

Effects of Meditation on the T-lymphocytes, B-lymphocytes and Natural Killer Cells Production

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ABSTRACT

The effects of meditation practice on the production of T-lymphocytes, B-lymphocytes and natural killer cells (NK) were evaluated in two groups of volunteers. Group I consisted of experienced meditators of more than two years while group II was inexperienced new comers. The selected healthy volunteers have to practice meditation one hour daily for a period of four months. Venipuncture was done at the beginning (month 0) and at the end of the 4-month meditation. Fluorochrome conjugated monoclonal antibody to CD45, CD3, CD5, CD4, CD8, CD19 and CD(16+56) were incubated with peripheral blood lymphocytes and the number of positively labeled lymphocytes were determined by flow cytometer.

The statistical analysis showed that CD3+ lymphocytes were significantly increased in both groups of volunteer after meditation practice for four months. In group I, the numbers of CD3+, CD8+ and CD(16+56)+ lymphocytes of experienced meditators were significantly increased ($P < 0.05$, $P < 0.01$ and $P < 0.01$, respectively). For the inexperienced group, CD45+ lymphocytes were significantly increased ($P < 0.05$) as well as CD3+, CD5+ and CD8+ lymphocytes ($P < 0.01$). No alteration of CD19+ lymphocytes and no correlation between CD4+ and CD(16+56)+ lymphocytes were observed in both groups. The results presented herein indicated that meditation practice might aid in improvement of the immune system, especially the production of T-lymphocytes and natural killer cells.

Key words: B-lymphocytes, T-lymphocytes, natural killer cells, meditation

INTRODUCTION

Meditation practice is a mode of mind training in a peaceful state. Benefits of meditation practice include body relaxation, anxiety and stress reduction and improvement of intellectual consideration (Jin,1992). It also promotes more effective body systems function, better respiration

and lower blood pressure (Wallace, 1970). These all lead to the better immune system of the body.

The regulation of immune system comprises several important cells such as T-lymphocytes or T-cells, B - lymphocytes or B-cells, natural killer or NK cells in the lymphoid type, as well as monocytes and phagocytotic cells, i.e., basophils, eosinophils and neutrophils, of the

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myeloid type. Researches have been done to see the effect of meditation on the overall amount of cells in the immune system especially the athletic group of people (marathon runners and joggers) and the results showed the significant improvement of these cells (Solberge *et al.*, 2000). However, the effective mechanism of specific immune response depends largely on the lymphoid cell types, i.e., T-cells, B-cells and NK cells. Using the cellular markers of these cells to identify the specific group could render us to clarify the functional response of typical cells to meditation and provide more information on the cells of immune system as a whole.

MATERIALS AND METHODS

Volunteer selection

Experienced meditators (5 males and 6 females) and 10 new comers (4 males and 6 females) were selected based on their good health, HIV and Hepatitis-B negative, abstinent from blood donation in the last three months, and in the age range of 20-40 years. There was no contact or communication between these two groups. They practiced the same type of meditation one hour daily for four months.

Blood cells determination

Five milliliters of blood was collected from each meditator at the beginning of the experiment and at the end of the 4-month meditation period. The blood was transferred into EDTA-coated test tubes and divided into two parts. One milliliter of blood was subjected to a complete blood cell count using automated cell count. The remaining 4 ml of blood sample was tested to find the lymphocytes antigens using CD 3 FITC, CD 4 FITC, CD 5 PE, CD 8 PE, CD 19 PE, CD 16+56 PE and CD 45 PHCP fluorochrome-conjugated monoclonal antibodies by the following procedure. Ten milliliters of fluorescence monoclonal antibody was added to 100 μ l of blood sample,

thoroughly mixed and left for 15 min in the dark at room temperature. Three milliliters of PBS was added into the mixtures, centrifuged at 2000 g for 5 min and the supernatant was discarded. Two milliliters of lysing reagent was added, mixed and left in the dark for 10 min. After the solution became clear, it was centrifuged at 2000 g for 5 min, washed with PBS and centrifuged again to remove RBC. One milliliter of PBS and 100 μ l of fixing reagent (1 % formaldehyde) were added to the sample tube and mixed well. CD antigen was determined using flow cytometer. The result was statistically analyzed using SPSS and pair t-test for equal n population and independent t-test for unequal n population.

RESULTS AND DISCUSSION

The selected volunteers of group I consisted of 5 males and 6 females, 27-40 years of age. They are all college-graduated and employed and have been practicing meditation for more than two years. Since they have been participated in meditation they are familiar with the members in the same group. Group II consisted of 4 males and 6 females at the age of 21- 27 years. Most of them are college-graduated but unemployed employed. They have no previous experience in meditation and do not know each other in the same group.

Total lymphocytes (CD 45+), T- cells (CD 3+, CD 4+, CD 5+, CD 8+), B-cells (CD 19+) and NK-cells (CD 16+56)+ of group I and group II were determined at the beginning (month 0) of the experiment. The average percent CD antigen are shown in Figure 1 and Table 1. The results indicated the similar average amount of CD 45+ (99.74, 95.42%), CD 19+ (13.56, 17.71%), CD (16+56)+ (24.95, 26.18%) and CD 4+ (46.38, 47.51%) in both groups. However, the average amount of CD5+ (81.15%), CD 3+ (74.23%) and CD 8+ (26.12%) in group I were much higher than those of group II at 32.39, 18.18 and 16.67%, respectively.

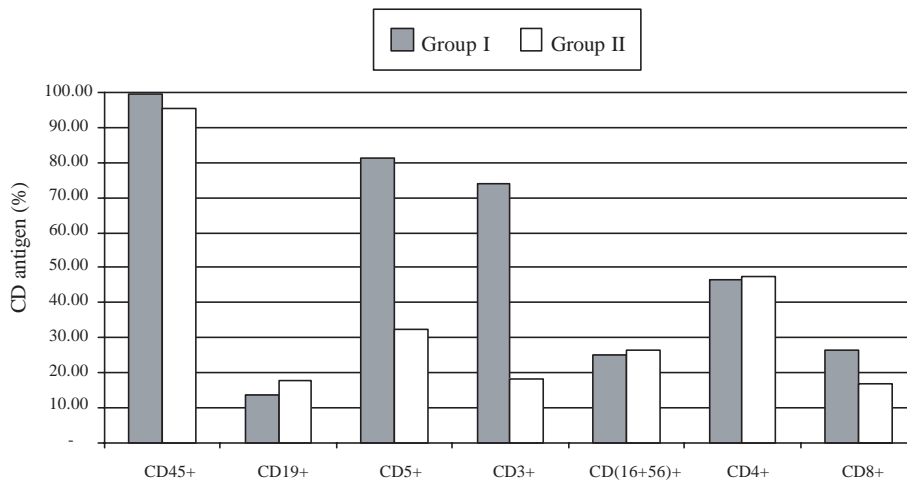


Figure 1 Percent CD antigen at the beginning of meditation in group I and group II.

Table 1 Average percent CD antigen of meditators group I and group II.

CD antigen	Group I (n = 11)		Group II (n = 10)	
	Month 0	Month 4	Month 0	Month 4
CD 45+	99.74 ± 0.18	99.72 ± 0.26	95.42 ± 3.17	99.15 ± 0.42
CD 19+	13.56 ± 3.63	13.03 ± 2.65	17.71 ± 7.73	14.19 ± 3.71
CD 5+	81.15 ± 2.99	79.86 ± 8.95	32.39 ± 8.38	70.25 ± 10.52
CD 3+	74.23 ± 4.28	77.50 ± 4.18	18.18 ± 12.33	50.99 ± 19.90
CD (16+56)+	24.95 ± 7.42	40.27 ± 16.31	26.18 ± 11.63	28.50 ± 8.80
CD 4+	46.38 ± 8.91	50.33 ± 7.42	47.51 ± 13.39	41.97 ± 7.92
CD 8+	26.12 ± 7.52	43.80 ± 7.34	16.67 ± 3.61	25.21 ± 6.36

group I – having meditation experience more than two years before test

group II – having no meditation experience

Since these three markers CD 5+, CD 3+ and CD 8+ are the markers on T-cells where CD8+ is specific only on T-cytolytic, it is quite clear that the two years experience in meditation could contribute to the high production of T-cells and hence, effective cell-mediated immune system.

After having been practiced the same type of meditation one hour daily for four months, the average percent CD antigens in group I and group II were recorded (Figure 2). Total lymphocytes (CD 45+) and B-cells (CD 19+) of the experienced meditators (group I) remained the same while CD(16 + 56)+ of NK cells and CD 8+ of T-cytolytic cells had been changed at highly

significant level ($P < 0.01$) from 24.95 to 40.27% and from 26.12 to 43.80%, respectively. However, the average percent CD antigens of CD 3+, CD 4+ were slightly increased ($P < 0.05$) from 74.23 to 77.50% and from 46.38 to 50.33%, respectively (Table 3).

As for inexperienced meditators (group II), the increase in average amount of CD antigens after four months of meditation was observed in every type of cells except those having CD 19+ and CD 4+ as surface markers. The drastic changes of CD antigens were found in the cells having CD 5+ and CD 3+ with the increment from 32.39 to 70.25% and from 18.18 to 50.99%, respectively.

A moderate increase of CD antigens was found in CD45+, CD (16+56)+, CD 8+ from 95.42 to 99.15%, from 26.18 to 28.50%, and from 16.67 to 25.21%, respectively (Table 4 and Figure 2). This moderate improvement of CD45+ production in the inexperienced meditators (group II) and the drastic increase of CD 3+, CD 5+ and CD 8+ at highly significant level showed the strong effect of four months meditation period on the production of T-cells especially T-cytolytic cells.

Comparing each type of CD antigens between these two groups at the end of 4-month meditation, it was found that CD 45+, CD 3+, CD

5+, CD (16+56) +, CD 4+ and CD 8+ of experienced meditators (group I) was significantly higher than those of the inexperienced meditators (group II). Even though the improvement of the immune cells in group II is clearly seen but there are several factors contributing to the less achievement of the lymphocytes production to the level of group I. First of all, the inexperienced volunteer are strangers to each other and are unemployed. The stress from being exposed to the new environment and adjustment needed for practicing meditation could cause the release of hormone from the pituitary gland which inhibits

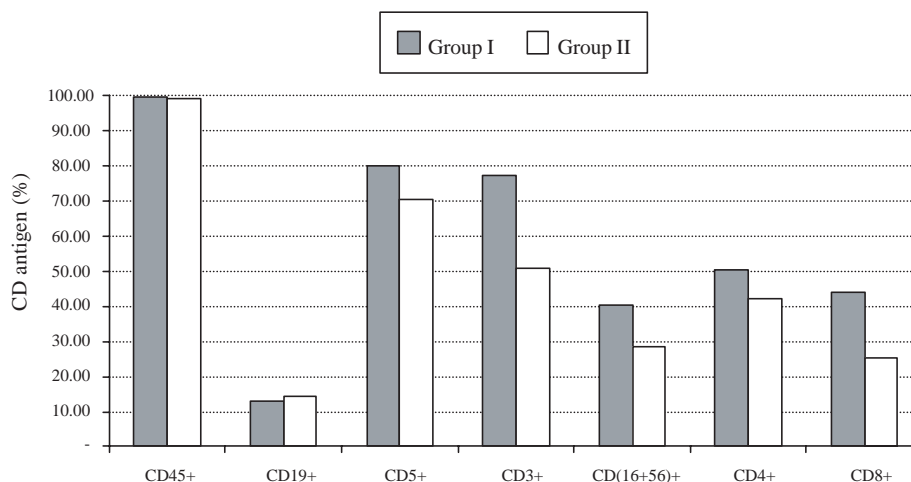


Figure 2 Percent CD antigen at the end of 4-month period of meditation in group I and group II.

Table 2 Statistical analysis (t-independent) of the average CD antigen found at the end of 4-month meditation period of group I and group II meditators (df = 19, P<0.05, 0.01).

CD antigen	Group I (n = 11)	Group II (n = 10)
CD 45+	99.72 ± 0.26	99.15 ± 0.42 **
CD 19+	13.03 ± 2.65	14.19 ± 3.71
CD 5+	79.86 ± 8.95	70.25 ± 10.52**
CD 3+	77.50 ± 4.18	50.99 ± 19.90**
CD (16+56)+	40.27 ± 16.31	28.50 ± 8.80**
CD 4+	50.33 ± 7.42	41.97 ± 7.92**
CD 8+	43.80 ± 7.34	25.21 ± 6.36**

Note : * statistically significant

** the difference is highly significant

± standard deviation

the full function of the cells in the immune system. Brosschot and Benschop (1992) reported the decrease of NK-cells and CD 8+ antigens in the patients under stress. However, the stress should be subsided after four months of meditation as also reported by Farwell (1985) on the alleviation of stress after transdental meditation.

Relaxation of mind in the experienced meditators (group I) resulted in a distinctive change of CD (16+56)+ indicating the highproduction of NK-cells after four months of regular meditation showed the superiority of practicing the technique of meditation over the inexperienced meditators (group II). The effect of meditation on the relaxation of mind was also reported by Kiecolt *et al.*(1985). The longer time of practice could make the meditators reach the relaxation stage faster. However, there was no change of CD 4+ found in both groups of meditator after four months of meditation. Since interleukin-2(IL-2) produced from CD 4+ cells (T-helpers) is the main activator of NK-cells, there was no correlation between the effect of CD 4+ to the increment of CD (16+56)+ in this aspect.

It is also interesting to find no effect of meditation on the production of CD 19+ (B-cells)

which suggested the minimum relationship of meditation to the humoral immune system.

CONCLUSIONS

Meditation has caused the change in the number of immune cells in the following manners:-

1. T-cells markers of CD 45+, CD 3+, CD 5+ and CD 8+ were increased in the inexperienced meditators (group II) after one hour daily practice for the period of four months.

2. The CD 3+, CD 8+, as well as CD (16+56)+ of NK-cells were increased in 2-year experienced meditators (group I) after four months of the same type of meditation.

3. B-cells were not affected by meditation in either groups of meditator.

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Table 3 Statistical analysis (pair t-test) of the average CD antigen of group I meditators at the beginning and at the end of the four months (n=11, df=11, P < 0.05, 0.01).

CD antigen	Month 0	Month 4
CD 45+	99.74 ± 0.18	99.72 ± 0.26
CD 19+	13.56 ± 3.63	13.03 ± 2.65
CD 5+	81.15 ± 2.99	79.86 ± 8.95
CD 3+	74.23 ± 4.28	77.50 ± 4.18 *
CD (16+56)+	24.95 ± 7.42	40.27 ± 16.31**
CD 4+	46.38 ± 8.91	50.33 ± 7.42
CD 8+	26.12 ± 7.52	43.80 ± 7.34 **

Note : * statistically significant
 ** the difference is highly significant
 ± standard deviation

Table 4 Statistical analysis (pair t-test) of the average CD antigen of group II meditators at the beginning and at the end of the four months (n=10, df= 9, P < 0.05, 0.01).

CD antigen	Month 0	Month 4
CD 45+	95.42 ± 3.17	99.15 ± 0.42 *
CD 19+	17.71 ± 7.73	14.49 ± 3.71
CD 5+	32.39 ± 8.38	70.25 ± 10.52 **
CD 3+	18.18 ± 12.33	50.99 ± 19.90 **
CD (16+56)+	26.18 ± 11.63	28.50 ± 8.80
CD 4+	47.51 ± 13.39	41.97 ± 7.92
CD 8+	16.67 ± 3.61	25.21 ± 6.36 **

Note : * statistically significant
 ** the difference is highly significant
 ± standard deviation

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