

The Relationship between Teaching Experience, Exercise Habit, Health Related Fitness, Bone Density and Arterial Stiffness of Korean Female Teachers

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Abstract

The purpose of this study was to investigate the relationship between teaching experience, regular exercise habit, health related fitness, bone density and arterial stiffness (PWV) by teaching experience of Korean female teachers. The subjects are 390 (age of 46.48 ± 7.2) female teachers participating in teacher training programs. Teaching experience was divided into five categories (less than 10 years, less than 15 years, less than 25 years, over 25 years). Regular exercise habits were determined by how often they exercise regularly per week. Also, health related fitness (% fat, active physical fitness), arterial stiffness (PWV) and bone density (T-Score) were evaluated. Exercise habit, physical fitness awareness and health awareness were significantly higher in over 20 years compared to less than 10 years. Also, bone density was significantly higher in less than 10 years compared to over 20 years, whereas PWV was not different significantly in teaching experience. There were significant correlation between exercise habit and health related fitness as well as between exercise habit and bone density. Also, there were significant inverse correlation between exercise habit and arterial stiffness as between bone density and arterial stiffness. Therefore, it is necessary for teachers to take part in various health training courses or programs regularly for their health.

Keywords: Bone Density, Exercise Habit, Fitness, PWV, Teaching Experience

1. Introduction

According to the statistical data of Department of Education, total of 473,815 educators are teaching the future children in kindergartens, primary, middle and high schools all over the country. Among them, the ratio of women teacher has rapidly increased in 10 years from 59.8% in 2003 to 68.5% in 2013, which is almost 70%, and specially, portions of women teachers have been increasing that they made 77.9% in primary school, 67.5% in middle school and 45% in high school, in 2012¹. Teachers take up high percentage among various influencing

factors on qualitative level of school education. Teachers not only affect growth and development of students as a most significant variable, but as they make great influence on local community, it is important to maintain their optimal health condition by creating correct lifestyle and habits¹. However, they are suffering from a lot of stress as high educational zeal, poor educational environment, and excessive administrative work^{2,3}. According to International Labor Organization, 25% of teachers in major developed countries are showing health problems due to serious stress, 1 out of 2 teachers over 40 years of age in Korea are suffering from various adult diseases⁴.

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Specially, 70% of teachers are suffering from or experiencing occupational diseases, and they are suffering from general health problems and their quality of life is declining from health problems related to their occupation as hair loss related to mental stress, vocal fold nodule, and varicose vein by conducting classes standing up for long hours^{3,5}.

The qualification for an ideal teacher may be recognized differently according to the point of view, but it is required to have ideal qualifications that are not only in professional field but also individual's field such as psychological health and physical health. Health related fitness that is closely related to physical health and lifestyle habit disease gets worse as the lack of exercise and stress increases and as the age increases, enhancement of health related fitness through regular exercise habits is effective in releasing stress and maintaining health^{6,7}. Osteoporosis occurs as the bone atomic mass and density decrease due to aging, amenorrhea, malnutrition, menopause, decrease in physical activity, and therefore, regular exercise habit is recommended as a part to prevent osteoporosis⁸. Also, to keep the elasticity of blood vessels high and prevent arterial stiffness, it is important to regularly participate in exercise and as the age increase, regular participation in exercise is reported as the most effective method of preventing arterial stiffness⁹.

Constant physical activity habit in everyday life is important for teachers to maintain their health while coping with various stresses from work or home, but they are placed in a very difficult situation realistically to participate in various physical activities to resolve stress¹⁰. Specially, female teachers are participating in exercises at much lower frequency than male teachers³. Therefore, measures for this finding need to be prepared because low physical activity level of teachers is closely related with health risks as cardiovascular disease, obesity, high blood pressure, and chronic stress, and is reported to have high relevance with various diseases and the number of absences¹¹. This study intended to provide basic data for the development of health improvement program of teachers in the future by analyzing exercise habits, health related fitness, and changes in bone density and artery stiffness on female teachers who are in dominant position in teaching profession according to the career level of education.

2. Materials and Methods

2.1 Subjects

The subjects of this study is 390 female teachers (the age of 46.48 ± 7.2) who are kindergarten, elementary, junior high and high school teachers. 390 applicants who agreed to the intent and contents of the research among female kindergarten, elementary, middle, high school teachers from G Metropolitan City, J do, and C-do who participated in summer and winter faculty development program of N University for 2 weeks from 2004 to 2013 were selected as the subject of this study.

2.2 Methods

Teaching experience was divided into five categories (less than 10 years, less than 15 years, less than 20 years, less than 25 years, over 25 years). Regular exercise habit was determined by how often they exercise regularly per week¹². Also, health related fitness were estimated by percentage of body fat, cardiovascular endurance, muscular strength, muscular endurance, flexibility, balance, agility, power, bone density was evaluated by T-Score, and arterial stiffness was tested by Pulse Wave Velocity (PWV). Survey questionnaires were used to gather the necessary data. For exercise habits, exercise habits scale developed jointly by Korea Institute of Sport Science and O2 run was used.

Arterial stiffness was measured in the supine position using a non invasive device. Brachial-ankle Pulse Wave Velocity(ba-PWV) was measured according to the manufactures protocol using VP-1000 plus (O₂ run Healthcare CO., Ltd., Kyoto, Japan). In brief, electrocardiogram electrodes were placed on both wrists. Occlusion and cuffs were wrapped around both sides of the ankles and brachia. Volume waveforms for the brachium and ankle were stored, and the sampling time was 10 sec for automatic gain analysis.

2.3 Statistics

Measured value of this study is calculated by mean and standard deviation using SPSS Ver. 11.0. The differences of teaching experience are tested by Chi-Square and One-way ANOVA, the correlation among variables is tested by Pearson correlation analysis, and significance level is .05.

3. Result

For ratio of answering 'never participate in physical activity in a week,' it was in the order of less than 10 years, less than 15 years, less than 20 years, and less than 25 years of teaching experience ($p < .05$). Specially, it was investigated that teachers with more than 20 years participate in exercise actively ($p < .05$). Health awareness and physical fitness awareness were significantly high in over 25 years and less than 25 years of teaching experience, respectively ($p < .05$). In addition, eating habits was significantly high in less than 25 years and over 25 years of teaching experience ($p < .05$). Body fat percentage was significantly lower in less than 10 years compared to over 25 years ($p < .05$). VO_2 max was significantly higher in less than 10 years compared to over 20 years ($p < .05$). In addition, active physical fitness such as grip, sit-ups, flexibility, agility, power and balance show highest level in less than 10 years but did not show significant difference according to the teaching experience. T-score was significantly high in less than 10 years ($p < .05$). Also, arterial stiffness shows lowest level in less than 10 years but did not show significant difference according to the teaching experience. In the analysis of correlation, there are significant correlation between exercise habit and health related fitness as well as between exercise habit and bone density ($p < .01$). Also, there are significant inverse correlation between exercise habit and arterial stiffness as well as between bone density and arterial stiffness ($p < .01$).

4. Discussion and Conclusion

Excellent education program and teachers are necessary to cultivate people of ability for Korean society of the future. Physical health cannot be excluded from various conditions to become excellent teachers. No matter how capable the teachers are, they cannot provide good education if they are not physically healthy, and health condition, regular life habit, and practice make great influence on students¹. Regular life habit can decrease mortality related to chronic disease by 47% and can lengthen life expectancy by 9.3 years all around the world. In this context, developing healthy life habit will be the first step of disease prevention and health improvement¹³. In this research, the ratio of teachers participation in exercise over 3 times a week has been found to be 22.7%, which is quite low, and 32.2% did not participate in exercise at all, which shows that not a lot of time is spent on exercise just as the precedent researches have proven^{2,14-15}.

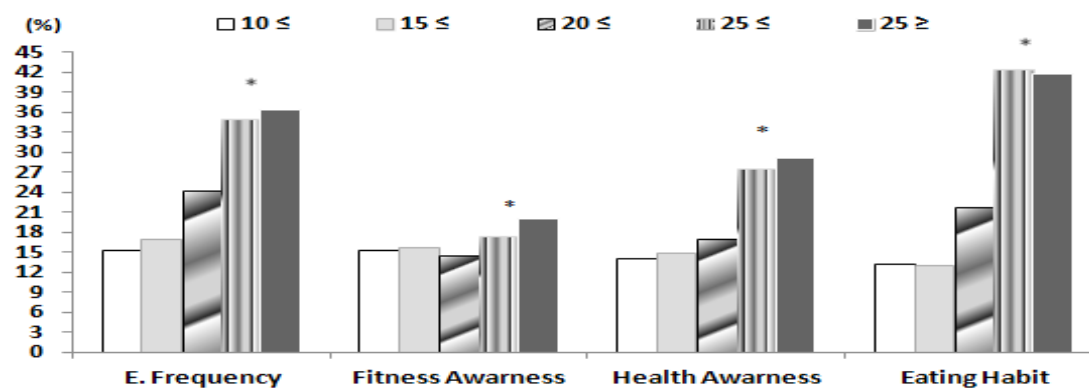
Especially, participation in exercise of teachers with experience of less than 10 years is shown to be the lowest (15.3%), and this phenomenon is considered to have happened because the teachers with less than 10 years of experience are in the age group of before and after 35 years old, who are in charge of various social roles that are in priorities with time including housewives, spouse, double-income and children fostering that they are not able to actively participate in physical activities. However, to maintain health, regular physical activity habits in daily lives are very important that it is necessary to provide systematic securities and various exercise programs that can be easily implemented at school field¹⁰.

Health related fitness can be said to be the ability to have energetic daily lives or to prevent diseases related to lack of physical activities in advance, and it includes body composition, cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, balance¹². In this research, among the factors of health related fitness, % fat is found to be the lowest for teachers with experience of less than 10 years. The reason why the teachers with less than 10 years of experience have been shown to have lowest % fat despite the lowest rate of regular exercise participation rate, is considered to be because they are using other methods such as diet therapy other than exercise to manage body fat. Also, among the factors of health related fitness, VO_2 max was very high in teachers with less than 10 years of experience and in other items (grip strength, sit-ups, sit-ups forward bend, side steps, standing high jump, one foot stand with eyes closed) were no differences shown according to teaching experience. These results show the united trend with precedent researches¹⁶⁻¹⁸ that as the age increases, regular participation in exercise helps maintaining muscular strength, muscular endurance, balance, agility, and with high ratio of teachers with over 20 years of experience participating in exercise. It is considered that sustained motion load has caused appropriate stimulation for musculoskeletal, etc., creating positive reaction to the organs. Osteoporosis is a type of systemic disease in which sensibility of fracture increases due to the decrease in bone mass and disability in microstructure of bone structure and it is regulated to be the tenth disease that prevalence rate increases every year^{12,19}. Especially, osteoporosis that frequently occur to women due to the physiological characteristics may cause serious side effects to health as it gets to fracture that special caution is needed²⁰.

Table 1. Health related fitness, bone density and arterial stiffness according to teaching career M ± S.D

Variables	10years≤ ^a (n=82)	15years≤ ^b (n=84)	20years≤ ^c (n=79)	25years≤ ^d (n=70)	≥25years ^e (n=75)	F-value pr>F	post -hoc
%fat	25.09±3.86	26.68±5.05	27.37±4.97	28.60±3.99	28.97±4.68	4.341/.0371*	a<e
Cardiovascular endurance(ml/kg/min)	34.34±4.07	29.63±5.04	28.72±4.05	27.70±6.38	26.48±4.71	5.443/.0292*	a<e
Muscle Strength(kg)	26.13±2.84	24.83±6.17	24.60±5.59	24.24±5.72	23.18±4.25	1.902/.154	
Muscle endurance(beats)	25.42±3.06	21.27±3.25	20.55±3.86	20.13±3.14	18.75±2.71	.960/.387	
Flexibility(cm)	20.67±5.15	18.52±4.18	18.26±3.84	17.36±3.63	16.57±3.87	.142/.868	
Agility(beats)	29.08±4.73	27.23±6.17	26.79±7.19	25.62±6.87	22.11±6.71	.119/.888	
Power(cm)	30.15±5.46	29.05±6.13	28.50±7.24	26.57±8.35	25.52±7.03	1.930/.0916	
Balance(sec)	63.27±6.07	57.42±9.85	55.41±8.68	54.81±7.21	53.09±8.66	2.006/.140	
T-Score(score)	-1.18±0.52	-1.25±0.39	-1.48±0.51	-1.76±0.63	-1.83±0.48	5.139/.0287*	a<e
RHpww(ms)	339.04±24.68	362.17±34.10	366.83±29.16	375.59±37.79	380.64±42.68	2.629/.0935	
LHpww(ms)	343.87±32.75	356.37±31.70	360.26±42.13	365.43±30.62	377.41±28.58	1.329/.0696	
RFpww(ms)	378.94±35.62	388.74±38.86	403.01±30.72	415.37±32.61	419.96±37.22	0.398/1.939	
LFpww(ms)	380.65±40.13	392.39±28.79	405.19±32.87	407.45±30.54	415.29±39.28	1.635/1.024	

Values are means ± SEM.* Significantly different from rest method (p<0.05). pwv: pulse wave velocity,
a: less than 10 years, b: less than 15 years, c: less than 20 years, d: less than 25 years, e: over 25 years.

**Figure 1.** Exercise frequency, fitness awareness, health awareness and eating habit according to teaching career Values are means ± SEM.*Significantly different from teaching career (p<0.05). E. Frequency: 3days/week.

In ACSM¹², bone mass of group of physical activities and athletes is higher than group of sedentary life that regular exercise is recommended as primary prevention plans. In this research, T-score, which is the index of bone density according to teaching experience, has been found to be higher in teachers with less than 10 years of experience but T-score is showing distribution that corresponds

to osteopenia that it is important to form habit of participating in exercise. Also, teachers with over 20 years of experience are showing the lowest T-score but this may be due to natural reduction of bone density following the aging and menopause and since their ratio of regular participation in exercise is high that the measure of osteoporosis is not found. These results show the united

Table 2. Correlation of exercise habit, health habit, bone density, arterial stiffness in teacher

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A	1.00	-.237	.620**	.383*	.442*	.410*	.408*	.529*	.689*	.428*	-.426*	-.527*	-.419*	-.529*
B		1.00	-.095	.573*	-.057	-.125	-.143	-.459*	-.538*	.449*	.568*	.495*	.506*	
C			1.00	.083	.072	.131	.079	.036	.446	-.486*	-.471*	-.526*	-.588*	
D				1.00	.309*	.189	.170	.049	.411*	.380*	-.074	-.042	-.030	-.044
E					1.00	.086	.315*	.102	.223*	.325	-.107	-.068	-.030	-.105
F						1.00	.104	.039	.139	.495	-.032	-.035	-.090	-.025
G							1.00	.494*	.497*	.189	-.069	.008	-.056	-.030
H								1.00	.094	.159	-.055	-.051	-.121	-.092
I									1.00	.307	-.123	.149	.059	.072
J										1.00	-.098	-.056	-.108	-.091
K											1.00	.907**	.908*	.879*
L												1.00	.791*	.807*
M													1.00	.887*
N														1.00

* Significantly different among variables ($p < 0.05$), ** Significantly different among variables ($p < 0.01$).

A; Exercise Habit, B; %fat, C; VO2max, D; Grip strength, E; Sit-Ups, F; Sit & Reach Test, G; Side Step, H; Eye Closed One Leg Stand, I; Vertical Jump, J; T-Score, K; Right hand pulse wave velocity, L Left Right hand pulse wave velocity, M Right foot pulse wave velocity, N; Left foot pulse wave velocity.

trend with precedent researches²¹⁻²² that regular participation in exercise increases T-score, the mark of bone density. It is considered that repetitive and systematic physical activity played the role of the most important external factor for development and reformation of bone which is considered to be due to the increase in amount of muscle following the regular physical activities and change in bone mass²³. Blood goes into blood vessel system of almost 100,000 kilometers after coming out from heart and artery takes the important role of delivering blood from the heart. This artery has the elasticity to expand to maintain the pressure inside the blood vessel and return to original condition and due to various factors such as lack of physical activities, hormones, metabolism materials, aging, etc., blood vessel is damaged and as fibrosis is progressed, elastic and buffering capability of artery is destroyed²⁴. Especially, as women ages, damage of blood vessels and fibrosis is increased and arterial stiffness, which reduces elasticity capability, increases as well²⁵. In this research, although teachers with over 20 years of experience who participate in exercise are very old, there are no attentive differences to arterial stiffness of right and left hand and feet, showing the united trend with the precedent researches²⁶⁻²⁸ that continuous participation in exercise brings improvement in the function of blood vessels. These results are considered to have happened as the amount of blood flow in upper and lower limbs increased

and blood vessels expanded due to improvement in muscle abilities together with corporeal circulation after regular participation in exercise. Also, due to consistent stimulation, blood flow toward skeletal muscles increased and this increase not only expended the blood vessels but also positively affected the elasticity of blood vessels by activating sympathetic system²⁹. Specially, even though regular exercise is considered importantly in preventing and managing chronic disease, many people do not participate in physical activities in leisure time and suffer from various diseases. Low health related physical fitness due to decreased physical activity can cause high death rate, and there is high probability of causing chronic disease by lowering cardiovascular system or musculoskeletal function³⁰⁻³¹. In this research, exercise habits and health related fitness as well as between exercise habits and bone density showed positive correlation. Also, exercise habits and bone density as well as bone density and elasticity of blood vessels (right hand, left hand, right foot, left foot) showed inverse correlation. These results are caused by the positive effects in artery functions with improvement in health related strengths and function of blood vessels at the same time³¹⁻³⁵ and by change in amount of bone and expedition of osteoblast with lots of simulation to bones through regular physical activities^{20,36}. As this study, teachers with over 20 years of teaching experience (less than 25 years) showed high exercise habit of exercising regularly for more than 3 days a week, physical fitness awareness,

and health awareness, and they showed regular eating habit as well. Among health related fitness, teachers with less than 10 years showed lower percentage of body fat (%fat) than teachers with over 20 years, and grip, sit-ups, sit and reach test, side step, vertical jump, and standing on one leg with eyes closed were higher for teachers with less than 10 years, but did not show significant difference. Teachers with less than 10 years showed higher bone density than teachers with over 20 years, but stiffness of artery did not show significant difference. Also, it was identified that exercise habit has positive correlation with health related fitness and bone density, and inverse correlation with artery stiffness.

Therefore, it would be necessary for teachers to participate in various exercise programs periodically and regularly to maintain their health.

5. References

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