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Dissertation for the Degree of Doctor of Philosophy

A Study on the Application of Dancesport Program for Healthy Aging in Older Adults with Intellectual Disability

지적장애 노인의 건강한 노화를 위한

댄스스포츠활동 프로그램 적용 연구

By

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August 2014

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ABSTRACT

A Study on the Application of Dancesport Program for Healthy Aging in Older Adults with Intellectual Disability

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Department of Physical Education

The Graduate School of Seoul National University

The purpose of this study was to investigate the effects of a modified 12 weeks dancesport program on healthy aging among older adults with intellectual disability (ID) by analyzing variations in functional fitness, age-related hormones and antioxidant enzymes. Data were collected from a sample of 40 older adults with ID attending two different community welfare centers located in C and S cities, respectively. 20 participants from each community welfare center were recruited for the experiment. In the experiment, 20 participants from each center were assigned to either experimental or control groups (C: exercise group, S: control group). The dancesport program was administered for 12 weeks, 2 times a week for 90 minutes per session. An identical analytic procedure was conducted for both pre and post tests, which measured functional fitness (i.e., cardiovascular endurance, strength of upper

and lower extremities and flexibility), age-related hormones (Human growth hormone (HGH), Dehydroepiandrosterone sulphate (DHEA-S), Insulin-like growth factor-1 (IGF-1)) and antioxidant enzymes (Superoxide dismutase (SOD), Glutathione peroxidase (GPx), Catalase (CAT)). A total of 26 participants (experimental group: 14 and control group: 12) were retained for the analysis because 14 participants dropped from the program. SPSS 20.0 was used to analyze the data gained from the sample. The results of the experiment are summarized as follows.

First, a significant interaction effect (<.05) was found for every criterion selected in the measure of functional fitness (cardiovascular endurance (<.05), strength of upper extremity (<.01), lower extremity (.05) and flexibility (.01)), which indicates that the program improves functional fitness in older people with ID.

Second, with respect to the age-related hormone, there was a significant interaction effect for HGH (<.05) and DHEA-S (<.01), yet there was not one for IGF-1t. However, it was observed that the width of in the experimental group was lower than the control group.

Lastly, among the three indicators of the antioxidant enzyme, an interaction effect was found for GPx (<.05).

While a significant amount of attention has been given to the development of sporting programs and their related research for older people without disabilities, little attention has been given to older people with ID. The current study was designed to close this gap by investigating the effects of a 12 weeks

dancesport program on healthy aging among older adults with ID by analyzing variations in functional fitness, age-related hormones and antioxidant enzymes.

As the results showed, this study provides meaningful insights into understanding the effects of a dancesport program for older people with ID, as the study revealed the positive effects of a dancesport program in improving functional fitness, age-related hormones (except for IGF-1), and one of the variables (GPx) in antioxidant enzymes.

Keywords : Older adult, Intellectual disability, Dancesport, Aging, Age-related hormones, Antioxidant enzymes

Student Number : 2010-30419

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List of Abbreviations

CAT	**Catalase**
CONG	**Control group**
DHEA-S	**Dehydroepiandrosterone-sulfate**
EXG	**Exercise group**
GPx	**Glutathione peroxidase**
Healthy Aging	**Helping people to live long, improvement high level of physical function lives and enjoy a good quality of life**
HGH	**Human growth hormone**
ID	**Intellectual disability**
IGF-1	**Insulin-like growth factor-1**
IQ	**Intelligence quotient**
SOD	**Superoxide dismutase**

INTRODUCTION

1.1. Significance of the study

People cannot be free from the process of aging for even one day as all living species continuously progress through life from birth to death. Over the last few years, the older adult population is rapidly increasing around the world as a result of the development of medical service and social development. Korea also officially became an ‘aging society’ back in 2000 where the elderly population (people aged 65 and over) made up at least 7% of the country's population. The next level would be an ‘aged society’ where the elderly population would make up 14%. Korea is expected to cross that mark in 2018 if this phenomenon continues. The elderly population will soon reach 20% of the population by 2026 Korea will then be an ‘ultra-aged society’ (Statistics Korea, 2012).

In particular, persons with intellectual disabilities (ID) live longer than they did in the past. Until the 1970s, persons with disabilities faced lower life expectancies than their non-disabled peers (Kemp & Mosqueda, 2004), but the life expectancy of a person increased from 47 years in 1900 to about 78 years in 2009 in the United States (Services, 2009). Although the life expectancy of people with ID has not been officially announced yet in Korea, trends about aging of people with ID are predictable to estimate, according to report from the ‘2012 Statistics Disability Korea’ (Korea Statistics of the Disabled, 2012); over 50 years of age was 10.4% (15,775 people) and 24.6% (37,499 people) over the age of 40 surveyed of all ID (152,408 people). These previous reports suggested that social cares are also required for older

people with ID, similar to other older people.

Among the numerous characteristics of the individuals with ID, prematurity is one of the most important in today's modern society (Evenhuis, Hermans, Hilgenkamp, Bastiaanse & Echteld, 2012). As the lifespan of people with ID increases, new challenges will emerge in the future with regard to their care. A major challenge is that most people with ID need care for by their parents. It is estimated that 50 to 60% of people with ID live with family caregivers (Barron, McConkey, & Mulvany, 2006; Braddock, Emerson, Felce, & Stancliffe, 2001). Consequently their parents have trouble with care problems, because many older people with ID will outlive their parents (McCarron & McCallion, 2007). In addition, people with ID seem to have an increased risk of chronic multimorbidity (McCarron et al., 2013) which increases with age.

For these reason, aging of people with ID has become one of the biggest issues in current society, because a longer life span is resulting in increasing numbers of older adults with ID that place demand on the public health system and on medical and social services. Moreover the proper materials in terms of health and living of older adults with ID have been requiring for improving quality of their life. Thus, we need to understand their aging process and the characteristics correctly and precisely.

Although there is no appropriate assessment to measure aging process and reasons physical function plays an important role in aging indicator. Physical function leads to health and independence for the older people with ID because low fitness is a risk factor for cardiovascular disease and musculoskeletal health conditions, such as osteoporosis and loss of muscle mass, and increases the risk of falls (DHHS, 2008; Mazzeo & Tanaka, 2001). Low physical fitness is preventable or reversible by engaging in physical activity and structured exercise (Chodzko-Zajko et al., 2009),

which opens up possibilities to maintain or positively influence health and independence into old age. First of all, aerobic exercise can influence aging, cognition, and general well-being, including improvement of mental and psychosocial problems in persons aging with ID (Dixon-Ibarra, Lee, & Dugala, 2013). Several studies have shown that adults with ID have significantly lower rates of physical activity than their non-disabled counterparts (Draheim, Williams, & McCubbin, 2002; Temple, Frey, & Stanish, 2006). This is because individuals with disabilities haves a variety of barriers such as limited physical activity opportunity of participation, social prejudices, absence program of suitable education and inappropriate environmental of education.

Dance sport is a very effective way to increase physical activity of elderly with ID, because it consists of music and highly complex motor activity. Also, it is generally defined as paired dancing between a man and a woman combining as a couple (or groups of couples combining as a team) and using the required technique together with floor craft and artistic interpretation to produce a highly disciplined dance performance. For these reasons, dance sport is sufficient to increase physical activity for having an inattentive in people with ID. Although many of the beneficial effects of dance sport program for older adults with ID, this program is not used in various ways for older adults with ID.

Thus, to investigate whether dance sport program leads to more widespread healthy aging management for older adults with ID, we measured physical function, age-related hormone, and antioxidant enzymes.

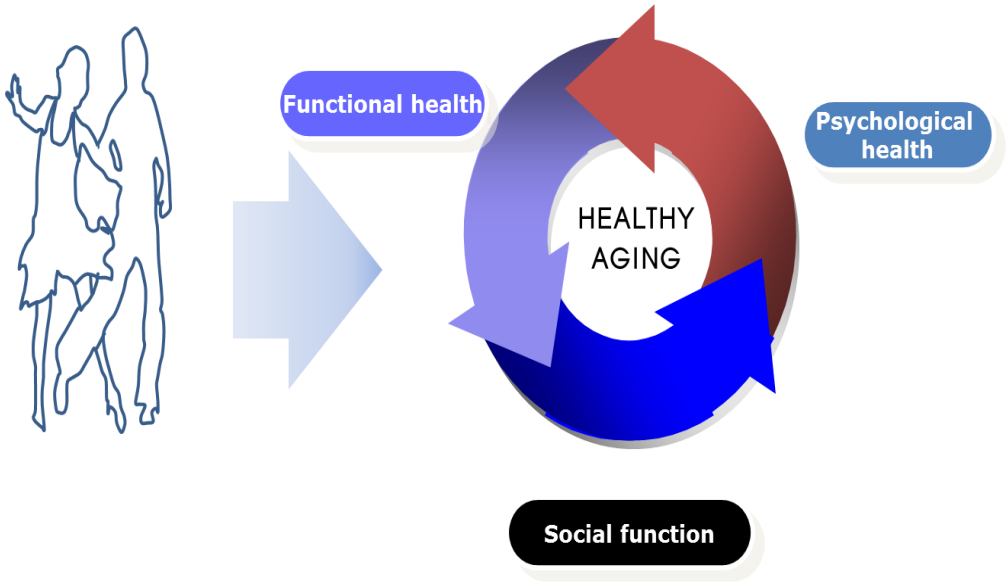

Figure 1. Effect of dancesport activity

1.2. Purpose of the study

The aim of this study was to investigate the impact of a dancesport activity program on healthy aging (physical function, age-related hormone, and antioxidant enzymes) in older adults with ID, and through this progress, dancesport activity program will be application for management of aging in older adults with ID.

1.3. Research hypothesis

1) There would be significant difference in body weight, body fat mass, muscle mass, BMI, blood lipids between the pre- and post-test through the dancesport activity.

2) There would be a significant difference in a functional fitness (cardiovascular endurance, upper body muscular strength, lower body muscular strength, flexibility, balance) between the pre- and post-test through the dancesport activity.

3) There would be a significant difference in age-related hormones (HGH, DHEA-s, IGF-1) between the pre- and post-test through the dancesport activity.

4) There would be a significant difference in antioxidant enzymes (SOD, GPx, CAT) activity between the pre- and post-test through the dancesport activity.

II. LITERATURE REVIEW

In this chapter the putted out literature regarding the key study questions about health and health care of people with ID is reviewed: definition of ID, epidemiology data in people with ID, functional fitness, and value of dancesport in people with ID.

2.1. Intellectual disability

In 2009, it was estimated that there were approximately 200 million people with ID in the world (Special Olympic, 2009). According to the Laws for the Welfare of Disabled (2007) of Korea, the term intellectual disability (ID) replaces “mental retardation” used in previous editions of the manuals, after that ID is increasingly being used instead of mental retardation (Ministry of Health & Welfare, 2007) . In addition, fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), the diagnosis of ID is revised from mental retardation in the DSM-IV (American Psychiatric Association, 2013).

This disability is defined as consistently subaverage intellectual function (an IQ of approximately 70 or below) that is accompanied by defects in adaptive, conceptual, or social skills with onset before 18 years of age (American Association on Intellectual and Developmental Disabilities, 2010). Also, ID is divided into four levels of severity: mild (IQ ranging from 50-55, to approximately 70), moderate (IQ ranging from 35-40 to 50-55), severe (IQ ranging from 20-25 to 35-40) and profound (IQ below 20 or 25). According to this definition, about 85% of people with ID are in the mild category, 10% are in the moderate category, 3 to 4% are in the severe category, and only 1 to 2% of people are in the profound category.

There are few incidence studies. Harris (2006) reported the prevalence of ID to vary between 1% and 3%, globally. Among those with ID, mild, moderate, severe, and profound mental retardation affects about 85%, 10%, 4%, and 2% of the population, respectively (King, Toth, Hodapp, & Dykens, 2009).

ID can be caused by various biological or psychosocial factors, acting either alone or in combination. In a significant minority of people with ID, no clear cause for the ID can be determined. The major causes of ID (Medline Plus, 2006) are listed below.

- Genetic conditions. These include things like Down syndrome and fragile X syndrome.
- Problems during pregnancy. Things that can interfere with fetal brain development include alcohol or drug use, malnutrition, certain infections, or preeclampsia.
- Problems during childbirth. ID may result if a baby is deprived of oxygen during childbirth or born extremely premature.
- Illness or injury. Infections like meningitis, whooping cough, or the measles can lead to intellectual disability. Severe head injury, near-drowning, extreme malnutrition, exposure to toxic substances such as lead, and severe neglect or abuse can also cause it.

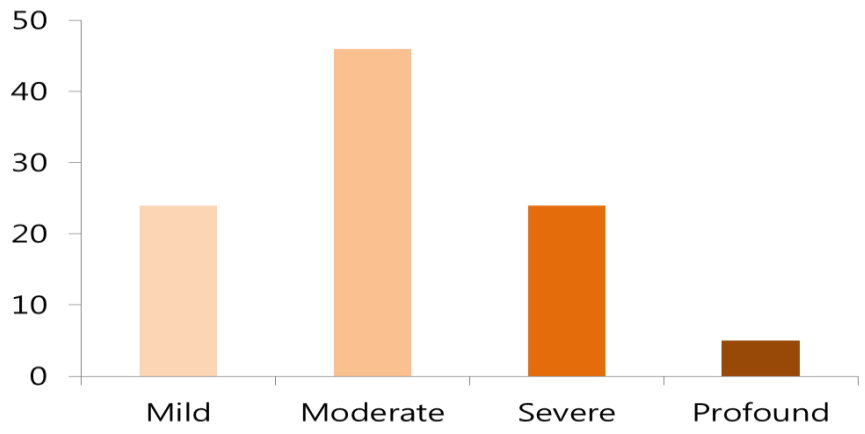

Figure 2. Level of intellectual disability (Kelly et al., 2010)

2.1.1. ID and Lifespan

The numbers of older people with ID in the past were very small, but are set to increase significantly. Despite this, there is a lack of information on the health and well-being of people with ID in society. There have been significant improvements in the mean lifespan of people with ID from as little as an estimated 18.5 years in the 1930s to 59 years in 1970s to 66 years in the 1990s in U.S.A (Braddock, 1999). Also, the life-expectancy of those with mild ID now approaches that in the general population of a similar socioeconomic status. Given these improvements, it has been predicted that the proportion of people with ID over 65 years of age will have doubled by 2020 (Janicki & Dalton, 2000) and that over a third of all people with ID will be over 50 years of age by that time (McConkey, Mulvany, & Barron, 2006). The Korea can estimate trends aging of people with ID, according to over 50 years of age was 10.4% (15,775 people) and 24.6% (37,499 people) over the age of 40 surveyed of all ID (152,408 people) from the '2012 Statistics Disability Korea' (Korea Statistics of the Disabled, 2012).

As people age their support and care needs change, which places new demands on services. Traditionally, many people with ID lived with their parents but, as lifespan increases, parents are now likely to predecease their offspring (McCarron & McCallion, 2007). In Korea, due to an increasing ID's aging society, it is vital to consider people with IDs' prevention and management as an important part of any care program.

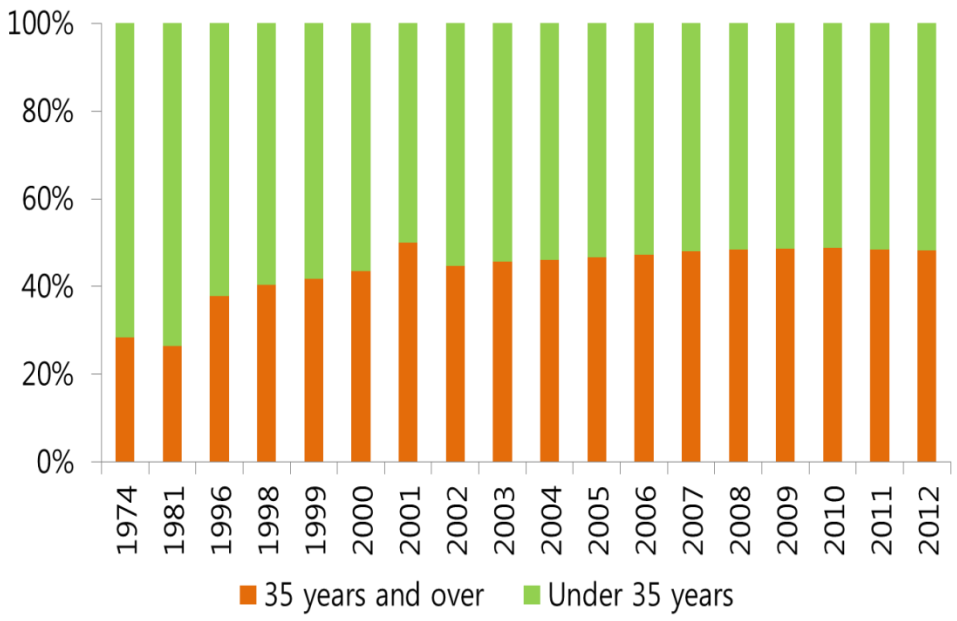

Figure 3. Proportion of people with moderate, severe or profound ID (combined), by age group, 1974-2012 (Kelly et al., 2012)

2.2. Aging

Aging is a complex process natural process that everyone must undergo at his or her own time and pace. Over the years, many theories have emerged to explain what process or mechanism drives aging. There are two main theories: programmed and damage or error theories. The programmed theories imply that aging follows a biological timetable, perhaps a continuation of the one that regulates childhood growth and development. The damage or error theories emphasize environmental assaults to living organisms that induce cumulative damage at various levels as the cause of aging (Kunlin, 2010).

Recently, people focus on get interested in healthy aging. Healthy aging is fundamentally a biopsychosocial process involving three broad contributing factors: (a) social structural influences (gender, socioeconomic status, race, age, and cultural context), (b) individual influences (psychosocial and behavioral), and (c) biological influences (inflammatory and oxidative damage, damage to irreplaceable molecules and cells, and blood metabolic hormones) (Bengtson et al., 2009).

2.2.1. Physical activity and oxidative damage

In view of the age related increase in the susceptibility to oxidative stress and because of the significant increase in oxidative stress during exercise one might question if untrained elderly would benefit from following an exercise-training program.

The free radical theory of aging hypothesizes a single common process, modifiable by genetic and environmental factors, in which oxygen-derived free radicals are responsible (due to their high reactivity) for the age-associated damage at the cellular

and tissue levels. In fact, the accumulation of endogenous oxygen radicals generated in cells and the consequent oxidative modification of biological molecules (lipids, proteins and nucleic acid) have been indicated as responsible for the aging and death of all living beings (Finkel & Holbrook, 2000; Harman, 1981).

The increased production of free radicals during physical exercise has been attributed to several factors, including the increase of catecholamines undergoing auto-oxidation, muscle transient hypoxia and re-oxygenation, lactic acid-induced free iron release from myoglobin, and inflammation-related neutrophil function (Ji et al., 1998). There is a substantial lack of data regarding the effects of acute or chronic exercise in aging animals or humans.

Regular physical activity and exercise are recommended for the maintenance of an optimal health status and the prevention or management of chronic diseases (DHHS, 1996; Pate et al., 1995).

2.3. Music and dancesport

Music and dance are strongly connected learning. In addition, music is very effective and interesting participation from people with ID. Staum (2013) showed that music and dance are able to stimulate learning. Dancesport is the activity that combines sport and dance, and allows the participants to improve physical fitness, mental health, and sociality. Dancesport consists of two different types: Latin American Dance and Standard Dance. The five Latin dances are Samba, Cha-Cha-Cha, Rumba, Paso Doble and Jive. The five Standard Dances are Waltz, Tango, Viennese Waltz, Slow Foxtrot and Quickstep (Liiv et al., 2014).

Dancesport does not need special equipment and can be performed anywhere regardless of season or weather (Kim et al., 2011). And also compared with other

aerobic exercises, dancesport has the additional benefits about stimulating the emotions, promoting social interaction, and exposing subjects to acoustic stimulation and music (Kattenstroth, Kolankowska, Kalisch, & Dinse, 2010).

The Cha Cha Cha, also called the Cha Cha, born in Cuba and introduced to the West in 1947. The Cha Cha is a non-progressive, lively, fun dance, which uses a ‘ball flat” foot action and keeps the body over the feet. The legs and hips are used to produce a strong rhythmic movement that compliments the music.

Many studies shows that intervention of dancing in the older adults have focused on improvement in cardiovascular parameters, muscle strength, posture and balance (Adiputra et al., 1996; Hui et al., 2009; Kreutz, 2008).

III. MATERIAL and METHOD

3.1. Participants

According to Schoufour el al.(2013), the frailty index mean of people with ID scores at age 50–59 years are comparable to those in the general population aged 70–79 years.

So, forty older adults with ID (age: 45 years or older) participated for this study. The exercise group (n=20) and control group (n=20) recruited from the community welfare centers for the disabled were located in C and S cities respectively. All participants were included if they had a total IQ between 45 and 70 or a diagnosis of third degree and excluded if they had any severe neurologic or orthopaedic impairment and were taking any medication that may adversely influence their physical response to exercise. Prior to the current study, all the participants and their caregivers submitted a written informed consent. During the course of the study, fourteen subjects were dropped. The primary reason was their low attendance rate (less than 70%) or they did not take the pre- and post-test.

3.2. Experimental design

We designed the following procedures to identify the effect of exercise on functional fitness, age-related hormones, and antioxidant enzyme activity in older adults with ID. . The exercise group (EXG) performed dancesport. The dancesport activity was performed for 90 minutes, 2 days per week, for 12 weeks. This session included 15 minutes of warm up, 60 minute of dancesport activity, and 15 minutes of cool down.

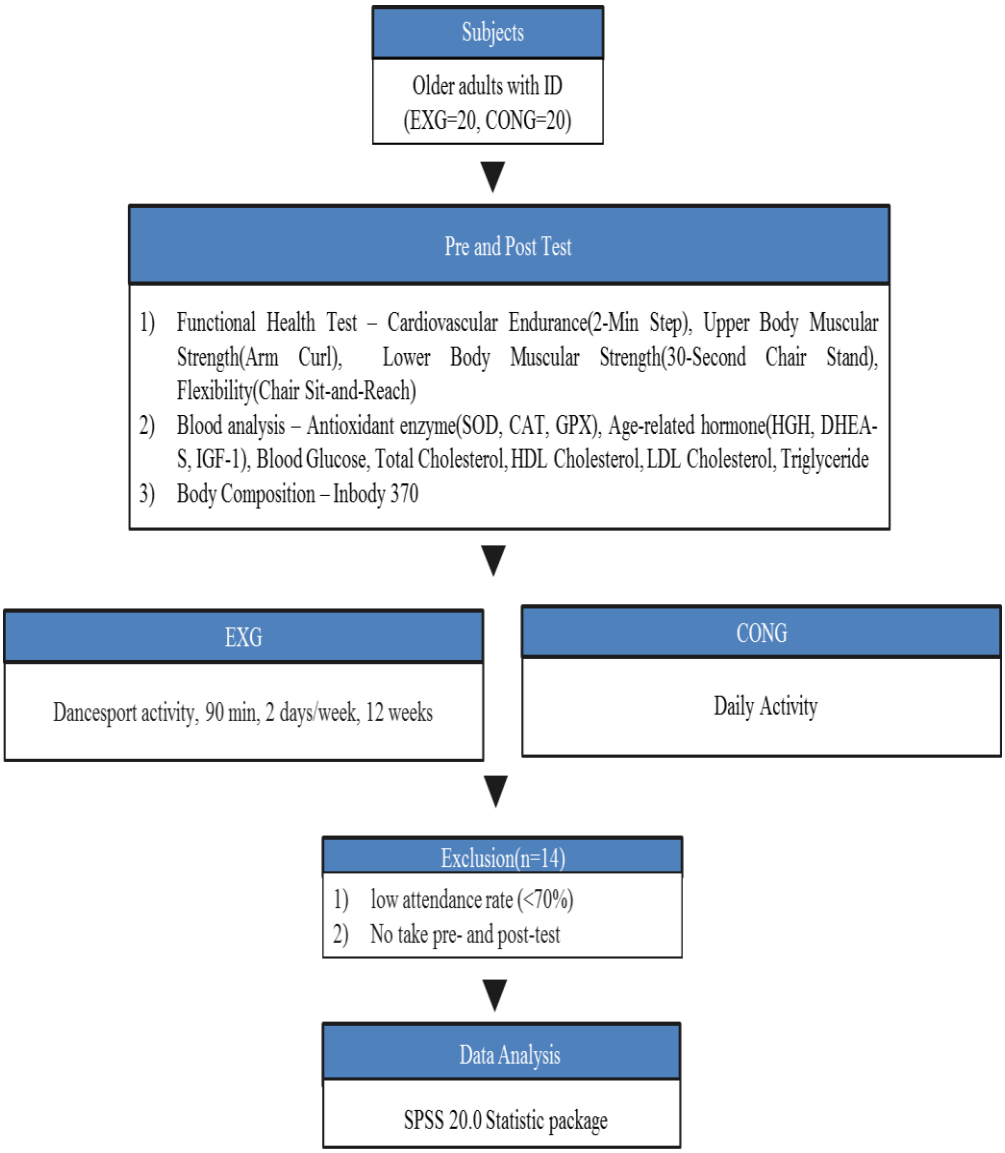

Figure 4. Experimental design

3.3. Biochemical and anthropometric measurements

Table 1. Experimental instruments

Variables	Analysis Method	Model	Company
Body Composition Analysis	BIA	In body 370	Biospace, Korea
Blood Lipid Profiles	Lipid test		The Green Cross Reference Lab, Korea
Age-related Hormone	Lipid test		The Green Cross Reference Lab, Korea
Antioxidant Enzymes	Lipid test	ELIZA Analysis	Cayman, U.S
Functional fitness Test	2-Min Step,	Senior Fitness Test(SFT)	Human Kinetic, U.S
	Arm Curl,		
	30-Second Chair Stand		
	Sit and Reach	Measuring apparatus	ST-18, Expert, Korea

3.3.1. Body composition

Each subject was evaluated the morning after an overnight fast in the Lecture Hall of Welfare Institutions which was the participants' usual morning gathering. They were evaluated in a single session and always by the same examiner. Before the measurements the subjects were asked to empty their bladders. Their height was evaluated using an extensometer and the body weight, BMI, fat mass, body fat percentage, fat free mass and muscle mass were measured by bio-impendence analysis using the In-body 370 (Biospace, Korea). Participants were asked to stand on the metal foot pads of the In-body machine, then the bioelectrical impedance measurement of their body composition was determined through a small alternative current.

3.3.2. Functional fitness

The cardiovascular endurance, upper body muscular strength, and lower body muscular strength were evaluated using the Senior Fitness Test (respectively 2-Min Step, Arm Curl, 30-Second Chair Stand; Rikli & Jones, 2001). Flexibility was measured using the Sit-and-Reach test.

3.3.3. Blood analysis

Blood samples were taken, after 12h of overnight fasting and 2 days of minimal physical activity, to determine the amount of lipids, age-related hormones and antioxidant enzymes. The blood was drawn from the anticubital vein into pre-

contained ethylenediaminetetraacetic acid (EDTA) tubes. Whole blood was centrifuged for 10 min at 3000 rpm and 4℃ and then the separated plasma was stored at -70℃ for subsequent analysis.

The lipid profiles such as triglycerides (TG), total cholesterol (total-C), low-density lipoproteins (LDL-C) and high-density lipoproteins (HDL-C), glucose and age-related hormone (GH, DHEAs, IGF-1) were measured at the Green Cross Reference Lab in Korea.

A SOD based assay kit (Cayman Chemicals, Ann Arbor, MI, USA, catalog#706002) utilizing a tetrazolium salt was used to detect superoxide radicals generated by xanthine oxidase and hypozanthine. The standard curve and samples were read at 450 nm. Standard measurements were performed on the same day. The intra-assay and inter-assay coefficient of variation was 3.2% and 3.7%, respectively. Plasma GPX activity was evaluated indirectly by a coupled reaction with glutathione reductase (Cayman Chemicals, Ann Arbor, MI, USA, catalog#703102). GPX measurements were performed on the same day, using a Catalase based assay kit (Cayman Chemicals, Ann Arbor, MI, USA , catalog#707002), and the intra-assay and inter-assay coefficient of variation was 5.7% and 7.2%, respectively.

3.4. Exercise program

For the purpose of this study, the dancesport exercise program was performed regularly for ninety minutes, two times a week for twelve weeks. This program was comprised while considering various characteristics of individuals with intellectual disabilities, and was administered by an instructor based on those subjected considerations. Definite intensity, frequency, and time of the experimental group are shown in table 2. To maintain an exercising intensity of the experimental group within the range of 40%~80% maximal heart rate (HRmax=220-age), participants were equipped with polar, which is a wireless heart rate measuring apparatus, and taught the dancesport activity program for this study. To get participants accustomed to the tempo, we led them through several exercises such as beating sticks, clapping hands, and jumping while clapping hands before beginning the main dance sport activity program. To become familiar with the dancing steps, participants were taught stepping without music, moving to the tempo of the music (moving to the right, moving to the left, moving forward, and moving backward step by step), standing still with one leg lifted, standing still on their tiptoes, walking on their tiptoes, and so on. The specific details of the dancesport programmed for this study are shown in the table below.

Each exercise session consisted of a 15-minute warm-up, a 60-minute main exercise, followed by a 15-minute cool-down.

Table 2. Dancesport program

Dancesport program		
week	content	Remarks while instructing
1~3	Being familiarized with dance sport	Developing rapport Body Awareness(Getting familiar with directions of right foot, left foot, right hand and left hand) Learning 4/4 tempo - Clapping hands to 4/4 tempo - Beating stick to the 4/4 tempo - Walking and jumping to 4/4 tempo Step practice - Walking to the tempo - Jumping to the tempo - Clapping hands while walking - Clapping hands while jumping - Stepping to right by crossing left food over the right foot to place on the right side of the right foot.  Performing Line dance applying the basic step - The instructor leads the participants to get involved in activity after performing enough demonstration. - The instructor leads participants to move with making sounds with voice when stepping. - The instructor leads participants to perform stepping while holding both hands and facing instructor.

		- When exercising step activity, a teacher leads participants to slowly follow the foot shapes  on the floor. - The instructor leads participants to conduct the step activity on their own when are familiarized with the step. At this time, it is useful that the teacher assists to grasp the waist of participants according to their performance level.
4-5	Chachacha (Basic movement & under arm turn)	After enough explanation, the instructor leads the participants to learn gesture to music. Learning the method to hold with the partner at the performance - The instructor leads awkward recipients to touch each other's palm together while performing. - For the ones who can put palms together, instructor should lead them to grasp hands and perform. Basic movement & Under arm turn - Participants partner up with instructor and perform. - The instructor gives the start sign to participants by touching their tiptoe. - When performing the under arm turn, instructor should be careful for the partner to perform safely. - The instructor leads that recipients can learn their turning performance as their performance level. - The instructor should prepare to manage unexpected fall of the participant by holding their hand and holding near their upper body with the other hand..

6-8	Chachacha (New York & Spot turn)	New York - Practice the hand movement after fully practicing the step performance. - Have them shout out 'New York' loudly when performing the movement - Have them pose in 'V' shape in front of a mirror Spot Turn - Instruct participants to turn as slow as possible at first. - Lead participants to turn a quarter of a circle at a time to prevent from balance being broken when turned 360degrees at once. - The instructor makes a defense to protect them by using instructor's both hands when recipients conduct their turn movement. - The instructor teaches recipients to conduct their turn movement in four tempo as considering their performance level
9-10	ChaChaCha (Three Chachacha & Hand to Hand)	Three chachacha - The instructor gives the sign to participants by pulling their hands when performing forward step, backward step and three chachacha. - Many of participants are not able to properly perform three chachacha movements. As a solution to this matter, the instructor should focus on them to move forward and backward on tiptoe. Hand to Hand - Attempt to perform by holding hands with instructor; however, try to be closer to participant by grasping wrist or upper arm if the movements are not smooth enough.

11-12	Chachacha (Shoulder to shoulder)	Shoulder to shoulder - Show a picture of penguin. - Have them practice after reminding the way penguin walks.

3.5. Statistical analysis

Data analyses were performed using the SPSS version 20.0 (SPSS Inc., Chicago, IL) for Windows statistical software. All data were expressed as mean ± SD. The treatment effects (pre x post) x (group) were determined by Two-way ANOVA with repeated measures. The level of significance was set at p <0 .05.

IV. RESULTS

This study was conducted to identify the effects of dancesport activity on the healthy aging (functional fitness, age-related hormones, and antioxidant enzymes) of older adults with ID. The results of this study were as follows. Six participants in the exercise group stopped attending class due to personal reasons (4 people - transmittable diseases, 2 people - change of residence) and eight members of the control group were unavailable for post-testing and were dropped from the analysis.

4.1. Participant characteristics

Subject characteristics are presented in <Table. 3>. There were no statistically significant differences in testing of homogeneous between EXG and CONG.

Table 3. Testing of homogeneous

Variables	CONG (n=12, M=7, F=5) M(SD)	EXG (n=14, M=10, F=4) M(SD)	t	*p*
Age(yrs)	51.17(5.29)	53.50(6.96)	0.95	0.35
Height(cm)	159.99(9.25)	158.75(11.61)	-0.29	0.77
Weight(kg)	65.79(13.51)	60.24(8.84)	-1.26	0.22
BMI(kg/m^2)	25.53(3.86)	22.92(3.39)	-1.84	0.08
Systolic BP(mmHG)	125.67(12.59)	124.14(24.23)	-0.19	0.84

Diastolic BP(mmHG)	126.41(14.14)	119.43(19.36)	-1.04	0.31
Total body fat (%)	31.37(10.10)	30.41(12.14)	-0.22	0.83
Total muscle mass (kg)	42.27(8.83)	37.49(7.73)	-1.47	0.15

BMI = Body Mass Index, BP = Blood Pressure

4.2. The change of anthropometric characteristics

<Table 4> respectively shows the change of body composition. After the 12 weeks of the dance sport activity, significant differences were found between groups for body composition variables. Especially, only the body weight variable (p=0.00) showed significant effects on EXG compared to CONG among various body compositions in this study (p<0.05).

Table 4. The change of body composition

Variables	CONG		EXG		Time × Group	
	Pre	**Post**	**Pre**	**Post**	**F**	***p***
Height (cm)	159.99(9.25)	159.66(9.04)	158.75(11.62)	159.67(11.17)	1.57	0.22
Body Weight(kg)	65.79(13.51)	66.36(13.38)	60.24(8.84)	58.25(8.06)	14.21	0.00*
BMI (kg/m^2)	25.53(3.86)	25.89(3.90)	22.92(3.39)	22.72(3.24)	2.13	0.16
Skeletal Muscle Mass(kg)	42.27(8.83)	41.90(8.54)	37.49(7.73)	37.51(8.18)	0.08	0.78
Body Fat Mass (kg)	24.18(11.08)	25.32(11.79)	17.79(8.17)	18.59(7.38)	0.06	0.81
Body Fat (%)	31.37(10.10)	32.56(9.88)	30.41(12.14)	31.76(11.36)	0.004	0.95

Values are mean (SD), *p<0.05

After the dancesport activity, there were significant effect on LDL-C (p=0.04), HDL-C (p=0.00) and Triglycerides (p=0.00) as Table 5. On the other hand, there were no significant changes in Total-C (p=0.12) and Glucose (p=0.48) between EXG and CONG (p>0.05).

Table 5. The change of blood profiles measures

Blood Profiles measures	CONG		EXG		Time × Group	
	Pre	**Post**	**Pre**	**Post**	**F**	***p***
Total –C (mg/dL)	187.50(29.32)	166.00(43.08)	189.79(25.24)	180.29(37.89)	2.61	0.12
LDL-C (mg/dL)	100.25(33.58)	96.58(38.34)	126.43(27.20)	110.93(26.94)	4.36	0.04*
HDL-C (mg/dL)	50.58(13.45)	42.83(9.13)	45.00(11.03)	48.93(13.84)	20.55	0.00*
Triglycerides (mg/dL)	103.17(98.48)	119.50(130.35)	135.86(70.52)	112.93(50.11)	10.77	0.00*
Glucose (mg/dL)	115.58(68.45)	115.00(102.00)	87.71(13.09)	79.36(10.23)	0.60	0.48*

Values are mean (SD), *p<0.05

4.3. The change of functional fitness

4.3.1. Cardiovascular endurance

As shown in Table 6 and Figure 5, on the 2-Min Step test, there was a significant improvement in the EXG compared with CONG for cardiovascular endurance ($p<0.05$). Although there is no time×group interaction effects between the two groups, the exercise group increased cardiovascular endurance by about 30% after 12 weeks of dance sport activity. Interestingly, there was a significant improvement in the EXG compared with CONG for cardiovascular endurance.

Table 6. The change of cardiovascular endurance

Group	Pre	Post		F	*p*
CONG(n=12)	73.58(28.60)	76.33(26.44)	Time	10.728	0.00*
			Group	0.041	0.842
EXG(n=14)	63.64(18.60)	82.29(30.93)	Time × Group	5.92	0.02*

Values are mean (SD), *$p<.05$

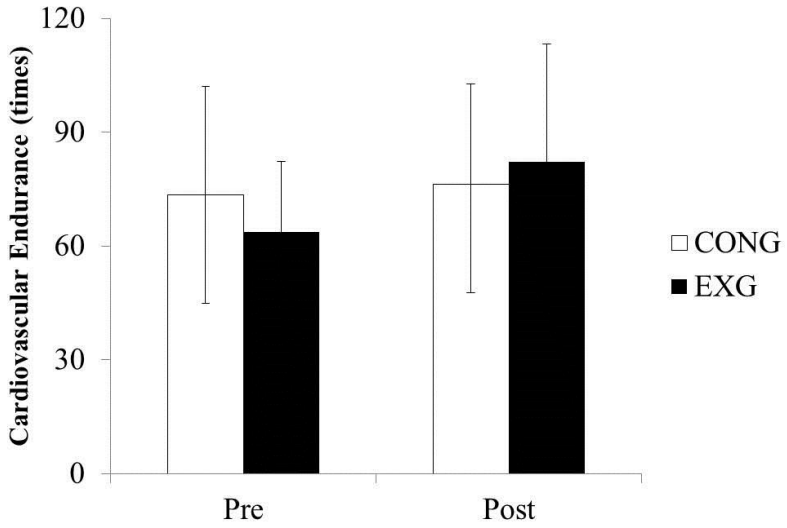

Figure 5. The change of cardiovascular endurance

4.3.2. Upper body muscular strength

As shown in Table 7 and Figure 6, there was a significant improvement in EXG compared with CONG for upper body muscular strength on comparing time change and relation of time and group (p<0.05). However, there was not significant change on group comparison between both groups (p=0.595).

Table 7. The change of upper body muscular strength

Group	Pre	Post		F	*p*
CONG(n=12)	21.75(5.85)	21.50(4.70)	Time	21.605	0.00*
			Group	0.290	0.59
EXG(n=14)	17.07(6.07)	23.86(6.19)	Time × Group	25.037	0.00*

Values are mean (SD), *p<0.05

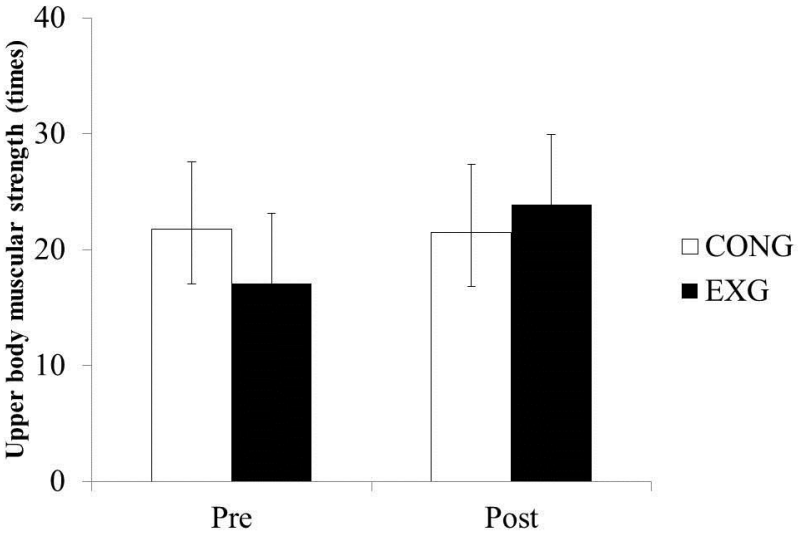

Figure 6. The change of upper body muscular strength

4.3.3. Lower body muscular strength

There was a significant improvement in EXG compared with CONG for lower body muscular strength on comparing time change and the interaction of time and group as the 30-second chair stand test ($p<0.05$). However, there was not significant change on group comparison between both groups ($p=0.849$) after dancesport activity for 12 weeks.

Table 8. The change of lower body muscular strength

Group	Pre	Post		F	*p*
CONG(n=12)	16.17(3.83)	16.75(3.86)	Time	9.243	0.00*
			Group	0.037	0.84
EXG(n=14)	13.93(7.38)	18.21(5.63)	Time × Group	5.344	0.03*

Values are mean (SD), *$p<0.05$

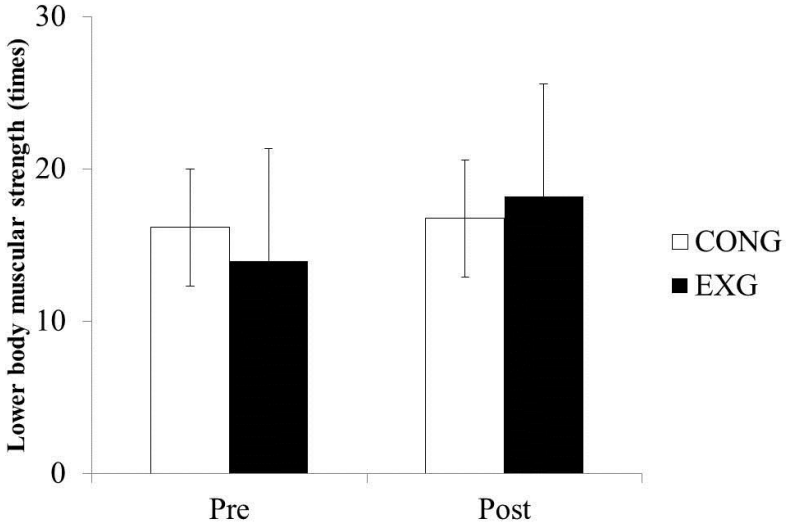

Figure 7. The change of lower body muscular strength

4.3.4. Flexibility

According to Table 9 and Figure 8, EXG showed an increase in their flexibility through the program of this study. Also, there was only a significant change on flexibility when comparing the time with the group. On the other hand, there were not significant differences in each variable of time and group on measuring the change of flexibility observed after dance sport activity for 12 weeks.

Table 9. The change of flexibility

Group	Pre	Post		F	*p*
CONG(n=12)	0.93(11.23)	-0.10(8.71)	Time	2.869	0.10
			Group	0.105	0.74
EXG(n=14)	-0.25(9.95)	3.57(10.01)	Time × Group	8.617	0.00*

Values are mean (SD), *p<0.05

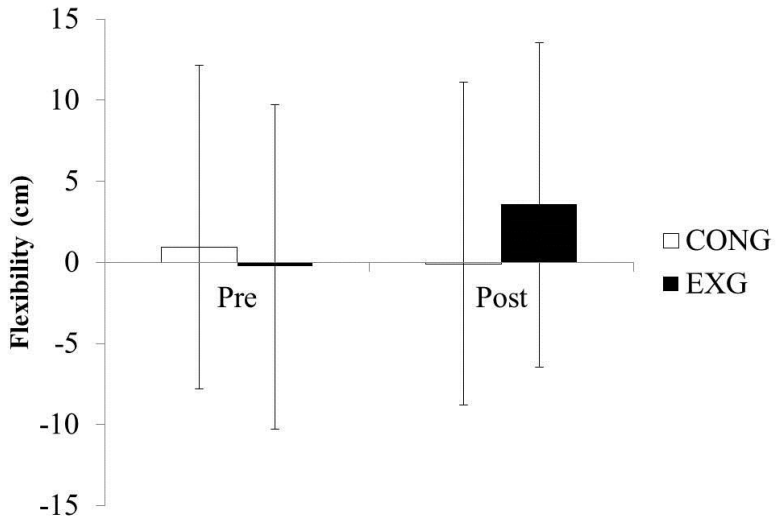

Figure 8. The change of flexibility

4.4. The change of age-related hormones

4.4.1. HGH

As shown in Table 10, HGH was significantly changed on both comparisons which were time change (p=0.03) and the interaction of time and group (p=0.04). Interestingly, the comparison between both groups only showed that there was no significant change (p=0.67).

Table 10. The change of HGH

Group	Pre	Post		F	*p*
CONG(n=12)	0.93(0.79)	0.51(0.55)	Time	5.205	0.03*
			Group	0.179	0.67
EXG(n=14)	0.60(0.99)	0.58(0.87)	Time × Group	4.301	0.04*

Values are mean (SD), *p<0.05

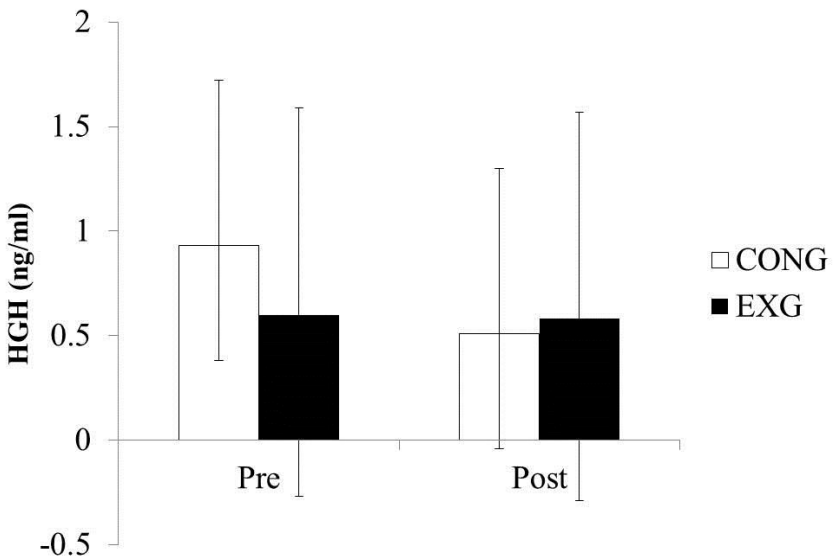

Figure 9. The change of HGH

4.4.2. DHEA-S

According to Table 11, DHEA-S was significantly increased in the EXG. Although there were not significant differences in each variable, which were time (p=0.42) and group (p=0.49), the interaction of time and group (p=0.00) only showed a significant difference in DHEA-S level.

Table 11. The change of DHEA-S

Group	Pre	Post		F	*p*
CONG(n=12)	95.79(59.01)	82.41(51.62)	Time	0.654	0.42
			Group	0.477	0.49
EXG(n=14)	100.03(55.64)	108.17(56.63)	Time × Group	11.038	0.00*

Values are mean (SD), *p<0.05

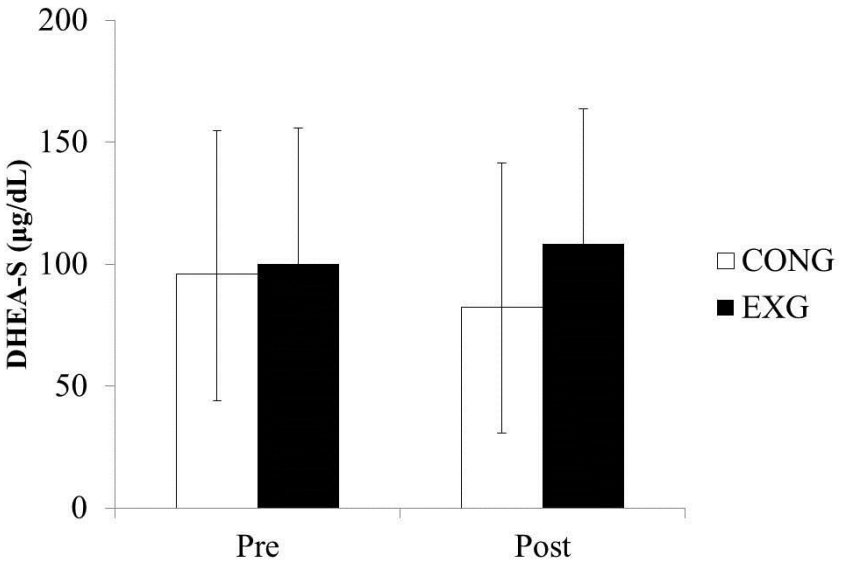

Figure 10. The change of DHEA-S

4.4.3. IGF-1

The change in IGF-1 level was shown in Table 12 and Figure 11. IGF-1 only showed the significant change on the time variable (*p*=0.00). On the other hand, the variables of group (*p*=0.56) and the interaction of time and group (*p*=0.05) didn't show significant differences through the program experiment of this study.

Table 12. The change of IGF-1

Group	Pre	Post		F	*p*
CONG(n=12)	127.60(32.53)	103.98(30.81)	Time	46.280	0.00*
			Group	0.342	0.56
EXG(n=14)	130.36(42.02)	117.4(35.75)	Time × Group	3.924	0.05

Values are mean (SD), *p<0.05

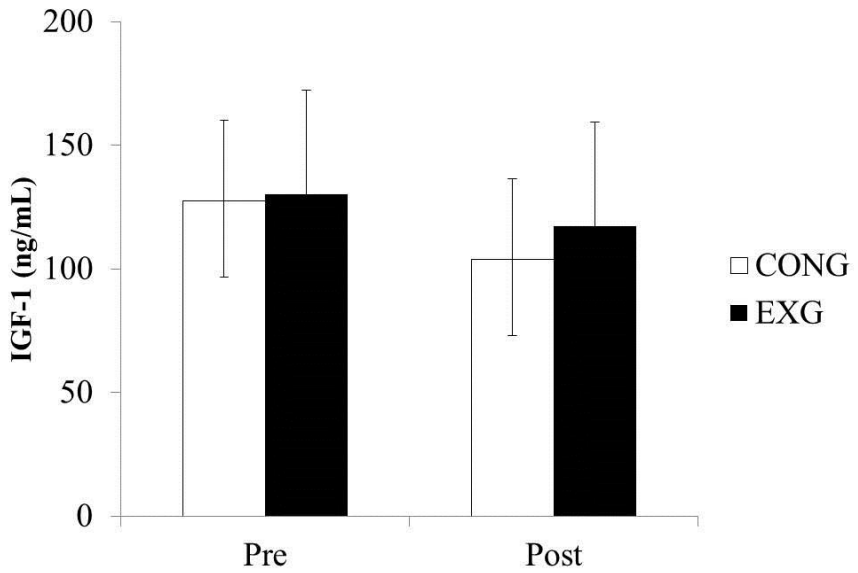

Figure 11. The change of IGF-1

4.5. The change of antioxidant enzymes

4.5.1. SOD

According to Table 13, although both variables such as time (p=0.00) and group (p=0.01) showed significant differences in the change of SOD, the interaction of time and group surprisingly didn't show a significant change.

Table 13. The change of SOD

Group	Pre	Post		F	*p*
CONG(n=12)	0.11(0.01)	0.09(0.01)	Time	21.301	0.00*
			Group	6.42	0.01*
EXG(n=14)	0.12(0.02)	0.11(0.02)	Time × Group	0.495	0.49

Values are mean (SD), *p<0.05

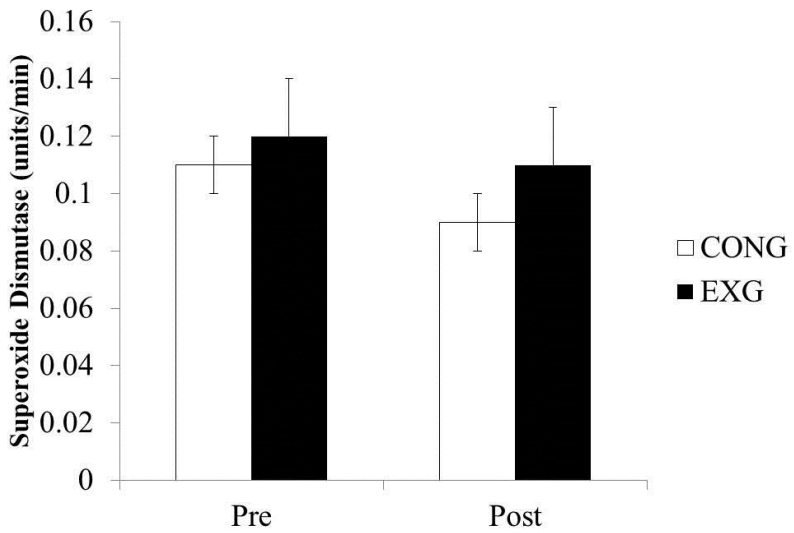

Figure 12. The change of SOD

4.5.2. GPx

Glutathione peroxidase activity only increased in EXG after dancesport activity intervention, as shown in Table 14. Also, the table shows that the interaction of time and group (p=0.01) only changed significantly through the program of this study.

Table 14. The change of GPx

Group	Pre	Post		F	*p*
CONG(n=12)	131.36(29.85)	117.65(30.14)	Time	0.003	0.96
			Group	1.86	0.19
EXG(n=14)	128.71(20.46)	143.02(19.33)	Time × Group	7.082	0.01*

Values are mean (SD), *p<0.05

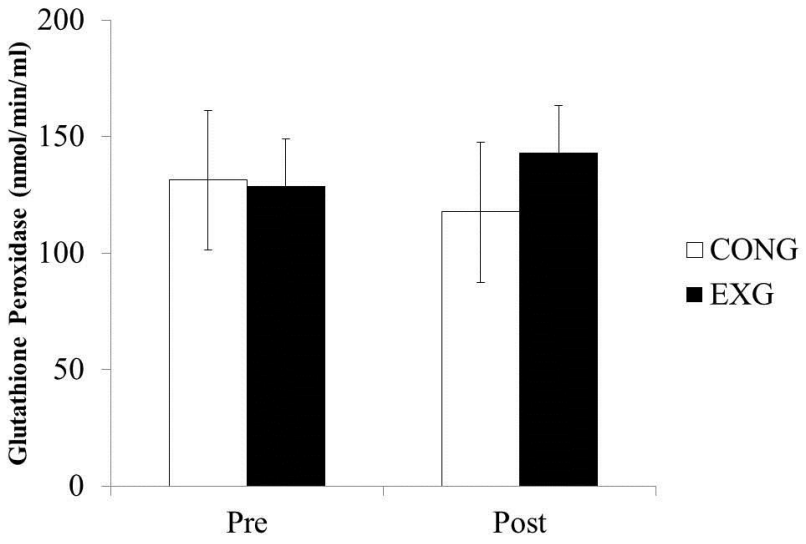

Figure 13. The change of GPx

4.5.3. CAT

The change in CAT activities is shown in Table 15. In the post exercise intervention condition, CAT activities were not significantly increased after the dancesport activity program. Therefore, there were not any significant differences in three variables of CAT activity level such as time, group and the interaction of time and group.

Table 15. The change of CAT

Group	Pre	Post		F	*p*
CONG(n=12)	17.81(3.36)	15.70(3.77)	Time	2.517	0.13
			Group	0.897	0.35
EXG(n=14)	18.53(4.41)	17.18(4.42)	Time × Group	0.118	0.73

Values are mean (SD), *p<0.05

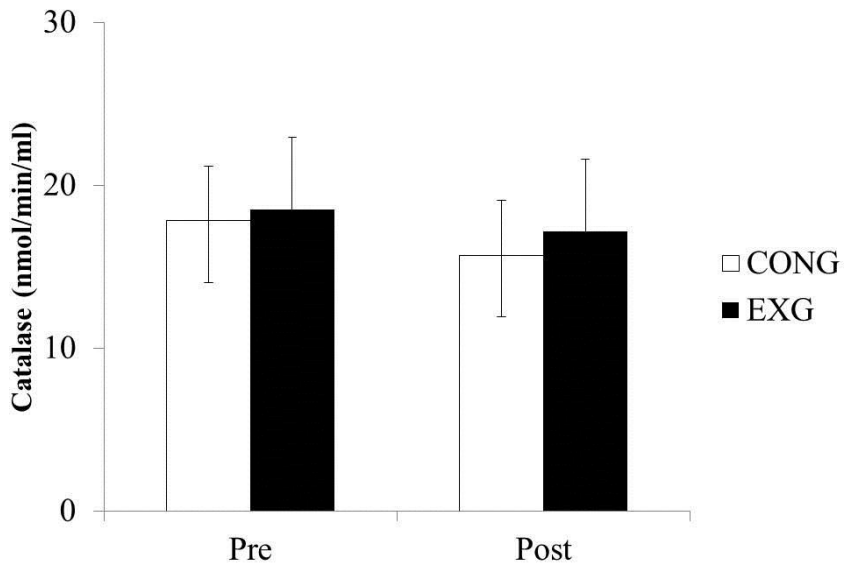

Figure 14. The change of CAT

V. DISCUSSION and CONCLUSION

The main purpose of this study is to investigate the effect of dancesport on older adults with ID, specifically, on functional fitness, changes in age-related hormones (HGH, DHEA-S, IGF-1), and changes in anti-oxidant enzymes (SOD, GPx, CAT) for a healthier aging process.

Functional fitness is considered the most important factor for older adults to independently and safely manage daily life (Sherrington et al., 2008). Also, according to Hilgenkamp et al., lowered physical fitness can be analyzed as the initial symptom for early aging in older adults with ID (Kattenstroth et al., 2010). Therefore, functional fitness can be an important factor to research regarding aging.

Music has been widely used in interventions for people with disabilities. This is because music is an effective way to stimulate and focus a person's attention. Physical fitness has also been shown to stimulate and focus a person’s attention (add reference). Dancesport combines both music and physical activity, which could be an ideal combination in increasing an individual’s cognitive function. Thus, in this study, dancesport was practiced by older adults with ID to compare the changes in their functional fitness. The results showed that all factors of functional fitness (cardiorespiratory endurance, upper muscular strength, lower muscular strength, and flexibility) positively improved. Physical activity tends to decrease with age (Chodzko-Zajko et al., 2009), furthermore this phenomenon strongly appears in people with ID (Hilgenkamp, Reis, van Wijck, & Evenhuis, 2012; Temple et al., 2006). That is the reason why we should pay attention to decrease in physical activities as an indicator of aging in older people with ID.

In the case of cardiorespiratory endurance, the EXG score was 63.64(4.97) before

exercise and 82.29(8.27) after exercise. This represents about a 20 times increase in EXG, which is a tremendous change. However, CONG did not show a large amount of increase, from 73.58(8.26) to 76.33(7.63), which showed that there is an interaction between time and group (<0.05). Physical activity decreases as age increases (Chodzko-Zajko et al., 2009), and it appears more in people with ID.

Previous researchers stated that high intensity exercise causes positive changes regarding cardiorespiratory endurance (Hagberg, Montain, Martin Iii, & Ehsani, 1989), however, Gwon & Rhee's recent research confirmed that a positive change was shown, even though the intensity of exercise was not high (Gwon & Rhee, 2014); which implies that the results varied due to the level of participation, indicating that the individual characteristics of each participant must be analyzed to apply the appropriate amount of physical activity. Because of the aforementioned reason, the cardiorespiratory endurance in people with ID can rapidly decrease and must be monitored closely due to the fact that low cardiorespiratory endurance is related to an increased cause of disease and mortality (Blair et al., 1995).

For this study, upper body muscular strength and lower body muscular strength were analyzed separately, because lower muscular strength is more important in dancesport. Results of upper body muscular strength showed that EXG increased from 17.07(1.62) to 23.86(1.65), an increase of nearly 40%, and CONG decreased from 21.75(1.69) to 21.50(1.36), which proved that there is an interaction between each group according to time (<.001). For lower body muscular strength, EXG increased nearly 30% from 13.93(1.97) to 18.21(1.50), and CONG had almost no change from 16.17(1.10) to 16.75(1.12). As a result, there is also an interaction in lower body muscular strength between groups and time (<0.05).

These results support studies explaining how exercising for a long period of time can reinforce muscular strength since muscular strength decreases due to a reduction in size and area of muscle mass with aging (Holviala et al., 2011; Peterson & Gordon, 2011; Spirduso et al., 2005). Also, reduced strength in lower body muscles increases the danger of falling and injury by 4 times, and also many researchers are reporting that injury affects independence of the aging population, including daily activities like walking, therefore, it should be taken seriously.

Lower muscular strength increased more than upper muscular strength, because dancesport activity focuses more on large muscles of the lower body due to its kinetic movement (Hui, Chui, & Woo, 2009). People with ID have more injuries because it is difficult to keep the center of body weight precisely over their tiptoe during dancesport. Therefore, the instructor must focus on lower muscular strength training and create more effective methods of instructing. Flexibility is the range of joint movement; this range is affected by bones, muscles, and the structure and function of tissues connecting them. As age increases, physical activity declines and flexibility decreases as the size of collagen fiber enlarges (Wilder et al., 2006). An increase in inactivity and a lack of flexibility causes a decrease in the range of motion in joints and they in turn become sensitive to injury; flexibility of the quadriceps and buttocks muscle groups are even related to backache. Due to the above reasons, flexibility of aged citizens', who have a limited physical activity range, can further decrease.

In this study, flexibility was tested via a sit and reach test. EXG's flexibility increased from -.25cm to 3.57cm after dancesport activity, but CONG decreased from 0.93cm to -0.10cm, which showed an interaction between group and time (<0.05). This research supports the literature indicating that stretching and physical activity can improve flexibility. But, these results could vary due to age of the participants,

period of time spent on testing, and the type of program. For example, when performing stretching, focusing on precise movement seems to improve flexibility. Therefore, it appears that it is important to consider appropriate programs for each aged person.

HGH, the growth hormone that comes from the anterior pituitary gland, has an important role regarding almost all metabolisms and physical changes in the body, and is one of the hormones that rapidly decrease with aging (Buford & Willoughby, 2008; Rudman et al., 1981).

The HGH research result, shown in Table 6, is quite interesting, because the HGH of older people with ID decreased among the study participants. However, CONG's showed a greater decrease than HGH, whereas the interaction between group and time changed positively (EXG-pre: 0.60(0.263)ng/㎖, post: 0.58(.233)ng/㎖, CONG-pre: 0.93(0.22)ng/㎖, post: 0.51(0.16)ng/㎖). Also the growth hormone from ages 20-40 is 3.0ng/㎖ and at ages 40-70 is 1.6ng/ml, which shows greater decreases as a person ages. According to Kim et al., by applying progressive resistive exercises to female adults over 65 years old for 12 weeks and comparing the GH amount, EXG showed a change from 0.88(0.17)ng/㎖ to 1.57(0.19)ng/㎖ and CONG showed a change from 1.21(0.52)ng/㎖ to 2.16(0.46)ng/㎖ (Kim, 2011). Also Ko et al., applied a 12 week walking program to male adults over 65 years old and analyzed changes in the GH. The results showed that EXG increased from 12.50(1.16)ng/ml to 13.98(1.08)ng/ml ($p<.001$) and CONG decreased from 12.13(0.85)ng/ml to 11.94(0.72)ng/ml. Since the research was conducted without classifying male and female participants, a precise comparison would be difficult (Ko, 2010). However, previous research showed that, even though the participants' ages were in their 50s, EXG was similar to normal 60-70 year old adults and it also showed a large decrease in their CONG's amount.

DHEA-S,steroid hormones secreted by adrenal glands (Ebeling & Koivisto, 1994), show the greatest plasma rate when a person is first born and gradually decreases after the age of 30. At the age of 75, the amount is nearly 20-30% that of young adults (McArdle, Katch, & Katch, 2010). Balcombe & Sinclair showed that a decrease in DHEA-S is intimately related to health problems in the aged population because it is related to cancer, artery hardening, a decrease in brain function, and impediment of the immune system (Balcombe & Sinclair, 2001). This DHEA-S research result shows that the DHEA-S rate in older people with ID who participated in dancesport increased (Table 6). However the CONG's rate decreased, which meant the interaction between group and time affected positive change (EXG-pre: 100.03(0.263) μg/dL, post: 108.17(.233) μg/dL, CONG-pre: 95.79(0.22) μg/dL, post: 82.28(0.16) μg/dL).

The result presented above is similar to Han (2008)'s report, which states that 12 weeks of walking and resistance exercises increased DHEA-S (Han, 2008) and Pritchard et al. reported that 12 weeks of cycling increased DHEA-S (Pritchard et al., 1999). Also, if the research based on the interrelationship of DHEA-S and cognitive function (Sorwell & Urbanski, 2010) is considered, delaying a decrease in cognitive function in older adults with ID can be expected through participating in dancesport.

In this study, after 12 weeks of participating in dancesport, the IGF-1 for EXG who participated, and the CONG for people who did not participate, had decreased. The CONG’s rate of decrease was much larger, though it was not a statistical difference (p=0.05). This result can be analyzed based on analyzing changes in BDNF and IGF-1 after regularly exercising for 12 weeks, which is similar to a study by Schiffer et al. However, BDNF did not show attentive change or any relationship to IGF-1(Schiffer, Schulte, Hollmann, Bloch, & Struder, 2009). Also, Adams & McCue (1998) explained that long periods of resistance training can expedite secretion of IGF-1.

Similarly, Gregory et al. showed that IGF-1 in blood increases (Gregory et al., 2013). This result is supported by the theory that change can vary due to the participants' method of exercising, the exercise intensity, period of excercise, age of participant, and sex of participant.

Also, examining research of IGF-1 and cognitive function by Yan et al. stated that circulating levels of IGF-1 increases by having to control genes related to micro vascular function and micro vascular structure, brain development, and synaptic plasticity, which contributes to the development and function of the brain, and it also stated that it positively affects, through IGF-1, exercise and growth factors such as BDNF (Foster et al., 2012). As explained, IGF-1 not only affects older citizens' physical ability, but is also highly related to cognitive function. Therefore, careful consideration of the above matter should bring about more positive research results.

The main reason for early aging in people with ID is not clear; however, it is quite easy to be powerless while aging even if there is no special disease because the human body continuously requires enough energy for activity, and free oxygen radicals are being produced during the process of creating energy (Yang, 2007).

Free oxygen radicals attack cell membranes and are a reason for mutation of cells which can cause cancer and joint inflammation by attacking the double bond of DNA, which results in diseased cells that accelerate aging. Therefore, superfluous free oxygen radicals affect all body parts negatively (Alessio, 1993) and can be the main cause for accelerating aging. Anti-oxidative enzyme substances, such as SOD, CAT, and GPX, and anti-oxidative substances such as vitamin C, E, and uric acid bear a large part in removing free radicals (Kim, 2007), therefore this study analyzed changes in SOD, GPX, and CAT via dancesport. After exercising, the activeness of anti-oxidative enzymes increases and many researchers reported that this type of

phenomenon positively affects the human body (Hammeren et al., 1992; Kurban, Mehmetoglu, Yerlikaya, Gonen, & Erdem, 2011; Marzatico, Pansarasa, Bertorelli, Somenzini, & Della Valle, 1997; McClean et al., 2011). However in this research, both EXG's and CONG's decreased, which did not show an interaction between time and group ($p=.488$), but showed attentiveness according to time ($p<0.001$).

Nam, Kim & Choe (2003) applied a folk dance within elastic bandage, which is similar to dancesport applied in the current study, and as a result, both SOD and GPX's activation increased almost equally. Lee & Park (2004) reported that, after swimming, there was a higher activation of GPX compared to the control group.

Highly intensive exercise increases CAT, which is located in skeletal muscle, the heart, and the liver, and it is stated that it brings more positive change to the antioxidant defensive structure of muscle than short (5 min) highly intensive exercising (Robertson, 1991). However, this type of result is thought to occur because it helps increase activation of CAT, which is an antioxidant substance, as age increases.

Also, results of this aerobic study analyzed factors for change by applying 12 weeks of dancesport activity. As a result, future research regarding changes in antioxidants after a long period of training and considering the participants' endurance, type of exercise, form of exercise, and rate of attending physical activity is important.

While this study is meaningful as the very first empirical attempt to examine the effects of a sporting program on healthy aging, focused exclusively on aged people with ID, there are several limitations.

First, the participants were not randomly assigned into either an experimental or control group because each group was recruited from two geographically distinct districts. This raises the concern as to whether the differences found inherently

existed or were stemming from the treatment effect (i.e., the sport program) between the two groups. Furthermore, it is necessary to include cognitive or affective variables into the design of the study in order to better explain the effect of the sports program. Lastly, the study did not examine the gender difference due to the lack of female participants, as 14 participants dropped out of the program in the middle of the study. Future studies should take these limitations into account in the design of the study in order to better understand the effects of the sports program on the well-being of older people with ID.

In conclusion, this study provides meaningful insights into understanding the effects of a dancesport program for older people with ID, as the study revealed the positive effects of a dancesport program in improving functional fitness, age-related hormones (except for IGF-1), and one of the variables (GPx) in antioxidant enzyme.

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ABSTRACT IN KOREAN

지적장애노인의 건강한 노화를 위한

댄스스포츠활동 프로그램 적용 연구

권 현 진
서울대학교 대학원
체 육 교 육 과

본 연구의 목적은 지적장애 노인들에게 지도가능 하도록 수정(modify)한 댄스스포츠 활동 프로그램을 12주간 적용하여 그들의 기능체력(functional fitness), 노화관련호르몬(age-related hormones) 및 항산화효소(antioxidant enzymes) 변화를 분석함으로써 지적장애 노인들이 보다 건강한 삶을 영위하는데 활용 가능한 기초자료를 제공 하는 것이다.

이를 위하여 C시와 S시에 위치한 복지관을 이용하는 지적장애 노인들을 각각 20명씩 모집하여, C시 복지관을 이용하는 대상자는 실험집단, S시 복지관을 이용하는 대상자는 대조집단으로 선정하여 12주간, 주 2회, 1회 90분 간 댄스스포츠활동 프로그램을 진행하였다. 사전과 사후검사는 동일한 방법으로 실시하였으며, 기능체력은 심폐지구력, 상지근력, 하지근력, 유연성을 측정하고, 노화관련호르몬은 Human growth hormone (HGH), Dehydroepiandrosterone sulphate (DHEA-S), Insulin-like growth factor-1 (IGF-1)을 측정하고, 항산화효소는 Superoxide dismutase (SOD), Glutathione peroxidase (GPx), Catalase (CAT)를 측정하였다.

최종 분석은 총 참여자 40명 중, 중도 포기한 14명을 제외하고 총 26명(운동그룹: 14명, 통제그룹: 12명)의 대상자를 분석하였으며, 측정된 모든 값은 Windows SPSS 20.0 version을 이용하여 분석하였다.

이와 같은 연구절차를 걸쳐 얻어진 연구결과는 다음과 같다.

첫째, 기능체력요인으로 선정한 심폐지구력(<0.05), 상지 근력(<0.01), 하지 근력(<0.05) 및 유연성(<0.01) 모두에서 상호작용 효과가 나타나(<0.05), 본 실험에서 실시한 12주 간의 댄스스포츠 활동 프로그램이 지적장애 노인들의 기능체력을 향상시키는데 효과적이라는 결과를 나타내었다.
둘째, 노화관련호르몬 변인 중 HGH(p<0.05)와 DHEA-S(p<0.01)는 상호작용이 있는 것으로 나타났으며, IGF-1은 상호작용 효과는 나타나지 않았지만 대조그룹에 비해 운동그룹에서 감소폭이 작게 나타난 것을 확인할 수 있었다.
셋째, 항산화효소의 세가지 변인 중 GPx에서 상호작용 효과가 나타났다(<0.05).

비장애 노인들의 운동 프로그램 개발과 연구가 활발히 진행되고 있는데 반해, 지적장애 노인들을 대상으로 한 연구가 매우 부족하여 적합한 운동 프로그램을 찾기가 매우 어려운 실정이다. 이에 본 연구는 지적장애인들의 특성을 파악하여 그들의 집중력을 이끌어내고 즐겁게 운동에 참여할 수 있도록 하는데 중점을 두었으며, 12주의 댄스스포츠활동 프로그램에 참여 후 측정한 기능체력의 모든 변인(심폐지구력, 상지근력, 하지근력, 유연성)에서 긍정적인 효과를 나타냈으며, 노화관련변인에서도 IGF-1을 제외한 HGH와 DHEA-S에서 효과가 나타났고, 측정한 항산화효소 세가지 변인 중 GPx에서 긍정적인 변화를 나타내어 댄스스포츠 활동 프로그램이 지적장애 노인들의 건강한 노화를 위해 효과적이라는 것을 입증하였다.

따라서 지적장애 노인들의 지적 수준 및 개인적 특성을 고려하여 댄스스포츠 활동 프로그램을 수정하여 활용한다면 지적장애인들이 보다 건강한 노년기를 영위하는데 도움이 될 것이라 사료된다.

주요어 : 노인, 지적장애, 댄스스포츠, 노화, 노화관련호르몬, 항산화효소
학 번 : 2010-30419

APPENDIX

2013년 Summer
댄스스포츠 참가 안내문

댄스스포츠는 예술과 스포츠가 접목되어 아름다우면서 역동적인 운동이기 때문에 즐겁게 건강관리를 할 수 있습니다. 또한 댄스스포츠는 한 쌍의 남녀가 함께 춤을 추면서 상호작용을 하기 때문에 건전하고 바람직하게 사교성을 키울 수 있을 뿐 아니라 평생 동안 즐길 수 있는 스포츠입니다.

Ⅰ. 모집인원 및 운영계획

프로그램명	모집 인원	운 영 계 획		강사	프로그램 내용
		요 일	시 간		
댄 스 스 포 츠	20	미정(주 2회, 90분)		권 현 진	Cha Cha Cha

※ 교육과정은 무료로 진행됩니다.

Ⅱ. 모집요강

◉ 모집기간 : 2013. 6. 7. ~ 2013. 6. 14.(1주)

※ 법정공휴일은 휴강하며 수강기간은 사정에 따라 조정 가능합니다.

◉ 모집대상 : 지적장애 성인 20명 선착순 모집

◉ 모집방법 : 신청서 작성

◉ 개강일시 : 2013. 10. 01.(화)부터-사전검사: 6월 17일 예정

Ⅲ. 프로그램 계획

세부일정	수행 내용
1~3주	• 박자 익히기 • 박자에 맞추어 이동운동기술
4~8주	• Line dance • Time step • Basic movement(파트너와 손 마주 대고) • Three cha cha cha (BWD) • Three cha cha cha (FWD)
9~12주	• New York • Hand to hand • Shoulder to shoulder • Spot turn to R & L • Under arm turn to R

※ 프로그램 세부 일정

	분류	내용	6월	7월	8월	9월	비고
프로그램일정	모집	대상자 모집	V				
		오리엔테이션 및 사전검사	5월			사후검사	
	프로그램	댄스스포츠	6월 시작		9월 종료		12주
			주 2회, 90분				

2013	프로그램 참가 신청서

이 름		보 호 자	
생년월일		장애진단명	
주 소			
연락처(집)		핸 드 폰	
신체적 특성	과거 수술, 약물 복용, 현재의 건강상태, 운동 시 특이사항 등을 구체적 기술		

위 사람은 **'2013 댄스스포츠 활동 프로그램'**
참가를 신청하며 해당 내용은
상기 프로그램 진행을 위한 정보제공에 동의합니다.

2013. . .

본 인 : (인) 보호자 : (인)

문의: 권현진(010-9032-xxxx)

『연구 참여 동의서』

안녕하십니까?

본 연구는 **'지적장애 노인의 건강한 노화를 위한 댄스스포츠프로그램 적용 연구'**라는 주제로 진행 될 것이며, 연구 결과는 댄스스포츠 활동을 통한 신체활동 증진과 건강관리에 중요한 기초 자료로 활용될 것입니다.

본 연구의 참여자로서 다음의 사항을 성실히 이행할 것을 약속합니다.

1) 12주간, 주 2회 프로그램에 성실히 참여 하겠습니다.

2) 연구 진행상 필요한 인터뷰와 촬영, 각종 검사에 참여하겠습니다.

본 연구의 모든 내용은 연구 목적 이외에는 절대 사용되지 않을 것이며, 참여자의 인권을 존중하고 개인적인 정보가 유출되지 않도록 하겠습니다.

이에 본인(보호자)은 본 연구에 참여할 것을 동의합니다.

본인(보호자)은 연구에 관한 정보를 요구할 수 있으며, 본인(보호자)의 의사에 따라 연구과정을 중단할 수 있는 권리가 있다는 것을 확인합니다.

2013년 월 일

참여자 : _____(인)

보호자 : _____(인)

본인은 본 연구의 목적 및 그 내용에 관하여 상세하게 연구 참가자에게 설명해 주었고, 참가자 스스로 본 연구에 참여할 것을 결정하고 서명하였음을 확인합니다.

2013년 월 일

연구자 : _____(인)

체력 검사 측정지

※ 기본 인적사항

분 류		I.D.		성 명	
생년월일		연령 (만)		성 별	

※체력 측정내용

구 분	검사종목	단 위	결 과	비고
신체 조성	신 장	cm		
	체 중	kg		
	근 육 량	kg		
	체지방률	%		
혈압 심박수	수축기 혈압 (SBP)	mmHg		
	이완기 혈압 (DBP)	mmHg		
	안정시 심박수	bpm		
체력 검사	심폐지구력(2분 제자리 걷기)	회		
	상체근력(덤벨 들기)	회		
	하체근력(의자에서 앉았다 일어서기)	회		
	유연성(앉아 윗몸앞으로 굽히기)	cm		

2013 서울대학교 체육교육과대학원 건강운동과학실