

The Effects of Line Dance on Immune function and Inflammation for Elderly Women

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라인댄스가 여성노인의 면역기능 및 염증에 미치는 영향

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Abstract This study was conducted to identify the characteristics of immune function and inflammatory changes for elderly women, by having them to participate in line dance program. For this purpose, 18 elderly women in their 60s to 70s, living in Y city were selected, and 9 of the participants were randomly assigned to participate in the line dance program for 12-weeks (line dance exercise group), while the other 9 participants were assigned to carry out their daily lives without participating in certain physical activity (control group) for the same period. The subjects' immune function and inflammation were measured using SPSS 24.0 for datafication, and the average and two-way ANOVA analysis were conducted. The result indicates the immunoglobulin, IgA, has increased, but not dramatically. The level of IgG(p<.05), and IgM(p<.05) increase were detected from the line dance exercise group, but not so much from the control group. Inflammation indicator, the CRP(p<.05), were significantly reduced from the line dance exercise group, but not much for the control group. According to the collected data, line dance for the elderly women can be considered as an effective exercise program, and the result shows that inflammation is reduced and immune function is improved. It also implies the needs of active physical activity arbitration to keep the elderly women's health and to prevent the chronic disease in the future.

Key Words : Elderly women, Line dance, Immunogloblin A, Immunogloblin M, Immunogloblin G, CRP(C-reactive protein)

요약 본 연구는 여성노인의 라인댄스 프로그램 참여에 따른 면역기능 및 염증변화의 특징을 규명하고자 수행되었다. 이를 위해, Y시에 거주하고 있는 60-70세 여성노인 18명을 선정하였으며, 12주간 라인댄스 프로그램에 참여한 운동군 9명과 동일한 기간 특별한 신체활동에 참여하지 않고 일상적인 생활을 해온 통제군 9명의 두 집단으로 무작위 선정하여 분류하였다. 대상자들의 면역기능 및 염증을 측정하여 자료를 수집하였으며, 자료분석은 SPSS 24.0을 이용하여 평균과 이원변량분석을 실시하였다. 그 결과 면역글로블린인 IgA은 증가하였으나 유의한 증가를 보이지 않았고 IgG(p<.05), IgM(p<.05)은 라인댄스 운동군에서 유의한 증가가 있었으나 통제군에서는 유의한 차이가 나타나지 않았다. 염증지표인 CRP(p<.05)은 라인댄스 운동군에서 유의하게 감소하였고, 통제군에서는 유의한 차이가 없었다. 따라서 규칙적인 라인댄스 프로그램은 여성노인의 면역 향상 및 염증 감소에 매우 효과적인 운동프로그램이라 할 수 있으며, 염증을 감소시키고 면역기능 개선에 도움을 줄 수 있음을 보여주는 결과로, 향후 여성노인들의 건강유지와 만성질환 예방을 위해 적극적인 신체활동 프로그램 개발과 증진의 필요성을 시사한다.

키워드 : 여성노인, 라인댄스, 면역글로블린 A, 면역글로블린 M, 면역글로블린 G, C-반응성 단백질

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1. Introduction

The aging population is a phenomenon found throughout the world. As the developed science and medical technology has extended average life expectancy, the elderly population is increasing every year. The elderly population in Korea is taking more than 14%, which is considered as an aging society, based on the standard presented by UN, and it's expected to peak up to 25%, which is considered as a superaged society[1]. The life expectancy increase is one of the positive aspects of an aging society. However, the problem of chronic disease caused by aging leading to the various disease is becoming the social issue that is to be dealt not only by individuals but also by families and countries[2]. The necessity needs of exercise is emphasized in this modern society because it brings physical health and liveliness, and mental peace. Exercise is already a part of cultural activity. It also means the changes of social cognition in social value awareness aspect, and allowing one to exercise in accordance with the concept. The possible problems of one's elderly can be summarized into financial poverty, elderly deterioration, loss of one's role, boringness and loneliness. Among all, as doing nothing status begins after one retires socially, concerns on the way of overcoming the boringness due to loss of one's role, increase of leisure time is raised[3]. Therefore, there are necessity of creating condition for elders to participate in health promotion program, and development supply of exercise program with proven effectualness. The dance, aerobics, table tennis, tai chi activities, and etc. are the representative exercise program for elders, and there is a tendency of developing more programs to be applied at senior community centers or homes[4].

Meanwhile, regular physical exercise for middle-aged or elders reduces the death rate caused by cardiovascular or coronary artery risk, but the mechanism is not clarified yet. According to studies, coronary artery risk is caused by vascular inflammation factors such as WBC, albumin, C-reactive protein (CRP), and fibrinogen, resulting the increase of death rate. Development of the coronary arteries can be considered as the inflammation on blood vessel[5]. Among the factors mentioned above, CRP is a type of protein secreted in the body when infected or wounded. The immune system gets activated when there is an instant increase of blood CPR level. The CRP takes very important role when such infection is found or expected, as it can be the cause of blood coagulation, fibrosis, platelet aggregation and viscosity. Also, it was reported that the muscle loss resulted from aging influences on not only muscle system but also on immune system too[7]. Considering the issues above, line dance is the most easy-to-access program for elderly women. It's based on natural walking movement, with the feature that doesn't require partners; a number of people turning to cardinal points in line by following the fixed routine. One can participate without having partners, and as entire participants proceed the same movement altogether, there is a strong point of fulfilling the desire and interests. Line dance is relatively easier type of dance, and as it there's no burden heart or joints, elderly women can easily participate. Furthermore, both the exercise effect and fun can be achieved as line dance provokes participants interest as acquiring few basic movements can be used to create varied movements. The health fitness that elders are focusing on can be decreased as going through the menopause and the general stamina decline. The potential

reasons are the lack of exercise, physical activity, basal metabolism, or energy consumption. Well-managing the health fitness actually enhances the ability to keep the healthy body and capability to overcoming stress, and these are the basic elements for qualifying the life. Especially in case for women, active fitness managing is more important to stay healthy because the decrease rate is bigger due to the menstrual period, pregnancy, and menopause[8].

The line dance is known well as the healthy dance, and it's provided to elders worldwide[9]. It looks like the daily competency of group of elders participating the regular exercise gets improvement, comparing to the group that doesn't exercise[10]. Also, the regular exercise influences positively on nature of bone, and on the connective tissues, located near around muscle and tendon[11]. Meanwhile, there are studies of underwater exercise, combined exercise, and aerobic (walking) exercise for elders, but there is not much data on such mechanism influenced by the line dance. Therefore, this study focuses on finding the effects of the aerobic line dance on immune function and inflammatory factors for elderly women.

2. Research Method

2.1 Subject Study

The subject of this study were 18 elderly women in their 60s and 70s, living in Y city. The purpose, procedure, and details of this study were adequately informed by verbally and in writings, and all the subjects agreed to voluntarily participate in the study. Based on whether to participate in the line dance program, all of the 18 subjects were randomly divided into two groups (line dance exercise group and control group) to participate the

12-weeks study. The details of physical characteristic of subjects are as shown in the Table 1.

Table 1. Physical characteristic of subjects

Group	N	Ages (year)	Height (cm)	Weight (kg)	%fat (%)
LDG	N=9	65.66±3.39	155.72±3.79	61.75±6.42	33.27±3.55
CG	N=9	62.00±2.00	152.67±5.24	57.95±10.28	32.97±7.90

Values are mean ± standard deviation

LDG: line dance group, CG: control group

2.2 The contents and methods of the experiment

2.2.1 Body composition test

Before applying the exercise program to subjects, their body weight, BMI, body fat percentage, and body fat mass were examined by using InBody 520. Considering the accuracy, light clothes were put and all of metal accessories were removed, fast for 4 hours before examination, no exercise 12 hours before examination, no alcohol intake for 48 hours before examination were applied.

2.2.2 Blood component test

10ml of blood sample of subjects were taken by disposable syringe from their cardinal vein at pre and post of stable period after not taking food for 12 hours. Also, to minimize the variable of examination, severe exercise was prohibited 48 hours before the examination. Right after the blood samples were taken, they were centrifugated at 3,000rpm to separate serum, kept frozen at -80°C and sent to medical center S for analysis. The test method of TIA (Turbidimetric immunoassay) was applied to test the immune function (IgA, IgG, IgM), and Modular Analytics (Roche, Germany) was used to analyze. The test method of Immunoturbidimetric Assay was applied to test the CRP, and Cobas 8000(Roche, Germany) was used to analyze.

2.2.3 12-weeks line dance exercise program

The 12-weeks line dance exercise program conducted for this study was developed by revising and improving the line dance program Kim, Soon & Kim[12]. Complying with the recommended exercise level for health promotion for elders, the line dance program activity was composed with steps matched to rhythmical music (32 count), the intensity was 11-14 REP (rating of perceived exertion). The 60 minutes a day, and 3 days a week program was composed with warming up (10 minutes),

Main exercise (40 minutes), cool down (10 minutes). By applying the relatively smaller and simpler movements, the program was developed to provoke joy, fun, and interest to encourage participation to improve the body function. Considering the subjects are in elderly age group, the qualified professional instructor with long period of instructing in the field took the role of instructor. Frequent fluid intake during the exercise was freely allowed to prevent fatigue. The details on the 12-weeks of line dance exercise program is as shown in Table 2.

Table 2. 12 week line dance exercise program

Division	12-week line dance program			Exercise intensity(RPE)	Exercise time(min)
Warm-up	stretching(10 min)			9-11	10
Main exercise	Main exercise (40 min)	Cab driver Piece of cake Electric slide(walker) Tuesday's cha cha	1-4	11-14	40
		Cab driver Piece of cake Stagger lee My sweet heart Come on & dance Sweet sweet smile	5-8		
		Cab driver Piece of cake Come dance with me Electric horseman Sugar sugar Beautiful sunday	9-12		
Cool down	stretching(10 min)			9-11	10

Table 3. Two-way repeated ANOVA about the change of immune function & Inflammation factor

Item	Period	Group	N	M±SD	Group	SS	df	MS	F	p
IgA (mg/dl)	pre (0 Weeks)	LDG	9	215.33±84.81	group	.028	1	.028	.000	.999
		CG	9	219.11±41.92	error	148122.222	16	9257.639		
	post (12 Weeks)	LDG	9	220.77±90.60	period	26.694	1	26.694	.382	.545
		CG	9	217.11±38.65	period*group	124.694	1	124.694		
					error	1117.111	16	69.819	1.786	.200
IgM (mg/dl)	pre (0 Weeks)	LDG	9	117.22±68.04	group	1308.028	1	1308.028	.176	.680
		CG	9	110.33±50.20	error	118669.444	16	7416.840		
	post (12 Weeks)	LDG	9	124.88±69.32	period	56.250	1	56.250	1.440	.248
		CG	9	107.66±54.36	period*group	240.250	1	240.250		
					error	625.000	16	39.063	6.150	.025*
IgG (mg/dl)	pre (0 Weeks)	LDG	9	1266.33±142.14	group	9120.250	1	9120.250	.133	.720
		CG	9	1326.66±226.66	error	1097626.889	16	68601.681		
	post (12 Weeks)	LDG	9	1306.44±139.28	period	1213.361	1	1213.361	1.205	.288
		CG	9	1309.77±219.62	period*group	7310.250	1	7310.250		
					error	16104.889	16	1006.556	7.263	.016*
CRP (%)	pre (0 Weeks)	LDG	9	1.22±0.41	group	.694	1	.694	.708	.412
		CG	9	1.11±0.39	error	15.686	16	.980		
	post (12 Weeks)	LDG	9	1.10±0.52	period	.002	1	.002	.059	.811
		CG	9	1.10±0.48	period*group	.200	1	.200		
					error	.588	16	.037	5.433	.033*

LDG= Line Dance Group, CG= Control Group, CRP: C-reactive protein, *p<.05

2.3 Data processing

The analysis of the data in this study was conducted using SPSS Ver 24.0 to computational processing, and average (M) and standard deviations (SD) were calculated. To verify the difference between the result of pre-experiment and post-hoc result, and to check the measure viewpoint of 2 groups, two-way ANOVA with repeated measures were used. The significance level of statistical analysis was set to $\alpha=0.05$ level.

3. Research Results

The result and variance analysis of immune function and inflammatory markers are show in the Table 3.

3.1 Changes in Immune Function

The result of immunoglobulin IgA for the control group showed decrease from $219.11 \pm 41.92 \text{mg/dl}$ to $217.11 \pm 38.65 \text{mg/dl}$ after 12-weeks, and for line dance exercise group showed increase from $215.33 \pm 84.81 \text{mg/dl}$ to $220.77 \pm 90.60 \text{mg/dl}$ after 12-weeks. Two-way repeated ANOVA results for the analysis for group, time, and the interaction effect in between time and group showed not so much differences.

The result of immunoglobulin IgM for control group was showed decrease from $110.33 \pm 50.20 \text{mg/dl}$ to $107.66 \pm 54.36 \text{mg/dl}$ after 12-weeks, and line dance exercise group showed increase from $117.22 \pm 68.04 \text{mg/dl}$ to $124.88 \pm 69.32 \text{mg/dl}$ after 12-weeks. Two-way repeated ANOVA results for the analysis for the interaction effect in between group and time showed not so much differences, for the interaction effect in between time and group showed significant differences ($p < .05$).

The result of Immunoglobulin IgG for the

control group showed decrease from $1326.66 \pm 226.66 \text{mg/dl}$ to $1309.77 \pm 219.62 \text{mg/dl}$ after 12 weeks, and Line dance exercise group showed increase from $1266.33 \pm 142.14 \text{mg/dl}$ to $1306.44 \pm 139.28 \text{mg/dl}$ after 12-weeks. Two-way repeated ANOVA results for the analysis for the interaction effect in between group and time showed not so much differences, for the interaction effect in between time and group showed significant differences ($p < .05$).

3.2 Inflammatory changes

The result of inflammatory marker CRP for control group showed decrease from $1.11 \pm 0.39 \text{mg/L}$ to $1.10 \pm 0.48 \text{mg/L}$ after 12-weeks, and line dance exercise group showed increase from $1.22 \pm 0.41 \text{mg/L}$ to $1.10 \pm 0.52 \text{mg/L}$ after 12-weeks. Two-way repeated ANOVA results for the analysis for the interaction effect in between group and time showed not so much differences, for the interaction effect in between time and group showed significant differences ($p < .05$).

4. Discussion

In this study is to verify the effects of 12-weeks of line dance exercise program for elderly women in their 60s and 70s, and intends to discuss the followings based on the verified results of immune function and inflammatory changes.

4.1 Changes in immune function by the line dance exercise

Irregular physical activity and lack of exercise decline the physical strength, and influence negative affect by causing diabetes, cardiovascular disease, cancer, or etc[13]. However, exercise can indirectly promote immune function by supporting the circulation

of immunocytoma, immunoglobulin, and various cytokines, and by controlling internal secretion of nervous system.

The result of this study conducted to verify the effects of 12-weeks of Line dance exercise program for elderly women showed increase of all of the immunoglobulins (IgA, IgG, and IgM) in line dance group. This result is similar to the study conducted by Choi and Yoon[16], 12-weeks of underwater exercise program conducted on elderly women, showed positive result for immune function(IgA, IgG, IgM), and study conducted by Zhang. Kim. Seo & An[7], 18-weeks of Tai chi exercise program conducted on elderly women, showed positive result for immune function (IgA, IgG, IgM), and study conducted by Kim et al[17], 12-weeks of combined exercise (outdoor walking and band-resistance exercise) showed the positive result that content of immunoglobulin (IgA, IgG, and IgM) is remained the same or loss was prevented. On the other hand, the result of study conducted by Kim & Oh[18], 12-weeks of regular swimming exercise, showed decrease of IgG, IgA, and IgM, and the result of study conducted by Ho[19], 12-weeks of walking in bare feet and with shoes on for women after menopause, showed decrease of IgG, IgA, and IgM, which is the opposite of the result of this study. The adequate level of exercise helps improving immunity, but intense level of exercise increases the risk of infection, which can cause the negative result to the immune function[20]. In accordance with this, it implies that middle or low intensity level of exercise is more likely to provide positive result in terms of immune function, rather than high intensity level of exercise[21]. Therefore, the middle intensity level of the 12-week of line dance exercise program conducted in this study is adequate, and this line dance exercise program

is effective exercise program to improve immune function.

4.2 Inflammatory changes by line dance exercise

The lack of physical activity causes diabetes, obesity, high blood pressure, and metabolic syndrome, becoming the cause of death for elders[22], and it is closely related to cardiovascular disease too. One of the representative prognosis precursor for causing cardiovascular disease is C-reactive protein(CRP) that causes vascular disease such as arteriosclerosis, and it was reported that cardiovascular disease can be prevented by conducting regular physical activity that lowers the level of CRP[23, 24].

According to the precedent research on relation between exercise and CRP, the study conducted by Choi & Oh[25], 12-week of combined exercise for obese men, showed the positive result of CRP decrease, and the study conducted by Jeong[26], 12-week of pilates and gyrotonic exercise for middle-aged women, showed result the significant decrease of CRP statistically, and the study conducted by Cho[27], walking and running exercise for men in their 20s, showed positive result that the CRP level after the exercise have statistically reduced. Also, it was reported that the CRP level showed positive changes for elderly diabetic patients by participating combined exercise program[28]. On this wise, the result of precedent research showed the exercise regularly influences positively to blood inflammatory level, but some results indicate that there were only slight changes or even none. Donges et al[29] conducted 10-weeks of progressive resistive and aerobic exercise to subjects with sedentary lifestyle, and found only the CRP level of group that conducted aerobic exercise was decreased, and the study conducted by Conraads, et al[30]

and Klimcakova, et al[31], 12-weeks of combined and resistive exercise, showed no changes in CRP level. In this study, by conducting 12-weeks of line dance exercise program for elderly women, the decrease of CRP level was found, as the same result from the precedent research. The line dance exercise program conducted in this study has decreased the inflammatory response, and it's closely related to decrease of CRP level. This change implies the potential of improving not only the cardiovascular disease but also the various types of inflammatory disease.

5. Conclusion & Suggestion

This study is to verify the influence of 12-weeks line dance exercise for elderly women on immune function and inflammatory changes, and the results are as following.

First, compare to the control group, the immune function of line dance exercise group showed more increase of immunoglobulin A, immunoglobulin M, and immunoglobulin G, and the statistically significant changes were found. Second, compare to the group that didn't participate in exercise program, the inflammatory changes of line dance group showed decrease of C-reactive protein, and the statistically significant changes were found.

To conclude, the 12-week line dance exercise program has decreased the inflammation for elderly women, and resulted positively to immune function. This indicates that developing various line dance exercise programs customized based on elders' strength and physical condition will be supportive to improving the health of elders.

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