

The Effects of Breathing Exercise Toward IgG, Beta Endorphin and Blood Glucose Secretion

Siswantoyo^{1,2}, Mohd. Saleh Aman²

¹Faculty of Sport Science, Yogyakarta State University, Indonesia

²Sport Centre, University Of Malaya, Malaysia

¹splc_fikuny@yahoo.com

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Abstract – This study aimed to demonstrate the influence of breathing exercise toward IgG, Beta Endorphin and Blood Glucose Secretion In The Elderly. This is experimental research with the pretest – posttest design. The sample used the elderly 10 men aged 35-45 years. The unit of analysis in this study was blood taken from cubity vein, checking the blood glucose levels used glucometer, beta-endorphin and IgG used ELISA method. Data analysis statistics using the SPSS for windows, was conducted the t-tests. The results showed that based on the statistical analysis, IgG significantly ($p:0.013$). The mean increase in IgG was 33.266 ng/mL, beta-endorphin significantly ($p:0.000$). The mean increase in endorphin was 3.922 ng/mL, and the decrease of blood glucose showed significant ($p:0.000$). The mean decrease in blood glucose levels was 28.9 mg/100ml. Blood glucose levels showed a decline after the breathing exercise. Conclusion, It can be concluded that regular, targeted and programmed breathing exercise seven week can increased the secretion of IgG and beta endorphins, as well as decreasing blood glucose levels. Breathing exercise are alternative sports to improve immunity.

Keywords – Breathing exercise, Immunity, Elderly

I. INTRODUCTION

In China, breathing exercise are widely used for respiratory therapy in various hospitals and rehabilitation centre. In Indonesia there are many kinds of schools of martial arts and schools of respiratory arts, but the use of maintenance therapy and breathing exercise towards healthy, fresh life is not optimally implemented. Breathing exercise can improve physical fitness and body immunity [1]. Breathing exercise are the efforts to develop stressor reduction and to increase the quality of human resources, which are managing stressors to maintain and even restore homeostasis [2]. Physiologically, the levels of body condition of ages

were different. In relation to the age, the elders generally experience degeneration of the work quality of their body organs. However, it can be improved by doing exercise, because the exercise will be able to stimulate the increase of hormone secretion. Although numerous benefits have been expressed above, but the influence of breathing exercise toward the increase of immunity (Beta endorphin, IgG and the decrease in blood glucose levels) are still unclear.

Breathing exercise intended above are the sports which rely on the three main components which are integrated in its implementation, namely: stance of motion exercise, breathing flows (inspiration - hold - expiration, with a certain rhythm), and concentration (spiritual: *dhikr*). Breathing exercise which are used in this study is the LSPSN model. In this breathing exercise, there are nine levels, namely: the level of pre-basic, basic, fine control, combined, hard control, the combined of hard control, the direction, one step, and meditation [3; 1]. At the primary level, the time of breath holding in every motion, based on previous studies ranges from 37 to 52 seconds [4] mentions that in the Korean *amachacidodives*, the breath holding lasted in 30 seconds will put the levels of blood gases in the normal category, while holding breath in 32-95 seconds results in the arterial mean of PO_2 62 ± 14 s. The normal blood gas is 97.4 [5]. Thus, the breathing exercise can be categorized as mild hypoxia. Hypoxia exercise will more powerfully stimulate as immunologic stress response compared with other exercise under normal conditions and hypoxia exercise also increase IL-6, neutrophils, NK cell activity, plasma TNF α , IL-10 and induce growth hormones and cortisol [6]. Through regular practices, especially the concentration ones, our mind can be controlled, stable as well as raising the production of ACTH hormone (adrenocorticotropical hormone) and cortisol, which at certain levels can stimulate body immunity to produce

immunoglobulin that plays the role of body immunity [7].

Immunity is required to adapt to life situations and environmental conditions. Our body has the ability to adapt to the stimulating stressor. The stressor is various and can be derived from aspects of psychological, physiological, and physical activities. Breathing exercise are part of stimuli in the form of physical activities. Physical activities can be categorized into two namely aerobic and anaerobic. Basically, aerobic exercise are physical activities performed within a relatively long period, light intensity, and using primary energy sources of carbohydrates, whereas anaerobic physical activities are performed within a relatively short period, with maximum intensity, and using the main energy source of ATP-PC. From the view of physical activities which are based on the use of oxygen, there pop up a lot of variety of sports, usually called breathing exercise. Breathing exercise are identical to the "power within." Doing a lot of exercise can influence personal life and can be used for martial arts, healing, health achievement, developing skills, and other psychic abilities. There are many types of respiratory-based exercise such as reiki, tai chi, self-healing, meditation and some other methods which use additional tools in the form of music that many people refer as the method of grounding. It is revealed that listening to music during exercise will positively influence the athletes.

Physical exercise with the determination of extremely excessive doses will cause unfavourable effects on the body. The effects of the load of physical training on the body resistance have been observed in people who are not athletes. Once doing heavy physical exercise will lower IgA, the moderate load will lower activity of B lymphocytes, the T-cell functions. People who are not athletes who underwent a physical exercise program with the intensity of 60-70%, in the first week lower IgG and IgM. Total lymphocytes and the ratio of Th/Ts decrease the activity of NK cells [8]. Negative effects mentioned above can be minimized if the dose of the given exercise is right. Physical exercise with the proper dosage can lead to the adaptation process of the system levels, namely: the nervous system, the hormone system, the cardio respiratory system, the metabolic system, the neuro-musculoskeletal system, and the body immune system [9-11]. The concept of psychoneuroimmunology is able to explain biological phenomena, whether pathobiology or physiobiology, through linkage behaviour and immunological resistance, with intermediary neurotransmitter, neurohormonal, hormones and cytokines [12,13]. The

concept of Psychoneuroimmunologic can be used to express physiobiology changes caused by breathing exercise.

The development of "import" breathing exercise is currently growing rapidly. In China and India have long developed a method of exercise such as yoga, ayurveda, tai'chi, Qigong, reiki which is done by meditation, relaxation, and concentration that focuses on breathing, and these exercise are usually used for therapy. Doing Tai'chi quan exercise frequently can increase T-lymphocytes in blood [14]. Irregular breathing exercise will cause negative effects on our body, such as pains in muscles and joints and other impacts. Based on the studies above, we need further scientific evidence on breathing exercise. Based on the theory of psychoneuroimmunology, so far there are several paths associated with immunologic endurance. The pathways are through the growth hormone, ACTH, β endorphin, prolactin and other hormones. But from some of the routes that have been frequently used by researchers is the path of ACTH-Cortisol-immune responses. Thus, other channels still require a lot of evidence and further research. Exercise in mild hypoxia conditions can stimulate the increases in a variety of cytokines and provide the stimuli as immunologic stress responses more powerful if compared with exercise in normal conditions [15]. When the stress oxidative occurs, SOD enzymes and catalase inhibit ROS and induce the production of interleukin 6. β endorphin will promote NK cell activities during chronic exercise with high intensity and long duration [16]. IL-6 is produced in skeletal muscle in mice and humans during the long training and high intensity [15, 17].

Meditation in a certain time can lower cortisol levels [18]. With the levels of cortisol which are not too high, it will positively influence T-lymphocytes. Breathing exercise are usually done in a long duration. With regular, targeted, and programmed practices with the proper dose (intensity, duration, frequency and model of exercise), it will achieve the higher immune responses. The mechanism of the increased body immunity will be discussed more clearly and detailed through psychoneuroimmunology exercise, which involves the factors of mental condition (stressful) in the mechanism of immunity changes [19]. Although there are a lot of empirical evidence about the benefits of breathing exercise disclosed above, but the mechanism of the effect of breathing exercise toward the increased immunity responses is still not clear and still requires further study. If such mechanisms can be uncovered and explained, it means that the indirect benefits on body immunity can be found. Starting from the background,

the problem can be formulated as follows: Does breathing exercise affect the increase of body immunity (IgG, beta endorphin and decreased blood glucose levels) of elders.

This research aims to reveal the modulation of immunity in the elders caused by breathing exercise. As the indicators which are measured in this study are beta endorphin levels, immunoglobulin G (IgG), and blood glucose levels of the elders. The hypothesis in this study is that breathing exercise increase beta endorphin levels, IgG and lower blood glucose levels of the elders.

II. MATERIALS AND METHODS

This research is experimental. It is intended to reveal the influence of immune modulation in breathing exercise. The efforts were conducted by measuring blood glucose levels, immunoglobulin G (IgG), and beta endorphin. The study design can be defined as a plan on how to collect, present, and analyze the data to determine the meaning of the data efficiently and effectively [20]. The design used in this study was the pretest – posttest design.

The population were the elders who did breathing exercise in the LSPSN. Determination of the size of the sample in this study was based on the same scope of studies [21]. The size of the sample was calculated using the formula was obtained the number of sample for group was 10 people. Materials used in this research were consists of 10 movements. The breathing exercise training program was conducted in seven weeks beginning with the introduction phase, and subsequently followed by training programs with the frequency of 3 times a week, intensity of sub-maximal, 6 sets /session, and repetition of stances of 15 steps.

The unit of analysis in this study was blood taken from cubital vein. Blood sampling performed twice (for pre&post-test data). The peripheral blood research is based on facts related to the components which reflected the body immunity and experienced the circulation and recirculation [8]. The training was conducted during seven week, 21 session with programmed and regularly which combined physical activities, breathing and concentration, (motion+breath+concentration, which were conducted simultaneously. In this study, the dependent variables: the levels of blood glucose, beta-endorphin (β -end), and immunoglobulin G (IgG).

It used glucometer to checking the variable of blood glucose levels, whereas beta-endorphin and IgG used ELISA (enzyme linked immunosorbent assay). The data analysis was conducted through descriptive and inferential statistics with the computer

program of SPSS for windows. Further statistical analysis was conducted through t-tests.

III. RESULT AND DISCUSSION

In this research, 3 variables (IgG, blood glucose, and β -end), have been collected from 10 people (45-50 years old) breathing exercise training program was conducted in seven weeks of 3 times a week, intensity of sub-maximal, 6 sets /session, and repetition of stances of 15 steps. The detail of the result 3 variable are taken from is presented in table 1 and the detail of changing increasing or decreasing variable is presented in table 2. The results of the t-test analysis are follows.

Table 1. Summary of the results of t-test analysis (n=10)

	Min	Max	Mean	SD	Sign
IGG_PRE	1388.50	1504.75	1471.47	31.11	0.013
IGG_POST	1478.50	1522.25	1504.73	14.29	
END_PRE	16.29	16.96	16.61	0.192	0.000
END_POST	20.30	20.73	20.53	0.131	
BG_PRE	109	146	130.1	10.556	0.000
BG_POST	87	115	101.2	9.041	

From Table 1 above, it can be determined the change difference of each variable. The changes can be seen in the table below.

Table 2. Data changes (Delta) of each variable

NO	IgG	Endorphin	Blood glucose
1	5	3.87	-34
2	122.92	3.93	-44
3	20.83	3.95	-47
4	32.91	4.19	-20
5	7.92	3.94	-51
6	35.42	3.89	-25
7	33.75	3.81	-16
8	42.08	3.91	-7
9	5.83	4.16	-17
10	26	3.57	-28
delta	33.266	3.922	-28.9

Based on the statistical analysis above, it can be inferred that the IgG significantly increased with $p = 0.013$. The mean increase in IgG was 33.266 ng / mL. The increase of IgG was caused by the ability homeostasis of the body. With regular, targeted, and programmed practices, the physical exercise were able to stimulate the body to adapt towards the positive direction (Eustress). Theoretically, in the first two

weeks, the immunoglobulin which was dominant in the body to cope with physical stress was in the form of IgM, and after 2 weeks of having the gene would gradually switch to IgG. The Increase of IgG can be an indicator of the increase of immunity of the participants of breathing exercise. There are research studies which study the relationship between physical exercise and endurance [22]. Physical exercise are good if regularly, targeted and programmed done with the proper doses. Immunity is very sensitive to changes in the dose of physical exercise [23]. Sensitivity changes in the parameters of the body immunity are caused by a mechanism of "stress" that existed at the expense of physical exercise [24]. Based in these conditions, the dose of physical exercise should be considered as one form of response in the body system. Reference [7] reports on the effect of physical exercise on changes in humoral response (IgG and IgM). With regular practice, especially the concentration, mental can be more stable and generate hormones such as ACTH and cortisol at certain levels which stimulate the immune system to produce immunoglobulin that play roles in body immunity. The stressor (physical trainings) increases the concentrations of plasma β endorphin and influence the improvement of the function of B cells and T cells, as well as strengthening the immune system in humans [25].

On the other hand, it is determined that breathing is also able to stimulate the increase of endorphin. Based on the results of t-tests, the significance was 0.000. The mean increase in endorphin was 3.922 ng / mL. Endorphin provides fresh feeling on our body. In addition, endorphin can suppress pain, slow the aging and many other functions. By the increase of endorphins, the body freshness of the participants of breathing exercise increases. Muscle contraction when doing breathing exercise requires the supply of energy. The energy used for muscle contraction is derived from glucose. Endorphins effectively provide euphoria and the composition of endorphin consists of 31 amino acids. Endorphin is produced naturally in the body (the National Cancer Institute, an online, August 2004). The production of endorphins is stimulated by the hypothalamic neuropeptide, corticoliberine. The line of HPA axis plays an important role in the production of adrenocorticotropin and beta-endorphin [26].

Beta endorphin will be produced during exercise in a long duration. With the intensity of supra-maximal of 90% VO₂max substantially increased concentrations of beta endorphin, and can be found on all people who performed these activities. Exercise may activate endogenous opioid system depending on the intensity of

exercise. Over the threshold intensity exercise causes an Increase in the blood levels of beta-endorphin. High intensity exercise with the duration of 30-60 minutes is enough to raise the levels of beta-endorphin. In the women, after having exercise in 8 weeks, the response to beta-endorphin increases in the first hour after exercise [27]. In the year 1980, it was first reported that physical exercise causes the changes of endorphin levels in the blood. It is said that physical training may activate the opioid system and stimulates the production of peptides regularly [28]. Beta-endorphin increase the production of interleukin 4 (IL-4) and also increase the expression of B cells [29].

In this study, the blood glucose is also one of the indicators. The results of the analysis show that blood glucose levels decrease after breathing exercise. The decrease of the levels of blood glucose had significance of 0.000. The mean decrease in blood glucose levels was 28.9 mg/100ml. Overall, the impact of the treatment of breathing exercise is the achievement of freshness of the body, the increase of IgG, and the decrease of blood glucose levels. The three indicators also represented indirectly that the perpetrator immunity increased breathing better.

The results above can explain that through psychoneuroimmunology in the breathing exercise where there are elements of concentration, physical activity and breathing manner can increase immunity. The relationship between the nervous and immune systems is described by [30]. The response of the nervous system can be reflected through neurohormonal secretion. The example of the nervous and hormonal flow system is the hypothalamus – pituitary – adrenal. Thus, both physical and psychological aspects can cause biological activity of the body, including the response of the body immunity [31]. The response dose of physical exercise can be observed on the body immune system [8]. That the body immunity can be described in the blood. The picture of body immunity in the blood can be a reflection of physical health.

IV. CONCLUSION

Breathing exercise which is done on a regular basic, targeted and programmed seven weeks can increase the secretion of IgG, endorphins and decrease blood glucose. Breathing exercise can be used as an alternative, cheap and easy sport to improve immunity.

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