Bioactivity of Phytochemicals in Curcuma Domestica on Lymphocyte Cell Count in Mice (Mus Musculus)

Nastiti Kartikorini[1(✉)], Rahma Widyastuti[2], Diah Ariana[1], Baterun Kunsah[1], and Florencia Dita Permata[1]

[1] D3 Medical Laboratory Technology Study Program, Faculty of Health Sciences, Universitas Muhammadiyah Surabaya, Surabaya, Indonesia
nastitikartikorini4956@gmail.com

[2] Applied Bachelor of Medical Laboratory Technology Study Program, Faculty of Health Sciences, Universitas Muhammadiyah Surabaya, Surabaya, Indonesia

Abstract. The immune system or immunity is a system that can protect the human body against foreign objects that enter the body. People can maintain their immune system by consuming healthy and nutritious food, exercising regularly, maintaining personal health, taking supplements or immune-boosting vitamins, and consuming traditional herbs, such as juice from the phytochemical Curcuma domestica (turmeric). Curcuma domestica is a tropical plant, and it can find in many parts of Asia, one of which is Indonesia. The main components of the phytochemical Curcuma domestica are curcumin and essential oils. In contrast, the phytochemicals of curcumin and essential oils can boost the immune system because they are proven to increase lymphocyte cells. This study aimed to determine the bioactivity of phytochemicals in Curcuma domestica on the number of lymphocyte cells in mice (Mus musculus). This study was experimental research with the pre and post-test design. The sample used in this study was 32 mice divided into two groups, including control and treatment groups. Data of lymphocyte cells were analyzed using a manual method, namely peripheral blood smear. The data were analyzed using the SPSS (Statistical Program Social Science) application using the independent t-test. The results were p = 0.000 (p 0.05), so Ho was rejected, and Ha was accepted. The results obtained in the control group showed that the average number of lymphocyte cells before treatment was 42.5%, and after treatment was 47.5%. While in the treatment group, the average number of lymphocyte cells before being given the phytochemical extract of Curcuma domestica was 41.75%, and after being given the phytochemical extract of Curcuma domestica was 57.25%. The conclusion is that giving the phytochemical extract of Curcuma domestica affects the number of lymphocyte cells in mice (Mus musculus).

Keywords: Bioactivity of phytochemicals · Curcuma domestica (Turmeric) · lymphocyte cell count · Mice (Mus musculus)

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1 Introduction

The immune system is a system that forms the ability in the body to fight bacteria, viruses, and other microbes so that the body avoids a disease. Immunity in the human body is very important. If the body's immunity decreases, the ability to protect our body also decreases. Thus, bacteria, viruses, and other microbes or pathogens can grow and multiply in the human body. Several diseases associated with a lack of immunity include TB, HIV, THYPUS, and FLU, and what is often discussed at this time is COVID-19 [1].

East Java became the second province with the largest TB cases in Indonesia, reaching 22,585 cases with 208 TB cases in children, and the city of Surabaya became the highest city with TB cases reaching up to 3,093 cases [2]. According to a report from the Ministry of Health, Surabaya was ranked first in the highest HIV and AIDS cases in East Java province, with a total of 7,000 cases [3]. In the case of COVID-19 in Surabaya, the total of Patient Under Investigation (ODP) was 1,398 people, the total of Patient Under Surveillance (PDP) was 523 people, and the total of confirmed cases was 208 people [4].

In healing the above diseases, strong immunity is needed to avoid or recover from the disease. One of the cells that play an important role in the immune system or commonly called immunity, is a lymphocyte cell. B lymphocytes are derived from bone marrow cells and are important in forming humoral antibodies in the blood. In contrast, T lymphocyte cells come from the thymus (thymus gland) and have an important role in forming antibodies cellularly. The normal value of lymphocyte cells in humans is 25–40% of the total number of leukocytes [5]. There are various ways to strengthen the immune system, including taking medicines that contain vitamin C, herbal ingredients, and traditional herbs. Plants that can be consumed and can be made into herbs to strengthen the immune system include ginger and turmeric [6].

Curcuma domestica (Turmeric) is a tropical plant, and it can be found in many parts of Asia, one of which is Indonesia. Curcuma domestica plants are easier to find or obtain, easy to plant, relatively inexpensive, and have many benefits. It is often considered alternative medicine and used as a spice, dye, and herbal medicine [7]. It also has a variety of shapes, including long, short, thick, and straight and some are curved. The main components of Curcuma domestica are the phytochemicals of curcumin and essential oils. The phytochemical content of curcumin in turmeric has many medicinal properties, such as antioxidant, anti-inflammatory, and antibacterial, and it can maintain our immune system [8].

Maintaining immunity is very important for humans. There are many ways to maintain the body's immunity to stay awake, one of which is by consuming traditional herbs, such as juice from Curcuma domestica, containing phytochemicals. The phytochemical of Curcuma domestica can boost the immune system and increase the number of leukocytes. The phytochemical content of curcumin in Curcuma domestica can increase the number of leukocytes, one of which is lymphocyte cells, because it functions as an antigen against disease [9].

The phytochemical curcumin in Curcuma domestica is naturally yellow. Curcumin belongs to a group of polyphenolic compounds that can cause protein denaturation and damage cell membranes. Phenolic compounds contained in the phytochemical of

Curcuma domestica can damage and penetrate bacterial cell walls and then precipitate microbial cell proteins [10].

Population and Research Sample
The population in this study was a group of mice (Mus musculus) obtained from the Central Agency of Veterinary Farma (PUSVETMA), A. Yani Street, 68–70 Surabaya. Meanwhile, the sample from this study was 32 mice (Mus musculus) divided into two groups, each consisting of 16 mice (Mus musculus) in healthy condition with shining eyes, not dull fur, active, good appetite, and approximately 20–30 g.

Research Variables and Operational Definitions of Variables
There are two types of variables used for this research, namely:

1. Independent variable: Administration of Phytochemical extract of Curcuma domestica (Turmeric)
2. Dependent variable: Total lymphocyte cell

The operational definitions of variables are as follows:

1. Provision of Phytochemical Extract of Curcuma domestica
   Giving the phytochemical extract of Curcuma domestica to mice (Mus musculus) as much as 1 ml every one time a day for 14 days using the probe through the mouth of mice (Mus musculus). Meanwhile, mice (Mus musculus) not given turmeric juice (Curcuma domestica) were replaced with aquades.
2. The number of lymphocyte cells was calculated using the manual method, namely making a peripheral blood smear that was read under a microscope. The number of lymphocyte cells was obtained from the calculation of the number of lymphocyte cells in the blood smear of mice (Mus musculus). The normal value of lymphocyte cells in humans is around 20–50% [11].

2 Methods of Data Collection and Data Analysis

The method used to examine lymphocyte cells is a blood smear. The blood smear method is intended to quantitatively determine the number of lymphocyte cells in the body. An easy way to do this is by using a microscope. Meanwhile, the data analysis used was the free T-test to determine the difference in the number of mice's lymphocytes before and after administrating the phytochemical extract of Curcuma domestica.

3 Results

The results of the study entitled "Bioactivity of Phytochemical in Curcuma domestica (Turmeric) on the Lymphocyte Cells Count in Mice (Mus musculus) used 32 mice (Mus musculus), which were carried out with two treatments and 16 repetitions. The examination was carried out by looking at the number of lymphocyte cells in mice (Mus musculus) before and after administration of the phytochemical extract of Curcuma domestica between the control group (TP) and the treatment group (P) to obtain the data in Table 1 as follows:

Table 1. Research Results of Phytochemical of Curcuma domestica on Lymphocyte Cell Count in Mice (Mus musculus)

Control Group				Treatment Group			
Sample Code	Lymphocyte Cell Number (%)		Difference (%)	Sample Code	Lymphocyte Cell Number (%)		Difference (%)
	Before	After			Before	After	
K1	44	52	8	P1	25	44	19
K2	40	45	5	P2	41	60	19
K3	40	46	6	P3	47	65	18
K4	44	46	2	P4	46	58	12
K5	42	50	8	P5	48	65	17
K6	41	42	1	P6	50	63	13
K7	41	48	7	P7	49	65	16
K8	40	49	9	P8	30	49	19
K9	49	50	1	P9	30	45	15
K10	40	48	8	P10	43	55	12
K11	43	46	3	P11	47	60	13
K12	44	47	3	P12	42	55	13
K13	44	50	6	P13	42	58	16
K14	44	52	8	P14	43	58	15
K15	42	44	2	P15	39	56	17
K16	42	45	3	P16	46	60	14
Quantity	**680**	**760**	**80**	Quantity	**668**	**916**	**248**
Average	**42,5**	**47,5**	**5**	**Average**	**41,75**	**57,25**	**15,5**
SD	**2,37**	**2,89**	**2,83**	**SD**	**7,39**	**6,55**	**2,50**

Information: K: Control; P: Treatment

The average increase in the number of lymphocyte cells in the Table 1 shows a difference between the average of the control group (TP) and the average of the treatment group (P). In contrast, the average difference between the treatment groups was higher than the average difference between the control group. In the control group, the average number of lymphocyte cells before treatment was 42.5%, and after treatment was 47.5%. While in the treatment group, the average number of lymphocyte cells before being given the phytochemical extract of Curcuma domestica was 41.75%, and after being given the phytochemical extract of curcuma domestica was 57.25%. The following is a graph of the average difference in the number of lymphocyte cells in the control and treatment groups (Fig. 1).

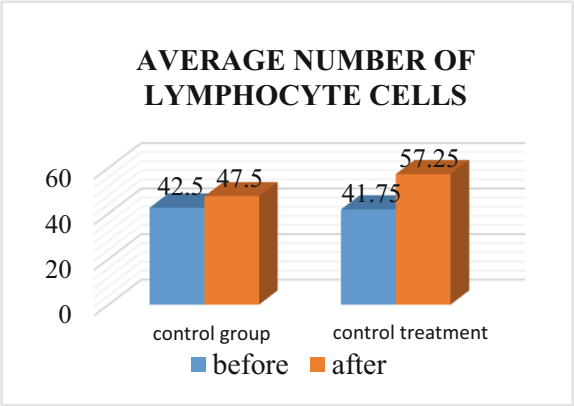

Fig. 1. Bioactivity of Phytochemical in Curcuma domestica (Turmeric) on Lymphocyte Cell Count in Mice (Mus musculus)

3.1 Data Analysis

The research data contained in Table 1 were processed using the SPSS (Statistical Program Social Science) application. then, the normality test was carried out using the Kolmogorov-Smirnova test, and the data were normally distributed with $p > 0.05$ (attached in the attachment). Furthermore, the data was tested using the homogeneity test, and the data was declared homogeneous with a result of $p > 0.05$ (attached in the appendix). After the data was declared normal and homogeneity, the independent T-test (Independent Sample T-test) was carried out. A free T-test was conducted to determine the effect of increasing the number of lymphocyte cells in mice (Mus musculus), which were given the phytochemical juice of curcuma domestica and without the phytochemical extract of Curcuma domestica. based on the tests carried out, it can be seen that the significant value was (p) = 0.000 (<0.05), so Ho was rejected, and ha was accepted, so there was a significant effect on the number of lymphocytes between mice (Mus musculus) given turmeric juice (Curcuma domestica) with mice (Mus musculus) that were not squeezed with turmeric (Curcuma domestica).

4 Discussion

Based on the results of research on the phytochemical bioactivity of curcuma domestica on the number of lymphocyte cells in mice (Mus musculus). This research shows that the effect of turmeric (Curcuma domestica) juice has been shown to increase the number of lymphocyte cells in mice (Mus musculus). This can be seen from the results of the difference in the average calculation, which shows that there is a difference in the amount between the control group without turmeric juice (Curcuma domestica) with an average difference of 5% and the treatment group given turmeric juice (Curcuma domestica) with an average difference 15.5%. The t-test results show that the significant result is 0.000 (<0.05), so Ho is rejected, and Ha is accepted.

Administration of phytochemical extract of Curcuma domestica increases the number of lymphocyte cells in mice (Mus musculus). Curcuma domestica contains an active compound, namely curcumin, where curcumin has many benefits, including as an antibacterial, antioxidant, anti-inflammatory, and very good antiviral used to increase our immune system to stay healthy [6, 12]. The phytochemical content of Curcuma domestica functions as an immune stimulant and as an antigen against disease [9, 13]. The phytochemical Curcuma domestica has anti-inflammatory properties that can inhibit the production of prostaglandins in the cyclooxygenase cycle through the process of inhibiting the activity of the cyclooxygenase enzyme and suppressing leukotriene biosynthesis by inhibiting lipoxygenase and binding free radicals that can cause the inflammatory process [14, 15].

In addition to the curcumin content, according to Yuliati et al. [16], essential oils can also be used as antibacterial agents. This is because essential oils contain hydroxyl and carbonyl functional groups, including phenol derivatives. These hydroxyl and carbonyl functional groups can inhibit the growth of bacteria by damaging the process of cell membrane formation so that the cell membrane is not formed perfectly.

Curcuma domestica is a plant that is very easy to find or people often encounter in our area, and the price is relatively low. This Curcuma domestica plant is often used as a spice or kitchen spice, as a coloring agent, can also be made herbal medicine, and is often considered as an alternative medicine. This Curcuma domestica plant has many benefits, including increasing our body's resistance to avoid disease. Some researchers have also tested the benefits of Curcuma domestica and found many benefits to help our body's health needs, especially during a pandemic like this.

Based on the above results, it can be proven by the results of the number of lymphocyte cells in mice (Mus musculus) after being given the phytochemical juice of Curcuma domestica (turmeric) experienced a significant increase. Due to the content of curcumin and essential oils in Curcuma domestica, it functions as an immune system. Increasing the body's resistance can help us avoid contracting a disease and avoid bacteria, viruses, and other microbes or pathogens. So that the phytochemical extract of Curcuma domestica can be used as a choice of herbal medicine to increase human endurance was 57.25%.

Suggestion

1. For Further Researchers.
   For further research, it can be done by adding other phytochemicals, such as ginger, and java ginger, to increase body resistance and maximize the number of lymphocyte cells.
2. For Educational Institutions
   This research can be used to add broader knowledge and as input for learning media in developing science in the field of basic chemistry for health and hematology in educational institutions, especially medical laboratory technology.
3. For Society
   People can consume turmeric juice to increase endurance because it contains curcumin and essential oils, so it can be a substitute for chemical drugs to increase endurance.

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