# When taking vitamin C to non-smokers, Changes in The Concertration of Active oxygen in Blood and Pulmonary function

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Abstract- This study was conducted to investigate the effect of vitamin C on the reduction of figures of active oxygen concentraion in the blood by the sulfation function and the improvement of pulmonary function. In the results of the active oxygen concentration in blood, there was a decrease in both the male and female group who took vitamin C compared to before, but the pulmonary function test results did not show any significant difference. Overall, the results of the experiment showed that the use of vitamin C showed a slight improvement in the pulmonary function, but it had a great effect on the reduction of active oxygen in the blood.

Keywords - Vitamin C, Active oxygen, Forced Vital Capacity (FVC), sulfation action

#### I. INTRODUCTION

The human body produces the energy needed for physical activity, and the increase in physical activity leads to an increase in demand for energy, which inevitably accompanies an increase in oxygen uptake [1]. Like this, Oxygen is very closely related to our physical activity. In the process of oxygen metabolism in the body, harmful oxygen or free radicals are produced as a by-product.

This free radical is known to cause DNA damage, deformation and peroxidation, resulting in damage to cells as well as aging and various diseases. Free radicals are chemicals found in plants and animals, and when bacteria, fungi, viruses, and foreign substances enter the body, It acts as a germicide that protects the body by killing or dissolving it.

If this free radical is excessively increased in the body, it is rather a substance with both sides of the mutation that attacks the tissues of the body [2], Recently, the free radical theory related to free radicals has attracted attention. [3]

The body has an antioxidant defense system that includes antioxidant enzymes that can protect themselves from oxidative damage by oxygen free radicals. It can also help with non-enzymatic antioxidants that are ingested as food or medicine. These antioxidant systems have been shown to be complementary to specific antioxidants in tissues during oxidative stress [4], It is affected by a variety of physiological, pathological and nutritional factors [5]. Antioxidant enzymes and non-enzymatic antioxidants play a role in decreasing the risk of oxidative stress by changing the hydrogen peroxide and superoxide anion radicals generated during metabolism into weak and stable molecules such as oxygen and water which is less reactive. [6]. Among these, non-enzymatic antioxidants vitamin C and E have been evaluated as having the most excellent antioxidant ability [7].

Vitamin C, also known as ascorbic acid, is a water-soluble essential vitamin that is easily lost in the body and is known to act as a powerful antioxidant. It is also present in cells and is the most important antioxidant. This suggests that consumption of vitamin C may be a way to reduce oxidative stress by acting antioxidant [8].

The purpose of this study was to investigate the effect of vitamin C supplementation on blood oxygen concentraion and pulmonary function after taking 2 months of vitamin C supplementation. And to have a good effect on the results of blood oxygen concentration and pulmonary function by taking antioxidant supplementation reducing oxidative stress.

# II. PROPOSED ALGORITHM

## A. Subject of experiment

The subjects were 20 male and 20 female students in the Department of Clinical Pathology at Kyungwon University who had good physical condition and did not take vitamin C on an individual basis and did not take any special medication. The subjects were divided into two groups: vitamin C (experimental group : male 10, female 10) and non-vitamin C group (control group : male 10, female 10). Vitamin C group were given vitamin C continuously with sufficient water for 2 months at 3:30 pm.

## B. Ingredients of Vitamin C

Based on the results of antioxidant action of vitamin C, we have been taking vitamin C every day based on the fact that it reduces human stress by lowering the level of active oxygen in the body, Vitamin C used in this study is a health functional food derived from Koryo Eun Dan, and daily vitamin C dose of 1000mg was given with enough water. The recommended allowance of vitamin C per day is only 100mg, but 1000mg of vitamin C should be taken for the purpose of skin beauty, fatigue and stress relief. Therefore, We administered 1000mg of vitamin C to the experimental group at the same time every day for the efficacy, and also vitamin C is water-soluble, it was supplemented with enough water to help maximize absorption.

## C. Active oxygen level test

We made them take 1000 mg Vitamin C daily with enough water, and then took urine specimens from 20 male and 20 female, Using a free Radi Check test paper (a urine kit) from DF Co., Ltd., After putting the urine kit in the paper cup containing the specimen for the recommended time, By comparing the color of the urine kit(colorimetry), as the color is getting thick, We divided into Normal, Cautious, High, Very high groups according to the active oxygen levels, In each group, and they were also divided into upper and lower groups. In this study, both the experimental group and the control group were tested at the beginning of the experiment, After two months of taking vitamin C, both were re-examined.

## D. Breathing test

Both vitamin C (20 patients) and non-vitamin C (20 patients) were tested for their lung capacity at the beginning of the experiment to determine their natural lung capacity and We made them to maintain their daily life without any influence on the control group, For those taking vitamin C, After taking vitamin C with enough water at the same time each day for 2 months, FVC, FEV1, and FEV1% FVC values were used to reevaluate the lung capacity of both the experimental group and the control group (non-use group). At this time, we tried to reduce the error of their condition as much as possible by performing the test three times in both the experimental group and the control group yreferring to the value of the forced vital capacity during the spirometric examination.

## E. Management of experiment of subjects

Control of the control group did not impose any restrictions, A total of 20 male students and 10 female students taking vitamin C were given daily doses of 1000mg of vitamin C with enough water at 3:30PM by the well trained managers to minimize the problems that may arise due to time difference, The main point of the experiment was to make sure that they could take it every day for the correct execution of the steady intake.

## *F. The way of statistics*

Both the experimental group and the control group consisted of 10 males and 10 females, and their spirometry tests were started before the experiment and after the experiment, At this time, the values of FVC, FEV1, and FEV1% FVC were all referenced, and the values were all added up, divided by the number of persons belonging to each group and averaged. At this time, statistics of men and women were obtained separately. Active oxygen levels were also averaged for 10 male and 10 female subjects in the experimental group and the control group, respectively. The total number of persons in the normal, cautious, high, and very high groups was expressed as a percentage.

## III. EXPERIMENT AND RESULT

In the process of oxygen metabolism in the body, harmful oxygen or active oxygen is produced

"The taking of vitamin C can be a way to improve pulmonary function by reducing the oxidative stress due to antioxidant action."

After taking vitamin C (1.000 mg) daily for 2 months, blood oxygen concentration and pulmonary function test were obtained as follows.

## A. Questionnaire survey

In order to compare the concentration of active oxygen according to the degree of stress, the results of the questionnaire is as follows.. This information makes it possible to compare the mental and physical stresses, and the average of the mental fatigue results was "cautious".

## Do you think you are under a lot of stress?



Figure 1. Questionnaire survey results

	Absolutely not likely ←				Completely likely →		
A. Tiredness makes me less motivated	1	2	3	4	5	6	7
B. Exercising makes me tired	1	2	3	4	5	6	7
C. getting tired easily	1	2	3	4	5	6	7
D. Physical function is disturbed by fatigue	1	2	3	4	5	6	7
E. Fatigue often causes problems	1	2	3	4	5	6	7
F. Fatigue makes persistent physical activity difficult	1	2	3	4	5	6	7
G. Because of fatigue, it is difficult to deal with work or responsibility	1	2	3	4	5	6	7
H. If you pick out three symptoms that make me the most helpless, fatigue comes in	1	2	3	4	5	6	7
I. Because of fatigue, I suffer from academic and family life	1	2	3	4	5	6	7

# Please check the score that best reflects your status for the past week

Figure 2. Fatigue Severity Scale(FSS) survey sheet



Figure 3. Self fatigue-diagnosis

Fatigue severity Index(FSS) is a 9-item self-report questionnaire with a single dimension and is one of the most widely used fatigue measurement tools. FSS has been proven to be reliable and valid in a variety of diseases such as multiple sclerosis, chronic fatigue syndrome, cancer, and chronic hepatitis C.

The purpose of this study was to evaluate the reliability and validity of FSS as a useful tool for fatigue evaluation in undergraduate and graduate school college students. The total score is calculated as the average of the scores for each item, ranging from 1 to 7 points, and the higher the total score, the higher the fatigue was evaluated. The FSS consists of 9 items, and is based on your feelings over the past two weeks, and you are asked to answer the questions on a scale of 1 to 7, depending on how you agree with each question. The scores for each item were added together and the average value divided by 9 was used as the score. Therefore the higher the score, the higher the fatigue was evaluated.

In this study, fatigue group (fatigue score of 4 points or more) and Non-fatigue group (fatigue score of 4 points or less) were defined as 4 points based on the median value of FSS [9].

#### B. Blood active oxygen concentration test

B-1. Comparison of the results of vitamin C taking group (men) and vitamin C non-taking group (men)



Figure 5. Active oxygen test result - Male

The test method of vitamin taking and non - taking were done using an active oxygen kit. For the purpose of the objective study, the results of the test was determined by selecting one person and referring to the colorimetric chart.

The results of the test showed that 'Cautious' probability was higher in males-taking than in males non - taking, and 'Very high' in maels non - taking. That is, it shows that when vitamin C is taken, active oxygen decreases.



B-2.Comparison of results between vitamin C taking (female) and vitamin C non-taking (female)

The results of the active oxygen test showed that the result of Very high, which indicates that the vitamin C taking group (female) had a higher blood active oxygen concentration than the vitamin C non-taking group (female), was 10% higher.



C. Forced Vital Capacity (FVC) Vitamin C taking group (male)

C-1. First test result standard value

More than 80% of the FVC measurement (% Pre) and more than 80% of the FEV1 measurement (% Pre) were within the normal range beyond 80% of the measurement range. Thus, the results were compared through a secondary test.

C-2. Second test result standard value

Measured FVC (% Pre) was more than 80% and FEV1 (% Pre) was more than 80%, therefore, the measurement range exceeded the normal range, unlike the first test, the results of each item are slightly increased. The best results were obtained in the normal range. Comparing the results through the graph, the results for the group with vitamin C taking group(male) show that the pulmonary function is increased.



C-3. Forced Vital Capacity (FVC) Vitamin C non-taking group (male)

#### C-4. First test result standard value

More than 80% of the FVC measurement (% Pre) and more than 80% of the FEV1 measurement (% Pre) were within the normal range beyond 80% of the measurement range. Thus, the results were compared through a secondary test.

#### C-5. Second test result standard value

The measurement range was the same as the normal range reference value, with the FVC measurement (% Pre) of 80% and the FEV1 measurement (% Pre) of 80% or more, however, compared with the vitamin C taking group, there was a large difference in the results.

Figure 8. Pulmonary function test result - Male Non-Taking



# D. Forced Vital Capacity (FVC) Vitamin C taking group (female)

Figure 9. Pulmonary function test result - Female Taking

## D-1. First test result standard value

More than 80% of the FVC measurement (% Pre) and more than 80% of the FEV1 measurement (% Pre) were within the normal range beyond 80% of the measurement range. Thus, the results were compared through a secondary test.

## D-2. Second test result standard value

The measurement range was the same as the normal range reference value, with the FVC measurement (% Pre) of 80% and the FEV1 measurement (% Pre) of 80% or more, and there was no significant difference between the two groups in comparison with the vitamin C non-taking group (female). however, compared with the vitamin C taking group (male), the mean value of the results of the FVC of the male is shown to be higher.

## D-3. Forced Vital Capacity (FVC) Vitamin C non-taking group (female)



Figure 10. Pulmonary function test result – Female Non-Taking

#### D-4. First test result standard value

More than 80% of the FVC measurement (% Pre) and more than 80% of the FEV1 measurement (% Pre) were within the normal range beyond 80% of the measurement range. Thus, the results were compared through a secondary test.

#### D-5. Second test result standard value

The measurement range was the same as the normal range reference value, with the FVC measurement (% Pre) of 80% and the FEV1 measurement (% Pre) of 80% or more. When comparing the results of the first and second tests of vitamin C non-taking group(male), better results were obtained in the FVC among the pulmonary function tests of the vitamin C non-taking group (female).

#### **IV.CONCLUSION**

This study was conducted to investigate whether vitamin C has antioxidative effects in reducing the levels of active oxygen in the blood, and the results of active oxygen concentration in the blood showed a decrease in all of the vitamin C taking group, however, there was no significant difference in pulmonary function test results.

Previous studies have shown that fine dust acts on pulmonary epithelial cells and macrophages to induce oxidative stress and increase the active oxygen group (AOG)[10]. However, There were few studies on the improvement of pulmonary function by removing active oxygen. We have found that vitamin C lowers active oxygen, which is consistent with the findings of the WM Son and the other's study[10]. However, the lowered concentration of active oxygen in the blood did not show any improvement in pulmonary function. This is because the research period is limited to a short time of 2 months, the results of pulmonary function tests are highly influenced by individual efforts, and there is a limit to the difficulty of controlling individual health and psychological state before testing.

However, as a result of this experiment, vitamin C decreased the active oxygen concentration in the blood, and it was possible that the pulmonary function which is related to active oxygen could be improved. It also showed that decreasing blood concentration also has an effect on stress reduction. This scientific data suggests that vitamin C, which is vaguely known, is effective for immunity and oxidative stress, and it is expected to be used as basic data on vitamin C.

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