SGPT activity is easily detected compared to SGOT (Podolsky and Isselbacher, 2002: 45).

Elevated serum levels of GOT and GPT occur in almost all liver disorders. (Siekmann, 2002; Singh, et al., 2011). The SGOT and SGPT enzyme tests are used to detect liver disorders, find the cause, estimate the severity of the disease, assess the prognosis, and monitor the success of therapy (Sudoyo, et al., 2009).

There is a difference between SGPT and SGOT in detecting or performing enzyme tests. SGPT is mostly found in the liver, kidneys, heart, and skeletal muscles.

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While SGOT is found in the liver, heart, skeletal muscles, kidneys, brain, and red blood cells. However, SGPT is considered to be the most suitable for detecting liver inflammation through enzyme assays versus SGOT. On the other hand, SGOT only looks at diseases other than the liver, such as burns, kidney disease, and trauma (Gaze D. C, 2007: 8).

As already explained, employees of the aluminum smelting plant PT Inalum (Persero) Kuala Tanjung also work at night. It is necessary to study whether the shift work system implemented at PT Inalum (Persero) Kuala Tanjung affects the liver function of the workers in the company. As it is known that the liver is one of the most vital organs of the body and has a very large function and reserves in the metabolism of almost all food substances that are absorbed through the intestines and plays a role in the disposal of toxins (detoxification) whose cycle occurs in the early hours of the morning when humans should sleep. .

Based on the description above, it is necessary to do further research on the effect of the shift work system on liver disfunction which are characterized by increased levels of SGOT and SGPT in the blood of workers at the aluminum smelting plant, PT Inalum (Persero) Kuala Tanjung in 2017.

1.2 The Problem of Study

Is there any increasing levels of liver function enzymes SGOT and SGPT on the employees who work on a shift system at aluminum smelting plant, PT Inalum (Persero) Kuala Tanjung 2017?

1.3 The Objectives of the Study

To determine the effect of the shift work system on fatal liver disorders in employees of the aluminum smelting plant, PT Inalum (Persero) Kuala Tanjung which is characterized by increased levels of liver function enzymes SGOT and SGPT in International Units (IU/liter of blood).

1.4 The Significances of the Study

The significances of this study obtained are as follows.

1. To increase the writer's knowledge and insight regarding the effect of the work shift system on liver function disorders in plant workers in the production division of PT Inalum (Persero) Kuala Tanjung.
2. As an input for the company PT Inalum (Persero) Kuala Tanjung, especially regarding the effect of the work shift system on the description of the liver function of workers, especially plant operations, so that workers pay more attention to health and adequate sleep hours to balance the work shifts implemented by workers.

CHAPTER II
THEORETICAL REVIEW

2.1 The Company Profile of PT Inalum (Persero)

2.1.1 The Brief History of Company

On July 7th 1975 in Tokyo, after going through lengthy negotiations and with economic assistance from the Japanese government for this project, the government of Indonesian Republic and 12 Japanese investment companies signed a Master Agreement for the Hydropower Plant and the Asahan Aluminum Smelting Plant which became known as the Asahan Aluminum Smelting Plant. Asahan Project. On January 6, 1976, PT Indonesia Asahan Aluminum (Inalum), a joint venture company between the Indonesian government and was established in Jakarta. Inalum is the company that builds and operates the Asahan Project, in accordance with the master agreement. De facto, the change in Inalum's status from PMA (Foreign-Owned Company) to BUMN occurred on November 1, 2013 in accordance with the agreement contained in the Master Agreement. Termination of the contract between the Government of Indonesia and the Japanese Consortium of Companies took place on December 9, 2013, and de jure Inalum officially became a BUMN on December 19, 2013 after the Government of Indonesia took over the shares owned by the consortium. PT INALUM (Persero) officially became the 141st BUMN on April 21, 2014 in accordance with Government Regulation no. 26 of 2014 which is engaged in the aluminum industry in Kuala Tanjung, Batubara Regency and hydroelectric power plants in Paritohan, Tobasa district, North Sumatra (Company Profile, www.inalum.id).

2.2 Shift Work

2.2.1 Definition of Shift Work

Shift work has various definitions but usually shift work is equated with work that is formed outside normal working hours (08.00-17.00). These characteristics are continuity, change and special work schedules. In general, what is meant by work shifts are all arrangements for working hours, as a substitute for or in addition to working during the day as usual. However, there is also a more operational definition by mentioning the type of work shift, namely the work shift is said to be work that is permanent or often at irregular working hours (Kuswadji, 1997).

According to Suma'mur (1994), shift work is a pattern of working time given to workers to do something by the company and is usually divided into morning, afternoon and evening work. The proportion of shift workers is increasing from year to year, this is due to the investment spent on purchasing machines that require continuous use day and night to get better results. As a result workers also have to work day and night. This creates many problems, especially for workers who are not or less able to adjust to the usual working hours.

2.2.2 Shift Work System

The work shift system can differ between agencies or companies, although usually using three shifts per day with eight hours of work per shift. According to William quoted by Sri Ramayuli (2004), there are two types of shift work system consisting of: 1) Permanent shift, ie workers work on fixed shifts every day. Workers who work on a fixed night shift are people who are willing to work at night and sleep during the day. 2) Rotation system, i.e. workers who do not work continuously are placed on fixed shifts. Rotational shifts are rotational shifts that are the most disruptive

to circadian rhythms compared to permanent shifts if they last for a long period of time (Ramayuli, 2004).

The ILO (1983) states that the normal shift change is 8 hours/shift. Shift work carried out 24 hours including Sundays and holidays requires 4 work teams. This team is known as the continuous work team (3x8). Some companies implement a 3-3-3 system, in which each shift lasts for three days divided into 8 working hours, namely shift I at 00-08.00, shift II at 08-16.00 and shift III at 16.00-24.00. The end of shift II is given 2 days off, and at the end of shift III is given 1 day off. England uses a 2-2-2 system, this system is called a short rotation system, each shift is 2 days long and at the end of the shift is given 2 days off. In addition, the 2-2-3 system is also a short rotation system where one shift is carried out for 3 days, for 2 shifts it is carried out 2 days and at the end of the shift period is given 2 days off. This cycle alternates for each shift. At the end of the night shift, it is necessary to rest at least 24 hours (Suma'mur, 2013).

Based on the writer's observations in the field, he got information that in the operational and production section of PT Indonesia Asahan Aluminum (Persero) smelting with a shift system, which is divided into three shifts, namely shift I starting with working hours at 24.00-08.00 WIB, shift II starting with working hours at 08.00-16.00 WIB, shift III starts with working hours at 16.00-24.00 WIB. For employees who work in smelting operations, the company applies a 3-3-3 shift work system. This system is made where each work shift lasts 3 days, at the end of shift II you are given 2 days off and at the end of shift III you are given 1 day off. Employees who work using shifts are divided into four teams and work three shifts.

2.2.3 The Workers' Attitudes towards Shift Work

There are many views of people who do not like shift work but this attitude is not common. For example, a Weddenburn survey of responses to shift work of 315 steel industry workers in the UK found that 18% strongly liked it, 29% liked it, 22% disliked it, 23% disliked it, and 8% strongly disliked it. Individuals who don't like shift work are caused by several things including 61% think that work shifts affect social life, 47% think that work shifts cause irregular sleep times, 44% because night work, 38% irregular meal times, 35% cause early wake up (Firdaus, 2005).

Kuswadji (1997) also reports that workers' responses to three shifts work are as follows:

1. Morning shift: provide free time both for family life and not limited to social life.
2. Day shift: limited social life, wasted afternoon time and a little tired.
3. Night shift: tired, limited social life, not good for family life, sleep disturbance, giving a lot of wasted free time.

2.2.4 The Shift Work Effect

According to Fish quoted by Firdaus (2005) suggests that the effects of shifts twork hat can be felt include: 1) Physiological effects, namely decreased sleep quality: naps are not as effective as night sleep, many disturbances and usually time off is needed to compensate for lack of sleep during work night. In addition, decreased physical work capacity due to feeling sleepy and tired as well as decreased appetite and digestive disorders. 2) Psychosocial effects, this effect indicates a bigger problem than physiological effects, including disruption of family life, loss of free time, less opportunity to interact with friends, and disrupt group activities in society. Saksono

(1991) states that night work affects people's lives which are usually carried out in the afternoon or evening. Meanwhile, at that time night workers were used to rest or sleep, so they could not adapt actively in these activities, due to being excluded from the community. 3) Performance effects, where performance will decrease during night shift work caused by physiological and psychosocial effects. Decreased performance can result in decreased mental abilities that affect work alert behavior such as quality control and monitoring. 4) Effects on health such as gastrointestinal disorders, these problems tend to occur at the age of 40-50 years. Shift work can also be a problem for the balance of blood sugar levels for people with diabetes and impaired liver function. 5) Effect on work safety. The survey of the effect of work shifts on occupational health and safety conducted by Smith et. al, reported that the frequency the highest accident occurred at the end of the work shift rotation (night) with an average number of accidents 0.69% per worker. But not all studies mention that the increase in the rate of industrial accidents occurs on the night shift. However, it tends to occur a lot during the morning shift and occurs more during the night shift (Khairunnisa, 2001; Tilong, 2015; Sudoyo, et al., 2009).

2.3 The Liver Physiology and Aminotransferase Enzymes

Liver is the largest solid organ located in the upper right abdominal cavity. It is a regulator of almost all metabolism that occurs in the body, such as the metabolism of macronutrients (carbohydrates, proteins and fats), the storage of iron and vitamins, the formation of blood coagulation (clotting) factors, the formation of bile, as well as the metabolism of various hormones and drugs. In addition, the liver is also the site of the formation and distribution of bile acids and the destruction of steroid hormones such as estrogen. The most important of all, this organ is a detox device or filter and remove

toxins that enter to the body (Guyton, 2007).

In the early hours of the morning, the work of the liver increases which at that time occurs the process of removing (detoxifying) toxins or waste from the body's metabolism, for that we need to sleep so that the liver's work process in the detoxification process and liver work is not too heavy. In addition, in the early hours of the morning we are recommended to sleep so that the body's metabolic processes and the body's circadian rhythm take place properly. Because with sleep also red blood cells will collect in the liver and there is a process of regeneration of liver cells. Therefore, sleeping at these hours is very important so that liver function is not disturbed. If the work of the liver is heavy, it can cause interference and even have the potential to cause damage to the liver cells so that the defense against germs becomes weak. Workers who work at night or shift workers will disrupt the body's circadian rhythm which is at risk of disruption or damage to body organs that work harder during human hours to rest, including the liver in it (Kuswadji, 1997; Tilong, 2015).

One type of examination that is often carried out for liver damage is enzymatic examination. Enzymes are proteins produced by living cells and are generally found in cells. Under normal circumstances there is a balance between the formation of enzymes and their destruction. If there is cell damage or an increase in the permeability of the cell membrane, a lot of enzymes will come out into the extracellular space (extracellular) and into the bloodstream, so that the increase in enzymes can be used as a means to help diagnose certain diseases (Sudoyo, 2009; Boyer, et al., 2012).

There are a number of aminotransaminase enzymes produced by the human liver, but there are two types specifically measured to determine the work of the liver, namely Aspartate transaminase (AST) or better known as SGOT (Serum Glutamic Oxaloacetic Transminase) and Alanine transaminase (ALT) or better known as known as SGPT

(Serum Glutamic Pyruvate Transaminase) (Sridianti, 2016). These two transaminase enzymes catalyze the transfer of the -amino groups of aspartate and alanine to the -keto groups of ketoglutaric acid, forming oxaloacetate and pyruvate acids. These enzymes play a role in the process of gluconeogenesis by facilitating the synthesis of glucose from non-carbohydrate materials (ie, amino acids, lactic acid, non-ester fatty acids and glycerol). If there is cell damage or an increase in permeability of the liver cell membrane, this enzyme will be released into the extra cell space and into the bloodstream, so that an increase in the enzyme can be used as a means to help diagnose liver disease (Boyer TD, et al., 2012; Luklukaningsih, 2014, Qodriyati, et al., 2016). The increase in these two enzymes can be affected by various liver conditions. Elevated serum levels of GOT and GPT occur in almost all liver disorders. The highest increase occurred in several diseases of hepatitis, liver necrosis and hepatic cirrhosis. Thus, blood tests can diagnose liver damage. SGPT/ALT are generally examined more closely to detect liver damage (Sridianti, 2016).

2.3.1 Serum Glutamic Oxaloacetic Transaminase (SGOT)

SGOT also known as AST (Aspartate Aminotransferase), is a liver enzyme found in liver parenchyma cells that helps produce protein. This enzyme catalyzes the transfer of an amino group from aspartate to -ketoglutrate to produce oxaloacetate and glutamate.

AST reaction principle:

$$\text{L-Aspartate} + \alpha\text{-Oxoglutarate} \xleftrightarrow{A} \text{L-Glutamate} + \text{Oxaloacetate}$$

$$\text{Oxalacetate} + \text{NADH} + \text{H}^+ \xleftrightarrow{M} \text{L-Malate} + \text{NAD}^+$$

SGOT is also produced in other organs, such as the heart muscle, skeletal muscle,

brain and kidneys. Damage to any of these organs can cause elevated levels of this enzyme in the blood. SGOT will increase in blood levels if there is damage to liver cells, but it is considered less specific because this enzyme can also describe abnormalities in the heart, skeletal muscle and brain, and kidneys because this enzyme is also produced in other organs (Boyer TD, et al., 2012). High SGOT levels in the blood do not necessarily indicate abnormalities in liver cells. Therefore it is necessary to check SGPT as well, but when these two enzymes increase it can be ascertained that there is damage to liver cells (Pramudiantoro, 2013; Qodriyati, et al., 2016).

2.3.2 Serum Glutamic Pyruvate Transaminase (SGPT)

SGPT is also known as ALT (Alanine Aminotransferase), the same as SGOT which is an enzyme found in liver cells. SGPT is a liver enzyme that plays an important role in amino acid metabolism and glukeogenesis. This enzyme catalyzes the transfer of an amino group from alanine to α-ketoglutrate to produce glutamate and pyruvate. Pyruvate is converted to lactate under the influence of lactate dehydrogenase (LDH) and NADH.

ALT reaction principle:

$$\text{L-Alanine} + \alpha\text{-Oxoglutarate} \xleftrightarrow{A} \text{L-Glutamate} + \text{Pyruvate}$$

$$\text{Pyruvate} + \text{NADH} + \text{H}^{+} \longleftrightarrow \text{L-Malate} + \text{NAD}^{+}$$

This enzyme is found in small amounts in heart, kidney and skeletal muscle but has lower activity. In general, the SGPT/ALT test value is higher than the SGOT/AST in acute liver parenchymal damage, whereas in chronic processes the opposite is true (Singh et al., 2011). When liver cells are damaged, this enzyme will increase and flow into the bloodstream. On examination of blood tests in the laboratory will be seen elevated levels of SGPT (Singh, et al., 2011).

2.3.3 The Normal Value of SGOT and SGPT

SGOT/AST and SGPT/ALT blood serum are generally examined by photometry or spectrophotometry, semi-automatically using a photometer or spectrophotometer, or automatically using a blood chemistry analyzer (clinical chemistry analyzer) (Lothar Siekmann, IFCC, 2002). The normal value of SGOT is 3-45 U/L (units per liter of serum), while the normal value of SGPT is 0-35 U/L (units per liter of serum) (Joyce LeFever Kee, 2007).

It should be noted that there is a slight variation from the normal values for these two enzymes, and this is highly dependent on each laboratory. However, each laboratory will print the results of your examination and the normal values they use, so it's just a matter of comparing them with the numbers on the test results paper (Association of Specialist Doctors of Clinical Pathology, Jakarta Branch, 2004). Normal SGOT and SGPT results do not necessarily indicate that a person is free from liver disease. Because in cases of chronic liver disease (chronic and slowly progressing), it can be found that the levels of SGOT and SGPT enzymes are normal or only slightly increased. This condition is often found in cases of chronic hepatitis B or chronic hepatitis C. Liver enzymes will increase when there is severe damage to liver cells. Meanwhile, in chronic liver infection (chronic), liver cells are damaged slowly so that the increase in SGOT and SGPT is not significant and even looks normal. Therefore, in liver disease like this, other types of examinations are needed (Pramudiantoro, 2013).

2.3.4 The Conditions that Increase SGPT Levels in the Blood

According to Riswanto (2009) conditions that can increase SGPT are divided into three, namely: 1) An increase in SGPT > 20 times normal: acute viral hepatitis,

liver necrosis (drug or chemical toxicity). 2) Increased 3-10 times normal: mononuclear infection, chronic active hepatitis, extra hepatic bile duct obstruction, Reye's syndrome. 3) Increased 1-3 times normal: pancreatitis, fatty liver, Laennec's cirrhosis, biliary cirrhosis.

2.3.5 The Conditions that Increase SGOT Levels in the Blood

According to Riswanto (2009) conditions that can increase SGOT levels are divided into three, namely: 1) Increased height (> 5 times the normal value): acute hepatocellular damage, myocardial infarction, circulatory collapse, acute pancreatitis, infectious mononucleosis. 2) Moderate increase (3-5 times normal value): biliary tract obstruction, cardiac arrhythmias, congestive heart failure, liver tumors (metastatic or primary), muscular dystrophy. 3) Mild improvement (up to 3 times normal): pericarditis, cirrhosis, pulmonary infarction, delirium tremeus, cerebrovascular accident (CVA).

2.3.6 The Factors Affecting Levels of SGOT and SGPT

Based on research conducted by several experts related to the value of SGOT / SGPT, there are several factors that affect the level of increased levels of SGOT / SGPT, namely as follows. 1) Sleep rest; Patients with hepatitis who do not have adequate sleep rest or sleep time is less than 7 or 8 hours after the examination, there is an increase in SGOT and SGPT levels. 2) Fatigue caused by activity too much or fatigue caused by exercise will also affect the levels of SGOT and SGPT. 3) Taking certain drugs. Halotene, is a type of drug commonly used as an anesthetic. Isoniazid, is a type of antibiotic drug for tuberculosis. Paracetamol is a type of drug that is safe, if taken in the right dosage. But if excessive will cause cirrhosis (liver damage) which

is severe enough to even cause death. In addition to the types of drugs above, there are also other types of drugs that can damage liver function, such as alfatoxin, arsenic, carbon tetrachloride, copper and vinyl chloride (Pramudiantoro, 2013, Lin, et. al. 2008: 14).

2.4 Sleep Rest Needs

2.4.1 The Definition of Sleep, Sleep Patterns and Sleep Regulations

Sleep is a physiological process that is cycled and repetitive, each of which includes a different phase of brain and bodily activity, in this state it is relatively unconscious and full of calm without activity (Potter and Perry, 2006). Sleep is a relatively unconscious activity that is completely unconscious, calm without activity which is a repetitive cyclical activity and each represents a different phase of brain and physical activity (Tarwoto and Wartonah, 2004).

According to Gunawan (2001) sleep patterns are divided into 2, namely: 1) Regular sleep patterns which are also referred to as Non-REM (Non-Rapid Eye Movement) sleep. In this state, most of the organs of the body gradually become less active, breathing is regular, the heart rate decreases, the muscles begin to relax, the eyes and face remain motionless. The Non-REM phase lasts ± 1 hour, so it will be easy to wake up from sleep. 2) Paradoxical sleep pattern which is also known as REM (Rapid Eye Movement) sleep. In this phase, there will be rapid eye movements, heart rate and breathing up and down, while the muscles experience relaxation (total relaxation). This muscle relaxation process is very useful for restoring energy and eliminating all fatigue. The REM sleep phase (deep sleep phase) lasts for ± 20 minutes. In this phase, dreams often arise, delirious or even snoring.

Sleep is an activity that involves the central nervous system, peripheral nerves,

endocrine, cardiovascular, respiratory and musculoskeletal. Each of these events can be identified or recorded with an electroencephalogram (EEG) for brain electrical activity, muscle tone measurements using an electromyogram (EMG) and an electrooculogram (EOG) to measure eye movement (Potter and Perry, 2006).

Sleep regulation and control depend on the relationship between two cerebral mechanisms that alternately activate and depress brain centers for sleep and wakefulness. The reticular activating system (RAS) in the upper brainstem is believed to have specialized cells in maintaining alertness and awareness. The RAS provides visual, auditory, pain and tactile stimuli and also receives stimuli from the cerebral cortex (emotional thought processes) (Potter and Perry, 2006).

The conscious state causes neurons in the RAS to release catecholamines, such as norepinephrine. During sleep, it is released by the release of serum serotonin from specific cells in the pons and midbrain stem, namely the Bulbar Synchronizing Regional (BSR). Wake up and sleep someone depending on the balance of impulses received from the center of the brain, peripheral sensory receptors such as sound, light stimuli and the limbic system such as emotions. Someone who is trying to sleep, they close their eyes and try to be in a relaxed position. If the room is dark and quiet, the activity of the Reticular Activating System decreases, at that time the Bulbar Synchronizing Regional releases serotonin (Brunner and Suddarth, 2001).

2.4.2 The Benefits of Sleep

According to Potter and Perry (2006), during sleep NREM is beneficial in maintaining the function of the heart, liver and during low-wave sleep which in the body releases human growth hormone to repair and renew red blood cells, epithelial cells and special cells such as brain cells. In addition, the body stores energy during

sleep and a decrease in the basal metabolic rate saves the body's energy supply. Detoxification (excretion of toxins) at night by the liver also works well if sleep (deep sleep phase) is sufficient.

2.4.3 Sleep Patterns by Age or Developmental Level

Table 2.1 Sleep Patterns by Age/Development Level

Age	Normal Sleep Pattern
Newborn Baby	Sleep 14-18 hours / day, regular breathing, slight body movement. 50% REM sleep 45-60 minutes sleep cycle, easy to respond to stimuli.
Baby	Sleeps 13-16 hours/day, 20-30% REM sleep, may sleep through the night.
1-3 years old	Sleep about 11-12 hours / day, 25% REM sleep.
3-6 years old	Sleeps about 11 hours/day, 20% REM sleep.
School age	Sleeps about 7-8.5 hours/day, 20% REM sleep
Young adult	Sleep up to 7-8 hours/day, 20-50% REM sleep.
Middle adult	Sleep 7-8 hours / day, 20% REM sleep. May have insomnia and have difficulty sleeping.
Old adult (above 60 years)	Sleeps about 5-6 hours / day, 20-25% REM sleep, stage IV NREM decreases and sometimes absent, often awakens during the night.

Source: (Tarwoto and Wartonah, 2006).

2.4.4 The Factors Affecting Sleep

According to Himle et al., (2000) there are several factors that affect sleep both quality and quantity of sleep, namely: 1) Disease. A person who is sick requires more sleep than normal. However, illness makes the patient sleep deprived, for example in patients with respiratory disorders such as asthma, bronchitis, cardiovascular disease and neurological diseases. 2) Environment. Patients who usually sleep in a quiet and comfortable environment, then changes in the atmosphere such as noise will hinder their sleep. 3) Physical activity. Physical activity, work and exercise can affect sleep by increasing fatigue, it appears that physical activity increases both REM and NREM sleep. 4) Anxiety. In a state of anxiety will increase the sympathetic nerves so that it interferes with sleep. 5) Alcohol. Alcohol suppresses REM normally, a person who consumes a lot of alcohol can cause insomnia and irritability. 6) Drugs. Some types of drugs can cause sleep disturbances, such as Diuretics: cause insomnia, Anti Depressants: REM suppression, Caffeine: increase sympathetic nerves, Beta Blockers: cause insomnia, and Narcotics: suppress REM. 7) Age characteristics. A person's sleep needs are affected by the level of development, the older a person's age the shorter the hours of sleep. 8) Cultural implications. Cultural (habits due to the demands of work such as nurses, doctors, police, security guards) have habits that can affect sleep. Although the developmental stages are similar, bedding, sleep patterns, may vary according to culture.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Research Time and Place

The study was conducted in November 2017. It was conducted in the Smelter Occupational Health Section, Laboratory Installation of Inalum Health Center PT Indonesia Asahan Aluminum (Persero), which is a section that monitors and regularly checks the health of employees.

3.2 Materials and Tools

The material used was blood sample of an employee of PT Inalum (Persero) Kuala Tanjung who received a routine medical checkup. The tools used were a 22G injection syringe to suck blood from veins, tourniquit, alcohol swab, centrifuge to separate serum and frozen blood (blood coagulant) and an automatic blood chemistry analyzer (clinical chemistry spectrophotometer autoanalyzer) as a tool to examine blood samples to produce the results of liver enzyme levels of SGOT and SGPT in the blood, stationery, and a computer as a data processor.

3.3 Research Methodology

The data collected were primary and secondary data. Primary data was the levels of SGOT/AST and SGPT/ALT in the blood from the results of periodic health checks of employees which can be obtained from the Health Center Laboratory Installation of PT Indonesia Asahan Aluminum (Persero). The data to be taken was data from the results of periodic health checks for two periods, namely: medical examination for the period March - May 2017 and direct examination in October - December of 1701 employees. Secondary data was obtained from PT Inalum SPR (Smelter Public

Relations) section, namely the Public Relations section and SAW (Smelter Administration and Walfare) section, namely the personnel section, which includes: data on employees who have shift and non-shift work systems.

The data analysis technique was a paired T-test (Paired T-Test) which compared the results of laboratory examinations of SGOT and SGPT levels for shift and non-shift (day shift) workers, periodic medical check-ups for the period March - May (period I) and September - November 2017 (period II).

3.4 Population and Sample

3.4.1. Population

The population in this study were all employees of PT Indonesia Asahan Aluminum Persero Kuala Tanjung, amounting to 1701 people.

3.4.2. Sample

The sample is part of the number and characteristics possessed by the population. Because the population in this study amounted to more than a thousand, one of the best sampling methods used in this study was the Slovin formula (Sevilla et. al., 1993), as follows.

$$n = \frac{N}{1 + Ne^2}$$

Information:

n = number of sample

N = number of population

e = error tolerance limit (error tolerance)

With a population of 1701 employees and an error tolerance limit of 5%, the sample size is obtained using the Slovin formula as follows.

$$n = \frac{1701}{1 + (1701 \times (0.05^2))}$$

$$n = \frac{1701}{1 + (1701 * 0.0025)}$$

$$n = \frac{1701}{1 + (4{,}25)}$$

$$n = \frac{1701}{5{,}25}$$

n= 324 employess

The 324 employees will be divided into two groups, namely shift and non-shift (day shift) workers.

3.5 The Work Procedure

3.5.1 Sample Preparation

Employees who will be examined and have their blood sample taken are asked to fast the day before the examination for 10-12 hours, starting at 22.00 it is recommended not to eat anymore food, drink enough water and get enough sleep at night. Blood samples were taken in the morning at PT Inalum (Persero) Health Center. Blood samples were taken using a 5 cc volume injection syringe (22G). Samples were taken from the median cubital vein by means of a tourniquet placed on the upper arm, and the place to be punctured was disinfected with 70% alcohol. Each blood sample obtained was put in a blood sample tube without anticoagulant as much as 3-4 ml and given a number or label. After all samples have been collected, all samples left until the blood is completely frozen. After that, all samples were rotated using a centrifuge at a speed of 3500 rpm for 15 minutes. This is done to separate the clotted blood (blood coagulant) from the serum.

3.5.2 Sample Checking

While waiting for the blood sample to finish being rotated in the centrifuge, the computer is turned on, then the automatic blood chemistry analyzer (clinical chemistry spectrophotometer autoanalyzer) is turned on and warmed up and then started up. After that, the QC (Quality Control) reading is carried out. After the blood sample in the centrifuge has been rotated, then the serum is taken/aspirated using a 500 micro liter micro pipette, then put into the reaction sample cup, then given a sample number or label on the sample cup.

Then the samples are put into the tool sample rack. Then the identity, shelf number, sample number, and parameters of the inspection to be carried out are inputted into the computer, namely AST for SGOT and ALT for SGPT. After that, the sample rack containing the serum sample was inserted into the automatic blood chemistry analyzer (clinical chemistry spectrophotometer autoanalyzer). The start writing on the computer is pressed so that the sample analysis process is carried out by the tool. Furthermore, the levels of the results of the SGOT and SGPT analysis will be read on the screen. After the analysis is complete, the results are recorded in the results list table. Then the results are entered into a computer and data analysis is carried out.

CHAPTER V

CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions

Based on the results of research on the effect of the shift work system on liver function enzymes (SGOT and SGPT) in employees of the aluminum smelting factory PT Inalum (Persero) Kuala Tanjung, it shows that there are significant differences in SGOT and SGPT values in employees with shift work from the average value. SGOT Period I, which was 34.4 U/L, rose to 42.0 U/L in period II and the average value of SGPT Period I was 62.5 U/L to 73.4 U/L in period II. Meanwhile, the average value of SGOT and SGPT for non-shift employees also increased, but was still within normal limits, namely SGOT <35 U/L and SGPT <45 U/L. Thus, it can be concluded that working with shift work hours has a greater effect on increasing levels of SGOT and SGPT compared to working with a regular working hour system (non-shift / day shift). Employees with shift work systems experience increased levels of SGOT and SGPT which have an impact on liver function disorders caused by fatigue and lack of rest time. Meanwhile, regular employees (non-shift / day shift) experienced an increase in SGOT and SGPT levels but did not have an impact on liver disorders.

5.2 Suggestions

After doing this research, it is recommended for those who work with a special shift work system who work at night shifts to regulate the amount of sleep rest during the day with the aim of balancing their night work hours. In addition, employees who work with a night shift work system are advised to pay attention to their nutritional intake by consuming foods rich in amino acids and omega 3 such as marine fish, fish

oil, green vegetables, fruits (such as bananas, apples, tomatoes). , carrots and beets), nuts (such as soybeans, walnuts) as well as milk and temulawak extract drinks which are useful for nourishing liver cells damaged by night work. Consuming sufficient mineral water is highly recommended to prevent dehydration of factory workers (Suma'mur, 2013, Sihombing M and Raflizar, 2010).

For other researchers who want to continue this research, it is recommended that they add other variables such as age, years of service, number of hours of sleep rest in a day and other variables that can support this research to be better.