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The effects of music and no-music aerobic exercise on aerobic capacity and quality of life of elderly men

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Abstract

The impact of music and its psychological and physiological changes during exercise is issue that has always been focused on sport science experts. The aim of this study was to compare the effects of musical exercise on aerobic capacity and quality of life in elderly men. This study was conducted on 45 elderly men. The participants were randomly allocated into three groups: aerobic musical exercise, non-musical, and control groups. The exercise group performed a program for 8 weeks, 3 times per week. The quality of life was measured using quality of life scale and the level of aerobic capacity was measured using Bruce test. The results showed that eight weeks of musical and non-musical aerobic exercise can result in significant improvement in anaerobic capacity and quality of life of elderly men. The result showed a significant difference among the three groups considering anaerobic capacity and quality of life of elderly men. Tukey post hoc test indicated no significant differences between the aerobic exercise with and without-music; whereas, there was a significant different among these groups and the control group. It can be concluded that participating in exercise program can enhance the aerobic capacity and quality of life elderly men and such programs can be recommended for this aged population to facilitate their aging process.

Keywords: Exercise, Male, Music, Aerobic, Quality of Life

Introduction

Elderly is a process that encompasses all living organisms, including human. Aging is not a disease but is a vital phenomenon that includes everyone and is a natural process in which mental and physiological changes occur in body [1]. Many nations consider the rapid growth of the elderly population as the phenomenon of the 21st century. The world's elderly population over 60 years is estimated to be more than 605 million and it will increase to 2 billion by 2050 that is far greater than the growth of children population [2]. In developing countries, including Iran the country's elderly population growth rate is higher than the developed countries; more than half (59 percent) of the world's elderly population currently live in developing countries and it is estimated that this rate reaches to 71 percent

by 2030 [3].

The concept of the quality of life was introduced about 40 years ago in the United States and the social scientists were the pioneers who had started studying it. Over time and especially in the past two decades, researchers attempted to assess the life quality of different people through clinical trials in medical settings. Quality of life refers to the person's perception about the health status and life satisfaction condition [3].

Different studies have shown that with aging the dependency of the person on others in daily activity increases due to the deteriorating condition that occurs in different systems, particularly due to limitation of movement's ability this condition results in the feeling of unwellness and creates many negative effects on the quality of life [4]. Examining the quality of life of aged population and identifying effective interventions that may positively improve it may change the life condition of elderly and help them to deal effectively with their problems and independently cope with the various treatments.

Exercise may be one of the most effective methods for the prevention of disorders among the elderly. It may delay or facilitate aging by improving health condition and lead to vitality of the elderly [4].

King et al., investigated the effect of 6 months of regular physical in-group activity on well-being and quality of life of elderly and showed that in-group regular physical activity result in improvement of the quality of life and well-being of the participants [5]. In addition, Khazaee-Pool et al examined the effect of continuous physical activity on mental performance of elderly group and demonstrated that the training program can improve the mental functioning of the participants [6]. Furthermore, Chodzko-Zajko et al explored the effect of exercise on health status of elderly and showed that regular exercise program is able to improve the physical and mental performance of the participants [7]. It has been demonstrated that listening to music or even playing musical instruments can enhance depression and cognitive functions [8]. Thoma et al showed that different types of music have different effects on auditory system and endocrine glands [9].

Evidences reveal that the melody and rhythm of music affects human endocrine nervous system by initiating nerve impulses of the limbic, thalamus, and reticular activating system (RAS) [10]. Recently, it has been shown that exercise increase brain-derived neurotrophic factor (BDNF) in middle-aged women [11]. In addition, research shows that exercise increases levels of BDNF in the middle-aged women with major depression [12].

There is controversy over the effectiveness of music on physical performance (13-16). On the other hand, there is disagreement about the effect of music on aerobic exercise performance suggesting that the combination of physical exercise and music may improve aerobic exercise in healthy elderly people. The aim of this study was to compare the effect of aerobic exercise with and without music on aerobic capacity and life quality of elderly men.

Method

This quasi-experimental study was conducted in Isfahan, the center of Iran, in 2016. Forty five elderly men aged over 60 years participated in this research. The senior citizen men with full mental functioning capacity, Alert, Voice, Pain, Unresponsive (AVPU) criterion and the ability to answer questions were included in the project. They were physically active and were able to perform normal daily activities independently, but did not participate in any regular physical activities. The exclusion criteria were as follow: the absence of neurological disorders (stroke, Parkinson's disease and paralysis), cardiovascular diseases (acute myocardial infarction), acute heart failure, uncontrolled hypertension, unstable chronic diseases (diabetes, malignancies), severe congenital disorders or musculoskeletal disorders. Following the selection of sample from the accessible population, they were randomly assigned into three groups of music-aerobic

(n=15), non-music aerobic exercise (n=15), and control groups (n=15). Before the study, the procedures were fully explained to the participants and they completed a human consent form.

The participants referred to the testing area in group of five to complete the exercise program. The height and weight of the participants were measured using a stadiometer seca 206 and Balance Seca 760, both made in Germany. The cardiorespiratory fitness level (VO2max) was determined by standard Bruce test. The quality of life of the participants was determined by completing quality of life (QOL) questionnaire. The questionnaire has 72 items distributed into 6 subscales, including welfare body (12 items), personal growth (12 items), job satisfaction (12 items), social relations (12 items), innovative and creative behavior (12 items), and altruistic behavior (12 items). The Quality of Life Scale (QOLS) had shown 85% reliability by testing a sample of 140 people [17].

A regular exercise program of music aerobic exercise (MAE) was performed for 50 minutes, three times per week for two months. Eleven items of exercise with music, including stretch, flexibility, body circulation, manual dexterity, stepping, brain active exercise, aerobic, slow walking, relaxed turning, mild jumping jack, meditation, and breathing exercise were performed. Every 50-minute of MAE session included a warm-up stage with two slow music songs, an active exercise with six faster rhythms, and a cool-down stage with two relaxing music songs [18].

Five experts in sports science and five experts in music exercise validated and standardized the MAE protocol. Instructions on how to avoid sports injuries were given to the participants prior to the program. The research assistant and instructors were trained to lead MAE before the program started. The exercise intensity of the MAE session was determined calculating 64 percent of maximum heart rate using HR=(220−age)×100% [19]. Heart rate for the entire time during the protocol was measured by wireless pulse oximeters equipped with heart rate monitors. Descriptive and parametric inferential statistics was applied after the Kolmogrov-Smirinov test showed that the data were normally distributed. Student t-test, analysis of variance (ANOVA), and Tukey post hoc tests were used to test the hypothesis using SPSS-16.

Results

The result of one-way ANOVA indicated that no significant difference among the age (year), weight (kg), and height (cm) of the three groups ($p>0.05$). These results are presented in Table 1.

Table 1 *One-way ANOVA for the age (year), weight (kg), and height (cm) of the music aerobic, no-music aerobic and control groups (mean ± SD)*

Variable	Aerobic music	Aerobic	Control	p-value
Age (y)	63±6.78	60.4±2.69	59.33±3.18	0.94
Height (cm)	164.8±7.86	169.47±4.68	167.33±6.1	0.78
Weight (kg)	82.8±7.77	79.07±6.02	79.4±6.32	0.70

The results of one-way ANOVA showed no significant difference among the three groups before the implementation of the protocol in regard to the age, height and weight ($p>0.05$), but there was a significant difference in aerobic capacity among the three groups in posttest ($F=4.65$, $p=0.015$). Tukey post hoc test indicated a significant different between the exercised and the control group ($p<0.05$), but no significant differences between the music aerobic exercise and no—music aerobic groups ($p=0.76$). Paired t-test was employed to test the within group changes. These results are presented in Table 2. Both music aerobic exercise and no—music aerobic groups significantly improved in aerobic capacity ($p=0.003$, $p=0.012$); whereas, no significant change was found in the control group ($p=0.78$).

The results of one-way ANOVA for the quality of life scale indicated that there was a significantly difference among the groups in

posttest (F=54.08, p=0.008). Tukey pot hoc test indicated that there was a significant different between both exercises and the control group (p<0.05); whereas, no significant difference was found between the aerobic and non-musical exercise groups (p=0.48).

Paired t-test results of within group differences showed that both music and no—music aerobic exercise groups significantly improved in terms of quality of life (p=0.0001, p=0.006); however, no significant change was found in the control group (p=0.08).

Table 2 *Paired-t-test result of comparing pre and posttest aerobic capacity (mean ± SD) of musical, non- musical exercise, and control groups of elderly men*

Group	State	(Mean ± SD)	Change	Change%	t	p
Aerobic music group (n=15)	Pretest	43.73±6.69	19.94	+45.59	-3.64	0.003
	Posttest	63.67±24.47				
Aerobic group (n=15)	Pretest	48.13±13.4	15.34	+31.87	-2.89	0.012
	Posttest	63.47±7.74				
Control group (n=15)	Pretest	44.67±14.15	0.84	+1.85	-0.276	0.78
	Posttest	45.5±16.4				

Table 3 *Paired-t-test result of comparing pre and posttest elderly men quality of life (mean ± SD) across three groups*

Group	State	(Mean ± SD)	Changes	Change%	t	p
Aerobic music group	Pretest	234.33±24.9	54.77	+23.37	-5.95	0.0001
	Posttest	289.1±20.6				
Aerobic group	Pretest	249.8±36.1	30.7	+12.29	-3.24	0.006
	Posttest	280.5±21.5				
Control group	Pretest	251.6±26.1	5.3	+2.11	-1.61	0.08
	Posttest	256.9±25.3				

Discussion

The results of this study showed that eight weeks of musical and non-musical aerobic exercise caused improvement in the aerobic capacity of elderly men; however, no significant differences in the percent of change was found between these two groups. Ghaderi et al, examined the effect of motivating and relaxing music on aerobic performance, rate of perceived exertion, and salivary cortisol in male athletes and concluded that the music have a positive effect on aerobic performance of athletes [20]. Fakhari and Mahdieeh found that eight weeks of physical activity can improve the aerobic power in female patients with type 2 diabetes [21].

In addition, Kashef et al reported a positive effect of 8 weeks of aerobic training on the aerobic capacity and blood lactate of young men [22]. These research results are consistent with the findings of the present research. It seems that aerobic exercise can result in deeper inspiration and expiration that in turn results in strengthening of respiratory muscles and total body fitness. In such circumstances aerobic power increases following these activities.

In addition, it seems that after eight weeks of aerobic exercise with and without music raises the participants' morale and this could be one of the reasons for the increase in aerobic power. Moreover, it is possible that 90 percent of free fatty acids oxidative metabolism occurs when moderate intensity exercise (50 percent of maximum oxygen consumption) is performed in long term [23]. Due to increase of mitochondrial density following the aerobic exercise, oxidative capacity of muscle enzymes, activity electron transport chain enzymes, activity enzymes involved in the oxidation of fat, especially the beta oxidation cycle enzyme as well as lipoprotein lipase activity and lipid oxidation are increased. On the other hand, aerobic exercise performed in water can results in an increase in beta adrenergic receptor density in adipose tissue cell level; therefore, their susceptibility to

the process of lipolysis is increased [24]. It seems that the main driver of this process is the distribution of catecholamines and reduction of insulin effect on aerobic exercise, and increase of fat oxidation [23]

Aerobic training is likely to result in strengthening and maintaining of muscles strength, increasing oxygen supply to brain, increasing range of motion, developing muscle control, and decreasing muscle stiffness and hardness, enhancing balance ability and increasing the energy and feeling of wellness [25]. In regard to the effect of musical aerobic on aerobic power of the participants, it may be assumed that listening to music would cause the person to divert attention from fatigue caused by exercise and as a result lack sufficient resource to process other information as purposed by parallel information processing model [1]. Based on the theory of Astarbrvk's tunnel perception, listening to songs and music or any other stimulus causes the person not to feel the fatigue, therefore, keep on performing the task that eventually improves performance and increases the aerobic capacity of the performer [12] . Barzegar et al., showed that listening to fast music during incremental exercise significantly increase respiratory exchange ratio and the amount of carbon dioxide produced while no significant change in oxygen consumption and time to reach the threshold of anaerobic occurred [26].

Birnbaum et al found that listening to music with a fast tempo during the exercise increased oxygen consumption [27]. Tiev et al also reported that listening to music during exercise significantly increase oxygen consumption [28]. From neuromuscular point of view, it may seem that some external stimuli such as music while performing physical activity can increase the firing rate of primary motor neurons in the primary centers that results in further increase of muscle contractions [29]. In addition, there are reports that show listening to music with a fast tempo decreases muscle tension, increases blood flow to the muscles, and .causes muscles to switch to aerobic metabolism [30]. As noted earlier, the significant effect of aerobic exercise was similar regardless of music presence on aerobic power in the elderly participants.

The results of the present research also showed that eight weeks of aerobic training with musical and without music caused significant improvement in the quality of life of elderly; however, such effect was not found between the two types of exercises.

Ghasemtalebi et al., investigated the effect of 8 weeks of aerobic exercise performed three times per week on the quality of life of 23 elderly women and reported a positive effect of aerobic exercise on the participants 'quality of life [31]. Satoh et al., also conducted a research in which the effect of exercise training with music was examined on the cognitive function of 119 older adults (age 65-84 years) by dividing them into three groups of exercise with music, music only, and control condition and concluded that physical exercise along with music have a positive effect on cognitive function in the participants [32]. In addition, Geirsdottir et al studied the effects of 12 weeks of resistance training on physical performance and hope of improvement in the quality of life in 238 participants aged 65 years in Icelandic. The result of a for mentioned study showed significant improvement in lean body mass, muscle strength, physical performance, change in 6-minute walking distance, and health-related quality of life [33]. Svantesson et al., examined the effect of physical activity on the quality of life of elderly and found a positive correlation between the physical activity and decrease of chronic disease incidence, fear of falling, health care costs and improvement of cognitive function, muscle function and overall quality of life of the elderly [34].The results of these research are consistent with the findings of the present research. Exercise and physical activity play significant role on improvement of life quality, prevention of mental disorders, including depression, anxiety, stress, anger and stress [35]. Research result show that exercise (aerobic and anaerobic) reduces depression in depressed patients [36] that can be attributed to release of endogenous hormones such as

enkephalins and endorphins secreted from the anterior pituitary gland which in turn increases positive mood in people or it may be due to release of serotonin (or 5-hydroxyl tryptamine) secreted from the gastrointestinal system and central nervous system. Serotonin is a neurotransmitter that facilitates messages transmission from one region of the brain to the other regions. Approximately 40 million brain cells are affected directly or indirectly by serotonin. These cells are related with mood, sexual desire, appetite, sleep, memory and learning, regulating body temperature and some social behaviors that enhance energy, vitality and happiness in people [37]. Exercise and physical activity also have positive effect on the immune system that is responsible for stress management. Physical activity increases antibodies and type of lymphocytes T (carrying antibodies) that identify antigens production source within the body and intervene to eliminate the antigens' danger before they have a chance to harm the body. Physical activity increases the level of GH (growth hormone) in the elderly women more than the younger ones. It may be due to metabolic efforts in the body to store glycogen and reduce the breakdown of protein molecules and results in releasing the stored fat. [38]. In addition, physical activity and exercise reduce blood sugar levels and reduce cellular resistance to insulin absorption. In other words, exercise has insulin-like effect that facilitates glucose enters into the cells particularly the muscle cells [39].

Research result show that physical activities, including jogging, cycling, dancing, and walking may improve memory in time to respond quickly to environmental stimuli (environmental dominance) since regular exercise increases blood flow to the brain, leads to better oxygen and nutrition supply to the brain neurons, and prevents the narrowing of the arteries. Furthermore, exercise causes the release of a growth factor called B.D.N.F that enhances neurons resistant to damage and may prevent some memory disease including Alzheimer's and Parkinson [40]. It is likely that some of these changes occurred following the participation of both participants in exercise with and without music that was reflected in improvement in their quality of life condition.

Conclusion

Comparing the result of quality of life and aerobic capacity of both music and non-music aerobic exercise revealed that both group improved significantly but the effectiveness of the two types training was similar.

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Contribution

Study designs: BA, AH
Data collection and analysis: AH, BA, MS
Manuscript preparation: BA, MS.

Conflict of Interest

"The authors declare that they have no competing interests."

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Reference

1- Ferhan S, Vesile Ş. Fatigue and physical activity levels of 65 and over older people living in rest home. *Int J Gerontol*2011; 5(1): 13–6.

2- Christensen K, Doblhammer G, Rau R, Vaupel JW. Ageing populations: the challenges ahead. *Lancet*2009; 374(9696): 1196-208.

3- Schneider G, Driesch G, Kruse A, Wachter M, Nehen HG, Heuft G. What influences self-perception of health in the elderly? The role of objective health condition, subjective well-being and sense of coherence. *Arch Gerontol Geriatr*2004; 39(3): 227-37.

4- Newall NE, Chipperfield JG, Bailis DS, Stewart

TL. Consequences of loneliness on physical activity and mortality in older adults and the power of positive emotions. *Health Psychol*2013; 32(8): 921-4
5- King AC, Pruitt LA, Phillips W, Oka R, Rodenburg A, Haskell WL. Comparative effects of two physical activity programs on measured and perceived physical functioning and other health-related quality of life outcomes in older adults. *J Gerontol A Biol Sci Med Sci*2000; 55(2): 74-83.
6- Khazaee-Pool M, Sadeghi R, Majlessi F, Rahimi Foroushani A. Effects of physical exercise programm on happiness among older people. *J Psychiatr Ment Health Nurs*2015; 22(1): 47-57.
7- American College of Sports Medicine, Chodzko-Zajko WJ, Proctor DN, et al. American college of sports medicine position stand. Exercise and physical activity for older adults. *Med Sci Sports Exerc*2009; 41(7): 1510-30.
8- Seinfeld S, Figueroa H, Ortiz-Gil J, Sanchez-Vives MV. Effects of music learning and piano practice on cognitive function, mood and quality of life in older adults. *Front Psychol*2013; 1(4): 810.
9- Thoma MV, La Marca R, Brönnimann R, Finkel L, Ehlert U, Nater UM. The effect of music on the human stress response. *PLoS One*2013; 8(8): e70156.
10- Lee LH, Lai LH, Shaw CK, Chung HH. Effects of music on depression of the community-residing elders. *zu Chi Nurs J*2005; 4: 27–36.
11- Coelho FG, Gobbi S, Andreatto CA, Corazza DI, Pedroso RV, Santos-Galduróz RF. Physical exercise modulates peripheral levels of brain-derived neurotrophic factor (BDNF): a systematic review of experimental studies in the elderly. *Arch Gerontol Geriatr*2013; 56(1): 10-5.
12- Coelho FM, Pereira DS, Lustosa LP, et al. Physical therapy intervention (PTI) increases plasma brain-derived neurotrophic factor (BDNF) levels in non-frail and pre-frail elderly women. *Arch Gerontol Geriatr*2012; 54(3): 415-20.
13- Atan T. Effect of music on anaerobic exercise performance. *Biol Sport*2013; 30(1): 35-9
14- Thakur AM, Yardi SS. Effect of different types of music on exercise performance in normal individuals. *Indian J Physiol Pharmacol*2013; 57(4): 448-51.
15- Koç H, Curtseit T, Curtseit A. Influence of music on Wingate Anaerobic test performance. *Sci Mov Health*2009; 9: 134-7.
16- Baldari C, Macone D, Bonavolontà V, Guidetti L. Effects of music during exercise in different training status. *J Sports Med Phys Fitness*2010; 50(3): 281-7.
17- Cohen SR, Mount BM, Strobel MG, Bui F. The McGill quality of life questionnaire: a measure of quality of life appropriate for people with advanced disease. A preliminary study of validity and acceptability. *Palliat Med*1995; 9(3): 207-19.
18- Yeh SH, Lai HL, Hsiao CY, et al. Moderate physical activity of music aerobic exercise increases lymphocyte counts, specific subsets, and differentiation. *J Phys Act Health*2014; 11(7): 1386-92.
19- Hiilloskorpi HK, Pasanen ME, Fogelholm MG, Laukkanen RM, Mänttäri AT. Use of heart rate to predict energy expenditure from low to high activity levels. *Int J Sports Med*2003; 24(5): 332-6.
20- Ghaderi M, Rahimi R, Azarbaijani MA. The effect of motivational and relaxation music on aerobic performance, rating perceived exertion and salivary cortisol in athlete males. *South African Journal for Research in Sport, Physical Education and Recreation*2009; 31(2): 29-38.
21- Fakhari M, Mahdieah L. Effect of 8 weeks of selective physical activity on static balance and aerobic capacity in female patients with type 2 diabetes. *Quarterly Journal of Sabzevar University of Medical Sciences*2014; 21(4): 629-36.
22- Kashef M, Ramezani A, Mohammadi M. The effect of L-carnitine and aerobic exercise on aerobic power and blood latate in young male. *Sport Biosciences (Harakat)*2014; 6(1): 57-68.
23- Pasman WJ, Westerterp MS, Saris WH. The effect of body weight changes and endurance training on 24h substrate oxidation. *Int J Obes Relat Metab Disord*1999; 23(12): 1223-32.
24- Moro C, Pillard F, De Glisezinski I, et al. Exercise-induced lipid mobilization in subcutaneous adipose tissue is mainly related to natriuretic peptides in overweight men. *Am J Physiol Endocrinol Metab*2008; 295(2): 505-13.
25- Coelho FG, Santos-Galduroz RF, Gobbi S, Stella F. Systematized physical activity and cognitive performance in elderly with Alzheimer's dementia: a systematic review. *Rev Bras Psiquiatr*2009 ;31(2): 163-70.
26- Barzegar H, Vosadi E, Soori R, Akbarnejad A. Effect of music on athlete metabolic responses during incremental exercise. *Medical Sciences*2014; 24(3):153-8.
27- Birnbaum L, Boone T, Huschle B. Cardiovascular responses to music tempo during steady-state exercise. *J Exerc Physiol Online*2009; 12(1): 50-6.
28- Tiev M, Manire SA, Robert JR, Barbara W. Effect of music and dialogue on perception of exertion, enjoyment, and metabolic responses during exercise. *Int J Fit*2010;6(2):45-52
29- Shephard RJ. Chronic fatigue syndrome: an update. *Sports Med*2001; 31(3): 167-94.
30- Szmedra L, Bacharach DW. Effect of music on perceived exertion, plasma lactate, norepinephrine and cardiovascular hemodynamics during treadmill running. *Int J Sports Med*1998; 19(1): 32-7.
31- Ghasemtalebi S, Nataj Omran ZH, Farzaneh Ghrohi F. Effect of aerobics exercises on quality of life in elderly women. *International Journal of Sport Studies*2015; 5(3): 263-6.

32- Satoh M, Ogawa J, Tokita T, et al. The effects of physical exercise with music on cognitive function of elderly people: Mihama-Kiho project. *PLoS One*2014; 9(4): e95230.
33- Geirsdottir OG, Arnarson A, Briem K, et al. Physical function predicts improvement in quality of life in elderly Icelanders after 12 weeks of resistance exercise. *J Nutr Health Aging*2012; 16(1): 62-6.
34- Svantessona U, Jones J, Wolbert K, Alricsson M. Impact of physical activity on the self-perceived quality of life in non-frail older adults. *J Clin Med Res*2015; 7(8): 585–93.
35- Spirduso WW, Cronin DL. Exercise dose-response effects on quality of life and independent living in older adults. *Med Sci Sports Exerc*2001; 33(6): 598-608.
36- Strawbridge WJ, Deleger S, Roberts RE, Kaplan GA. Physical activity reduces the risk of subsequent depression for older adults. *Am J Epidemiol*2002; 156(4): 328-34.
37- Pate RR, Pratt M, Blair SN, et al. Physical activity and public health. A recommendation from the centers for disease control and prevention and the american college of sports medicine. *JAMA*1995; 273(5): 402-7.
38- Cox KL, Burke V, Gorely TJ, Beilin LJ, Puddey IB. Controlled comparison of retention and adherence in home- vs center-initiated exercise interventions in women ages 40-65 years: The S.W.E.A.T. Study (sedentary women exercise adherence trial). *Prev Med*2003; 36(1): 17-29.
39- Richter EA, Hargreaves M. Exercise, GLUT4, and skeletal muscle glucose uptake. *Physiol Rev*2013; 93(3): 993-1017.
40- Paillard T, Rolland Y, de Souto Barreto P. Protective Effects of Physical Exercise in Alzheimer's disease and Parkinson's Disease: A Narrative Review. *J Clin Neurol*2015; 11(3): 212-9.