The Number of Lymphocyte and Monosit due to Hypoxic Hypoxia

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Abstract
Oxygen have an important role in body metabolism. Lack of oxygen can caused uncomplete metabolism. There will be increasing consumtion of glucose in anaerob metabolism. Hypoxia can stimulate the circulatory system and hematology to improve oxygenation function. This research purpose to knows effect of hypoxic hypoxia duration to the lymphocytes and monocytes on Rattus norvegicus. This is experimental research, pre and post control group design. Hypoxia condition made from modification of hypoxia chamber with 10% oxygen level from total volume of chamber. Subject is male of Rattus norvegicus 2 month's old weight 150 – 200 grams. Measuring of lymphocytes and monocytes used manual hemocytometer and the hemoglobin use spektrofotometer. Data analysis used t-test and oneway anova CI 95 %. Results of analysis with Oneway-ANOVA statistical test showed there was no difference in the number of lymphocytes were statistically significant in the fourth study group after treatment ($p = 0.31$). Similarly Oneway-ANOVA statistical test showed there was no difference in the number of lymphocytes were statistically significant in all four study group after treatment ($p = 0.99$). The number of lymphocytes and monocytes increased due to hypoxic hypoxia although not statistically significant. Increasing the number of lymphocytes highest in the group induced hypoxic hypoxia 36 hours and the number of monocytes highest in the group induced hypoxic hypoxia 12 hours.
Keywords : lymphocytes, monocytes, hypoxia, oxygen

Hypoxia is an insufficient condition does not meet the needs of oxygen in the body due to deficiency of oxygen or the increased use of oxygen in the cellular level[1]. The basic purpose of cardiorespiratory system is to send oxygen (and substrate) into the cells and disposing of carbon dioxide (and other metabolic outcomes) of cells. Appropriate defense of this function depends on the respiratory and cardiovascular systems were intact and the inspired air supply adequate oxygen. Due to hypoxia is a change in the central nervous system, especially in the higher brain centers. Acute hypoxia will cause interference judgment, motor incoordination and a clinical picture that resembles a picture on acute alcoholism. If prolonged hypoxia, symptoms of fatigue, dizziness, apathy, impaired concentration, delays reaction time and decreased working capacity will occur. So hypoxia worsens, brain stem center is exposed, and death is usually caused by respiratory disorders[2].

Causes that can lead to hypoxic conditions there are several types, one of which is a condition where the pressure O2 contained in the arteries decreases. This condition is known as hypoxic hypoxia[3]. Hypoxic nature there are 2 that does not feel the arrival and painless[4]. Hypoxia is one cause of early medical emergency[5].

Maintenance of tissue oxygenation depends on three organ systems namely cardiovascular system, hematology, and respiration. If the flow of oxygen to the tissues is reduced, or if the excessive use of the network, the metabolism will change from aerobic to anaerobic metabolism to provide enough energy for metabolism[6]. Lack of oxygen can cause metabolism is not perfect, there is a lack of O2 characterized by hypoxia, which is in the process may further cause tissue death can even be life threatening[7].

Hypoxia associated with the occurrence of inflammation. Leukocyte consists of two main groups of agranular (lymphocytes and monocytes) and granular (neutrophils, eosinophils, and basophils). Leucocytes active role in the cellular and humoral defense against foreign objects[8]. Neutrophils play a major role in acute inflammation due to its composition in leukocytes at most and the time needed to reach the infected cells more rapidly than other types of leukocytes[9].

Seeing the importance of oxygen and its influence in the lives of hematology system, the researchers are interested to study the relationship between hypoxic conditions the number of lymphocytes and monocytes.

Method

This type of research is experimental research. The research design used is a pre- and post-control design. This research was conducted in the laboratory of the University Centre, Gadjah Mada University (PAU UGM) in Yogyakarta. Subjects were Rattus norvegicus males obtained from laboratory PAU University of Gadjah Mada. The samples used were Rattus norvegicus Spraque Dawley strain male 3 months old, weighing 150-200 grams. Samples are grouped randomly (simple random sampling) into 4 groups: 1 control group, one group of the induction of hypoxia for 12, 24, and 36 hours with each group consisting of 6 animals healthy norgicus Rattus. The air inside the enclosure is conditioned only 8-10% oxygen. Before and after the induction of hypoxic hypoxia examined the number of lymphocytes and monocytes by spectrometric methods. The results are analyzed using ANOVA test.

Results

Results were taken from data on the number of lymphocytes and monocytes before and after treatment.

Table 1. Number of lymphocytes and monocytes Before Treatment

		Mean	Minimum	maximum
Lymphocytes	Control	85.17	79.00	90.00
	treatment 1	79.50	75.00	86.00
	treatment 2	82.67	62.00	91.00
	treatment 3	85.50	78.00	89.00
monocytes	controle	6.50	3.00	10.00
	treatment 1	8.17	2.00	15.00
	treatment 2	5.67	2.00	11.00
	treatment 3	6.00	4.00	8.00

Table 1 shows that the average number of lymphocytes and monocytes before treatment, with the standards deviation, minimum and maximum values in the fourth kemompok research subjects prior to treatment. Furthermore dilkukan homogeneity test in the number of lymphocytes and monocytes four study groups.

Table 2. Test Homogeneity Total Lymphocytes and Monocytes Before Treatment

	Levene Statistic	df1	df2	Sig.
Lymphocytes	1.388	3	20	0,28
Monocytes	1.758	3	20	0,19

Table 2 shows that the number of lymphocytes in the four treatment groups showed results that there is no statistically significant difference (p = 0.28). Similarly, the number of monocytes in the four treatment groups showed results that no statistically significant difference (p = 0.19).

Results of analysis with Oneway-ANOVA statistical test showed there was no difference in the number of lymphocytes were statistically significant in all four study groups before treatment (p = 0.40). Similarly Oneway-ANOVA statistical test showed there was no difference in the number of lymphocytes were statistically significant in the fourth research groups before treatment (p = 0.53).

The number of lymphocytes and monocytes after treatment showed results that can be seen in Table 3.

Table 3. Number of lymphocytes and monocytes After Treatment

		Mean	Minimum	Maximum
lymphocytes	control	84.00	75.00	93.00
	treatment 1	81.17	69.00	89.00
	treatment 2	84.00	71.00	90.00
	treatment 3	88.00	83.00	91.00
monocytes	control	143.17	52.00	306.00
	treatment 1	296.33	162.00	385.00
	treatment 2	216.83	82.00	656.00
	treatment 3	144.33	60.00	270.00

Table 3 shows that the average number of lymphocytes and monocytes before treatment, with the standards deviation, minimum and maximum values in the fourth kemompok research subjects prior to treatment. Furthermore dilkukan homogeneity test in the number of lymphocytes and monocytes four study groups.

Table 2 shows that the number of lymphocytes in the four treatment groups showed results that there is no statistically significant difference (p = 0.28). Similarly, the number of monocytes in the four treatment groups showed results that no statistically significant difference (p = 0.19).

Results of analysis with Oneway-ANOVA statistical test showed there was no difference in the number of lymphocytes were statistically significant in the fourth study group after treatment (p = 0.31). Similarly Oneway-ANOVA statistical test showed there was no difference in the number of lymphocytes were statistically significant in all four study group after treatment (p = 0.99).

Discussion

The results of this study indicate that the number of lymphocytes and monocytes increased due to hypoxic hypoxia although not statistically significant. Increasing the number of lymphocytes highest in the group induced hypoxic hypoxia 36 hours and the number of monocytes highest in the group induced hypoxic hypoxia 12 hours.

Several physiological and pathological states can cause systemic or localised tissue hypoxia and accordingly all nucleated cells can sense and respond to changes in the oxygen concentration[10]. The organism's response to hypoxia is multifactorial involving the haematopoietic, respiratory, and cardiovascular systems in order to maintain adequate tissue oxygenation. However, severe hypoxia causes oxidative stress in blood[11,12]. Additionally, hypoxia induces a microvascular inflammatory response leading to increased vascular permeability and leukocyte-endothelial adherence and emigration[13,14].

Phagocytosis is important for the organism in the defence against invading microorganisms and in ridding the body of dead cells[15]. Phagocytes include several cell types such as neutrophils, monocytes, macrophages, dendritic cells, and mast cells. A disturbed phagocytosis, found in several diseases, results in increased susceptibility to bacterial infections[16,17]. A study by Wang and Liu carried out on healthy volunteers exposed to a 12% oxygen concentration demonstrated that hypoxia increased chemotaxis, phagocytosis and respiratory burst in leukocytes[18]. The study group also showed that moderate exercise performed under an oxygen concentration of 12% enhanced phagocytosis and promoted apoptosis of neutrophils[19].

Summary

The number of lymphocytes and monocytes increased due to hypoxic hypoxia although not statistically significant. Increasing the number of lymphocytes highest in the group induced hypoxic hypoxia 36 hours and the number of monocytes highest in the group induced hypoxic hypoxia 12 hours.

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