

DESCRIPTION OF THE NUMBER OF LEUKOCYTES IN INDIVIDUALS WHO SLEEP WITH THE LIGHT ON USING A HEMATOLOGY ANALYZER

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ABSTRACT

Many individuals still pay little attention to how to sleep well. During sleep, the body will produce the hormone melatonin. Normal production This melatonin hormone in the body can affect the number of leukocytes, especially neutrophils and lymphocytes. So this study aims to describe the number of leukocytes in individuals who sleep with the lights on using a hematology analyzer . The method in this study uses a quantitative approach to the type of research used in this is descriptive. The type of data used is primary data in the form of research results and documentation, as well as questionnaires and informed consent. The sampling technique in this study used a purposive sampling technique, with a total sample of 30 people. The data obtained from the results of this study are presented in the form of tables and narratives and then presented. Based on the results of the research that has been described, it can be concluded that the number of leukocytes in individuals who sleep with the lights on using a hematology analyzer consisting of 30 samples (100%) has a normal leukocyte count.

Keywords: Leukocyte count, sleep, lights on

INTRODUCTION

When we sleep, our body produces the hormone melatonin. This hormone has many benefits, including boosting the immune system and preventing and inhibiting the growth of cancer cells. The hormone melatonin plays a very important role in the sleep process and the quality of one's sleep. The performance of these hormones is strongly influenced by light, the synthesis and secretion of these hormones are stimulated by dark conditions and are stimulated by bright conditions. Normally the production of this hormone melatonin in the body can affect the number of neutrophils and lymphocytes, an important immune device of the body [18].

Sleep quality is an individual's ability to stay asleep, not just the amount or duration of sleep . Sleep quality indicates the

individual's ability to sleep and get the amount of rest according to their needs . Poor sleep quality results in decreased physiological and psychological health. Physiologically, poor sleep quality can lead to low levels of individual health and increase fatigue or fatigue. Psychologically, poor sleep quality can result in a lack of sleep emotional stability, lack of self-confidence, excessive impulsiveness and recklessness [18].

The regularity and length of sleep of each individual person is a subjective matter. There are people who need more sleep than others. There are people who sleep easily and those who have difficulty sleeping, there are people who sleep peacefully and who are restless and there are people who sleep peacefully in the dark, and so it is . Habits

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play a role in sleep patterns, it will be easier if these habits are followed [3].

Individuals who sleep with the lights on, result in inhibition or even stopping the production of the hormone melatonin which can have a negative impact on the body's immune system. Conversely sleeping with the lights off maximizes melatonin production [16].

An important part of the immune system is the presence of white blood cells (leukocytes) which function to fight infection-causing microorganisms, tumor cells and harmful foreign substances [1].

White blood cells (leukocytes) consist of granulated leukocytes or granulocytes, namely basophils, segmental neutrophils and stem neutrophils and leukocytes that are not granular or agranulocytes which consist of lymphocytes and monocytes [2].

The normal number of leukocytes is 4,000-11,000/ [mm] ^ 3. A decrease in leukocyte levels is called leukopenia which can be found in cases of diseases due to viral infections, bone marrow disease, etc., while an increase is called leukocytosis which can be found in bacterial infections, chronic inflammatory diseases, acute bleeding, leukemia, kidney failure, etc [1].

Until now, in Indonesia, leukocyte counts are generally carried out as part of a complete blood count. The purpose of this examination is to determine the number of white blood cells and to determine disorders that occur in the body [3].

The method recommended by the International Committee for Standardization in Hematology (ICSH) to calculate the number of leukocytes is a method using an automatic hematology analyzer. This tool automatically calculates the number of leukocytes with the principle of electrical impedance, this method is widely used and has a stable standard [3].

The advantage of using an automatic hematology analyzer is that it provides high precision and allows a high number of samples to pass through a system or process. However, routine maintenance, calibration

control, technical personnel who can operate the equipment and stable climatic conditions are required, besides that the prices of equipment and reagents are expensive for developing countries [4].

Based on the description above, the researchers wanted to conduct research on the description of the number of leukocytes in individuals who sleep with the lights on using a hematology analyzer.

Sleep is an unconscious condition where individual perceptions and reactions to the environment decrease or even disappear, and can be awakened with sufficient stimulation. One's goal is believed to be sleep is necessary to maintain mental emotional, physiological and health balance [5].

Sleep is a cyclical physiological process that alternates with long periods of wakefulness. The sleep-wake cycle influences and regulates physiological functions and behavioral responses. Two systems in the brainstem, the reticulum activating system and the bulbar synchronizing area are believed to work together to control the cyclical nature of sleep. and nerve fibers have connections through impulses into the cerebral cortex and into the spinal cord [14].

Reticulum formation assists reflexes and voluntary movements as well as cortical activity associated with full wakefulness during sleep. The reticulum system experiences some stimulation from the cerebral cortex and from peripheral sensory cells and organs. For example: when nature wakes us up from sleep, we are conscious when we realize that we must prepare ourselves for today. Sensations of pain, pressure and sound induce arousal through peripheral cells and organs, arousal is activated by the cerebral cortex and bodily sensations during sleep stimulation of the cortex is minimal [14].

The stages of sleep can be divided into 2 (two) types, namely sleep with slow eye movement, which is called Non-Rapid Eye Movement (NREM), and sleep with fast eye

movement, or Rapid Eye Movement (REM) [6].

Non-Rapid Eye Movement or NREM sleep is comfortable sleep and in NREM sleep brain waves are slower than in people who are unconscious or not sleeping. The NREM type has 3 phases, namely: Phase 1 to sleep, phase 2 to deep sleep, phase 3 to deep sleep [6].

REM sleep is also known as active sleep or paradoxical sleep. This means that REM sleep is very deep in nature, REM sleep is characterized by dreams, relaxed muscles, increased blood pressure, rapid eye movements (eyes tend to move back and forth), increased gastric secretion, irregular muscle movements, heart and respiratory rates regularly is often faster, as well as temperature and metabolism increases [6].

Quality of sleep is a state in which the sleep an individual lives produces freshness and fitness when awakened. The optimal sleep process and conditions during sleep describe the high quality of a person's sleep [7].

Aspects of sleep quality are divided into 3 (three), namely: Psychologically comfortable. It may be that someone is in a state of facing various problems, but the most important thing is how he responds to the problem. If a person remains optimistic in looking at various kinds of problems, believes there will be a way out, then he can sleep well. Conversely, if a person is burdened by various things before going to sleep, for example filled with fear, negative and pessimistic thinking, then his sleep is likely to be more easily disturbed [7].

The body is in a relaxed state (no heavy sleep activity) before going to bed. Physically, the recommended activity is not to do strenuous physical activity just before going to bed. When before going to bed a person should not do sports activities. Activity exercising too close to bedtime will have an effect a disturbance of one's sleep. The recommended time to exercise is in the afternoon, in this case, a few hours before going to bed, one should exercise. The

muscles have obtained the opportunity for relaxation, so that while sleeping one can live it soundly [7].

Rest well during sleep. Actually people sleep through some sleep phase, from the phase of not deep, deep, to not deep sleep. In connection with this deep sleep, experts describe this stage of deep sleep without interruption internal and external which makes sleep not restful [7].

Melatonin is a hormone secreted by the pituitary gland as a chronobiotic which plays a role in regulating normal circadian rhythms as well as the process of puberty, adaptation and immune response. Several studies have found that melatonin plays a role in fighting free radicals, increasing the immune response [8].

The sleep-wake cycle in humans follows a circadian rhythm regulated by the suprachiasmatic nucleus (SCN) which is located in the anterior hypothalamus in the brain. The SCN is often referred to as the body's master circadian clock because of its role in regulating all body functions related to circadian rhythms including core body temperature, hormone secretion, cardio-pulmonary function, kidney, digestive system, neurobehavioral function. The basic molecular mechanism by which neurons in the SCN regulate and maintain their rhythm is through autoregulation that regulates circadian gene products through complex transcriptional, translational, and posttranslational processes. The adjustment between the 24-hour internal circadian rhythm and environmental conditions is influenced by several factors, especially light, physical activity, and the secretion of the hormone melatonin by the pineal gland [9].

Blood is a body tissue that is different from other body tissues, is in a liquid consistency, circulates in a closed system known as blood vessels and carries out the function of transporting various materials as well as the function of hemostasis [10].

Blood functions to maintain a dynamic balance (hemostasis) in the body, including

maintaining body temperature, regulating the balance of water distribution, and also maintaining acid and base balance so that the pH of blood and body fluids remains in its proper state, and defends the body from attack by objects or foreign compounds which are generally considered to have the potential to pose a threat to the body's defenses [10].

Blood is the human blood volume of about 7% -10% of normal body weight and amounts to about 5 liters. The condition of the amount of blood in each person is not the same, depending on age, occupation, and the condition of the heart or blood vessels [10].

Blood consists of 2 main components, namely as follows: Blood plasma which consists of the liquid part of blood which consists mostly of water, electrolytes, blood protein. The corpuscles or blood cells consist of components such as erythrocytes or red blood cells, leukocytes or white blood cells and platelets [11].

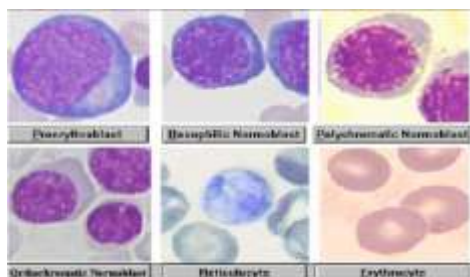


Figure 1. Corpusculatation or Blood Cells

Leukocytes are a group of blood cells that contain a nucleus. In human blood, the normal number of leukocytes averages 4,000 – 10,000 cells/mm³. If the number is more than 10,000 cells/mm³ it is called leukocytosis, while the number is less than 4000 cells/mm³ it is called leukopenia [2].

White blood cells are formed in the bone marrow from stem cells. the type of this cell group is the granular group (granulocytes), namely eosinophils, basophils and neutrophils; and non-granular groups (agranulocytes), namely lymphocytes and monocytes [13].

Lymphocytes have 2 main types, namely T lymphocytes which provide protection

against viral infections and can find and destroy some cancer cells and B lymphocytes which form cells that produce antibodies or plasma cells. Monocytes function to digest dead or damaged cells and provide immunological resistance against various infectious organisms [2].

In leukocyte examination, the number and morphological abnormalities were reported. Amounts reported as normal, increased or decreased. Under normal circumstances, leukocytes that can be found according to standardized sizes are: basophils, eosinophils, rod neutrophils and segmental neutrophils, lymphocytes and monocytes. The six types of cells differ in size, shape, nucleus, color of the cytoplasm and granules inside [12].

Basophils are not always found, their shape and size resemble neutrophils, their cytoplasm contains large and unequal large round granules, dark blue in color, granules can cover the nucleus, sometimes small vacuoles can be found in the cytoplasm [12].

Eosinophils are the same size and shape as neutrophils, but their cytoplasm is filled with large, large, reddish granules [12].

Neutrophils are larger than small lymphocytes, round in shape with lots of slightly reddish cytoplasm, purple nucleus, rod or segment shaped. It is said to be rod-shaped when the core indentation exceeds half the diameter of the core, segment-shaped when the core is divided into several parts that are connected to each other by chromatin threads. The cytoplasm is granular purplish [12].

Lymphocytes are divided into several types of lymphocytes, including small lymphocytes and large lymphocytes. Small lymphocytes 8–10 μm in size, globose in shape, nucleated about the size of a normal red blood cell, the lymphocyte nucleus fills most of the cell size with densely clumped chromatin that is dark blue-purple, and the cytoplasm does not contain granules. Large lymphocytes 12-16 μm in size, round or slightly irregular in shape; oval or round nucleus, located at the edge of the cell. The

cytoplasm is relatively more abundant than small lymphocytes, light blue or may contain red azurophilic granules [12].

Is the largest cell compared to the others, measuring 14-20 μm , irregular in shape, has a nucleus that varies in shape, generally shaped like a blue-purple kidney with chromatin like the brain gyrus. The cytoplasm is grayish in color, contains reddish fine granules and is sometimes vacuolated [12].

An increase in the number of leukocytes (leukocytosis) indicates an acute inflammatory or infectious process, for example pneumonia, meningitis, appendicitis, tuberculosis, tonsillitis, and others. It can also occur in myocardial infarction, liver cirrhosis, burns, cancer, leukemia, parasitic diseases, and stress due to surgery or emotional disturbances. A decrease in the number of leukocytes (leukopenia) can occur in patients with certain infections, especially viruses, malaria, alcoholics, SLE, rheumatoid arthritis, and hemopoietic diseases (aplastic anemia, pernicious anemia) [13].

Examination of the leukocyte count is a routine blood test carried out in the clinical laboratory. Until now, there are 2 methods of checking leukocyte counts that are often carried out, namely the manual method using a counting chamber while the automatic method uses a *hematology analyzer*. Due to the frequent requests for examinations to count leukocyte counts, to count leukocytes manually would take quite a long time and was not fast enough, an automatic leukocyte count was carried out, in which this tool uses electricity with the principle of independence. Even though the automatic price is quite expensive, this tool is able to check quickly, precisely and easily [13].

Sleep quality is influenced by several factors. Factors that affect the quality of sleep such as physical illness, drugs, lifestyle, emotional stress, physical exercise environment and fatigue, and food intake. The hormone melatonin plays an important role in the sleep process and the quality of

one's sleep. The performance of the sleep hormone is strongly influenced by light [14].

The light that is there when we sleep will inhibit the production of the hormone melatonin in the blood. Indirectly, light can inhibit the circadian rhythm mechanism (biological clock). That is why sleep disorders first appeared with the invention of the light bulb. With the presence of light, the work of the circadian rhythm is unstable, the body is forced to ignore sleep orders and is forced to move late into the night. The initial sign of disruption of circadian rhythms is disruption of the sleep process due to low production of the hormone melatonin [6].

Light is light or light. With light allows the eye to catch the shadows of objects that are around. The light from the lamp penetrates the eyelids and can then stimulate the brain to keep active, even though a person is in a state of closing his eyes. This can affect the production of the hormone melatonin. This hormone is produced by the pineal gland which is near the human brain. This hormone can play an important role in regulating a person's sleep cycle. The hormone melatonin can be produced and produced if the bedroom is dark [16].

The condition of the body in people who sleep with the light on can affect or stop the production of the hormone melatonin. This is because as long as there is light, the retinal photoreceptors will experience hyperpolarization which will inhibit the secretion of neorofirefin [18].

Retinihipotalamus - pineal system will be inhibited so that melatonin is secreted in small amounts. Unlike sleeping, turning off the lights (dark atmosphere) will stimulate the pineal gland to produce the hormone melatonin. When there is no light, the photoreceptors secrete neopfrinephrine which activates the retino-hypothalamus-pineal system. Alpha and beta adrenergic receptors increase in the pineal gland. The contact between nerofineprin and its receptor will activate the arylalkyloamin enzyme which will initiate the synthesis of melatonin and its secretion [18].

RESEARCH METHOD

This study uses a quantitative approach which aims to identify the number of leukocytes in individuals who sleep with the lights on using a Hematology analyzer.

This type of research uses a descriptive method which aims to describe the number of leukocytes in individuals who sleep with the lights on using a Hematology analyzer for 2019-2021 D-III Health Analyst students at Bina Mandiri University, Gorontalo.

The type of data in this study used primary data which consisted of the results of examining the number of leukocytes in individuals who slept with the lights on accompanied by documentation at Toto Kabila Hospital, Kab. Bone Bolango. Besides that, other primary data, namely from questionnaires and informed consent, were prepared by the researchers.

1. Leukocytes are a part or component of blood that functions to fight microorganisms that enter the body. The normal value is 4,000 – 10,000 cells/mm³.
2. The number of leukocytes is the number of white blood cells in a person's blood as measured using a hematology analyzer.
3. Sleeping with the lights on is an individual habit when sleeping by turning on the lights while falling asleep.

Laboratory examination is an act and examination procedure that aims to determine the diagnosis or help establish the diagnosis of disease. The laboratory examination consists of pre-analytical, analytical and post-analytic [2].

1. Pre Analytics

- a. Patient preparation : there is no special preparation, patients/respondents are only asked to fill out informed consent and a questionnaire.
- b. Tools preparation.

The tools used in this study were : 3 ml syringe, alcohol cotton, tourniquet, EDTA tube, hematology analyzer (DIRUI type BCC-3600) and examination results sheet.

Sample Preparation: The sample used in this study was venous blood from D-III Health Analyst Program students at Bina Mandiri University, Gorontalo.

The procedure for taking venous blood is as follows:

1. The patient's arm is cleaned with 70% alcohol cotton and left to dry.
2. A tourniquette/rubber shield is placed on the upper arm and the patient is asked to clench his hand so that the veins are clearly visible.
3. The vein is punctured with a syringe (tilt angle 45 degrees), in the middle or clear part and then the blood is sucked as needed.
4. The protective rubber is released slowly.
5. Cotton is placed over the needle and the needle is pulled out.
6. The patient is asked to press or bend the puncture site for a while until the puncture site is not bleeding.
7. The syringe needle is removed and the blood flows into a tube filled with EDTA that has been labeled with the patient's identity

2. Analytic

Examination of the number of leukocytes with a Hematology Analyzer Brand Dirui type BCC-3600.

- a. When the screen displays the main menu, confirm the "wholeblood" test mode at the bottom of the menu.
- b. Homogenize the blood sample, then insert the probe into the tube containing the blood sample.
- c. Pressed the "Count Button" (dark blue) to start inhaling the sample. During the suction process, make sure the probe tip is immersed in the blood sample so that no air is sucked in, but the probe tip does not touch the bottom of the tube.
- d. While sucking the sample, the indicator will be yellow.

- e. If you have sucked the sample, the indicator will change color from green to yellow, the probe will automatically enter the tool and start the sample calculation process.
- f. The inspection results will be displayed on the screen and automatically printed when the printer is set to "Auto".
- g. Read the inspection results and record them.

3. Post Analytics

The reference value for the number of leukocytes is 4,000 – 10,000 cells/mm³ [1].

RESEARCH RESULT

Based on the results of the research that was carried out on September 9 2022 conducted at the Toto Kabila Hospital Laboratory, 30 individual venous blood samples who slept with the lights on were examined with a Hematology Analyzer, described in table form along with narrative and presented as follows:

Table 1. Results of Examination Percentage of Leukocyte Count in Individuals Who Sleep with the Lights on Using a Hematology Analyzer Tool

No	Results Leukocyte Count	Lights On		
		Normal	Leukocytosis	Leukopenia
1.	Leukocyte Count	100 %	0%	0%

Source : Primary Data (2022)

Based on the table above, research data was obtained that the examination of leukocyte count using a hematology analyzer in individuals who slept with the lights on showed that all samples, namely out of 30 samples (100%), the leukocyte count was within normal limits.

DISCUSSION

Based on the results of the study, it was found that the number of leukocytes in individuals who slept with the lights on did not experience abnormalities in the number of leukocytes, in other words the leukocyte counts of all respondents (100%) were normal. The normal value of leukocytes is in the range of 4,000-11,000 mm³. Normally the number of leukocytes in an individual who sleeps with the light on, the individual is not sick and has sufficient defense against foreign substances that can enter the body [8].

The results of this study are in line with the results of studies conducted by previous researchers that individuals who sleep with the light on show normal leukocyte counts, normal basophils, normal eosinophils, normal rod neutrophils, normal lymphocytes, normal monocytes, but the neutrophil segment decreases by 20%. The results of examinations on individuals who sleep with the lights turned off show a normal number and type of leukocytes. While the results regarding the relationship between sleep quality and the number of leukocytes, lymphocytes, monocytes and granulocytes obtained the results that the Fisher's exact correlation test was sig. 0.009 for leukocytes, sig. 0.031 for lymphocytes, 0.000 for monocytes, and 0.012 for granulocytes, thus concluding all sig results of <0.05 indicate that there is a relationship between sleep quality and levels of leukocytes, lymphocytes, monocytes and granulocytes [8].

There were normal results on leukocyte counts for all samples in this study, supported by the theory put forward, that during sleep, the body will produce the hormone melatonin, which has many benefits, including boosting the immune system and preventing and inhibiting the growth of cancer cells. However, the synthesis and secretion of these hormones are stimulated by darkness and inhibited by light. Normally hormone production in the body affects the number of neutrophils and

lymphocytes, which are a device of the body's defense system. If the immune system is in a normal amount, it will be difficult for the body to get sick. If an individual sleeps with the light on, it will result in inhibition or cessation of the production of the hormone melatonin which can have a negative impact on the immune system. Whereas sleeping with the lights turned off maximizes the production of the hormone melatonin, so it can have a good impact on the immune system [18].

He added that an important part of the immune system is the presence of white blood cells (leukocytes) which function to fight infectious microorganisms, tumor cells and harmful foreign substances. Leukocytes consist of 6 types, and play a very important role in the immune system. Neutrophils, basophils, eosinophils, and monocytes are included in the non-specific immune system, while lymphocytes are included in the specific immune system. Neutrophil cells play a role in the initial defense of non-specific immunity against bacterial infections. Basophil cells play a role in the inflammatory response. Eosinophil cells play a role in the response to parasitic and allergic diseases. Lymphocytes play a role in forming antibodies that circulate in the blood or in the cellular immune system. Monocyte cells undergo a maturation process to become macrophages after entering the tissue [18].

Although theoretically it is said that the light that is present when we sleep will inhibit and reduce the production of melatonin in the blood, and indirectly, the light inhibits the circadian rhythm mechanism (biological clock) where the initial sign of disruption of the circadian rhythm is disruption of the sleep process due to low production of the hormone melatonin [8].

However, light is not the only factor that affects sleep quality, but there are several factors that play a role, such as physical illness, drugs, lifestyle, emotional stress,

physical exercise environment and fatigue, and food intake [14].

According to researchers, this is what causes the leukocyte count to be normal even though sleeping with the lights on [8].

Based on the researcher's direct experience in the research process, there are limitations to the research experienced and there are several factors that can be paid more attention to future researchers in further perfecting their research. One of the limitations felt by the researcher is that during the process of collecting the data provided by the respondent through the questionnaire, sometimes it does not show the opinion of the respondent, this happens because sometimes there are differences of opinion, thoughts, assumptions and understanding.

CONCLUSION

Based on the results of the research and discussion that has been described, it can be concluded that the number of leukocytes in individuals who sleep with the lights on which consists of 30 samples (100%) have a normal leukocyte count.

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