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Comparisons of Quality of Life and Asymmetric Atrophy in Regularly Walking Elderly Female Stroke Survivors

Regularly participating in physical activity is known to improve quality of life and body composition in elderly with stroke. However, comparatively less physical activity is performed by the stroke survivors. The factors related to inactivity in elderly female stroke survivors have not been elucidated. Therefore, this study aims to compare the quality of life factors and limb compositions between the active and inactive elderly female stroke survivors. Forty nine subjects between the ages of 65 to 75 years were selected from the KNHANES data between the years 2009 to 2011. In addition, 186 age-matched healthy peers were also selected for limb composition comparisons. The subjects were groups based on walking days per week: walkers; 3 days or more, non-walkers; less than 3 days per week. BMI and waist circumference were within the obesity ranges for both the non-walkers and walkers. As results, the trend for greater fat (±10%) and lean mass (±30%) differences were observed for non-walker and walkers, respectively. Significantly greater reasons for function limitation by stroke and hypertension were reported with significantly greater self-care difficulty was shown by the walkers. In conclusion, elderly female stroke survivals may require customized motivation and continuous support to participate in physical activity regularly.

Key words: *Bilateral atrophy, Quality of life, Stroke, Physical activity, Walking*

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INTRODUCTION

Stroke is one of the most traumatic event that may affect all part of a person's life. One of the major adverse effects of stroke is reduction of quality of life [1]. Various adverse outcomes have been associated with stroke. One of the detrimental effects of stroke is reduction in motor control with denervation to the skeletal muscles. With reduction in motor controls and increased difficulty in mobility, muscular atrophy accelerates. Muscular atrophy in stroke survivors is one of the commonly reported phenomenon [2-4]. In addition to primary complications related to a stroke event, secondary complications such as recurrent stroke, pneumonia, depression, and dementia may occur to reduce functionality in daily living and quality of life. It was previous reported that significant amount of stroke survivors rely on others with some sort of disability [5,6].

Regularly performed physical activity has been known to reduce the risk of many adverse health outcomes including adverse effects of stroke [7,8]. Moreover, regularly performed physical activity has been repeatedly reported to be strongly effective in deterring and even improving the detrimental effects of stroke [3, 8]. Regardless of repeatedly proven efficacy of physical activity in stroke, the amount of physical activity participated by stroke survivors is known to be reduced after a stroke event in comparison to the general population [1]. Physical inactivity before or after has been known to reduce the probability of independence during the activities of daily living in stroke survivors [9]. Various types of barriers and motivations may affect the degree of physical activity participation after stroke [10]. Loss of nerve control, mobility, and muscle quality occur in vicious cycle of inactivity. A study which tracked the amount of physical activity in stroke survivals reported a significant reduction in physical activity from 14,730 steps per day to 7379 steps per day or by 50% [11]. Although several studies reported on the possible causes of physical inactivity in stroke survivors, most of the studies included physiological or clinical reasons for limiting participation to physical activity. Studies on comparing the health related factors and compositional differences were not conducted as to the author's knowledge. Greater rate of insufficient physical activity is more prevalent in women than men. Multi-factorial causes have been reported to greatly reduce the amount of physical activity in women including physiologic, socioeconomic, and mental factors [1, 12]. However, factors that are related to reductions in physical activity in elderly female stroke survivors have not been clearly elucidated. Elucidating the factors may help to further promote physical activity in female stroke survivors.

Regardless of functional and physiological limitations, regularly performed physical activity is recommended to deter the rate of senescence and changes in body composition. Partial immobility and functional limitation has been known to lead to further muscular atrophy and vice versa for progressively worsening the quality of daily activities and quality of life. After a stroke event, many of the survivors spend time bed rested getting treated or for the immobility condition. Impaired neurological signalings from the central nervous system to the innervating skeletal muscle lead to reduction in myofiber diameter sizes and muscular strength. A prolonged bed rest with impaired neurological signals leads to increased rate of whole body and contralateral body atrophy [3]. All intensities and types of physical activity have been reported to be beneficial in various types of complications. However, although higher levels of physical activity have been strongly associated with lowering the risk for all outcomes including cancer, diabetes, health disease, and stroke, lower levels of activity have been repetitively reported to have major gains in adverse outcomes [8].

Therefore, this study aimed to compare the factors related to physical activity participation comparing the anthropometric variables, clinical status, reasons for functional limitation, and general health quality variables between the active and inactive elderly female stroke survivors. Body limb composition differences were observed between the groups to compare progression of bilateral atrophy. In order to compare the results of the stroke survivals, health peers were grouped according to the amount of physical activity participation based on the days of walking.

SUBJECTS AND METHODS

Subjects

This study was conducted with data of the KNHANES (Korea National Health and Nutrition Examination Survey) IV and V conducted by the Korean Center for Disease Control and Prevention in 2009 to 2011. 2009 to 2011 data of KNHANES includes detailed anthropometric assessment results. The survey included the Health Interview Survey, Health Behavior Survey, Health Examination Survey, and Nutrition Survey. Among the surveys, this study utilized the Health Interview Survey, Health Behavior Survey, and Health Examination Survey. Written consents were obtained from the examinees by the participating clinical specialists prior to the examinations. The KNHANES IV and KNHANES V assessment data between the years 2009 to 2011 were approved by the ethics committee of the Korea Centers for Disease Control and Prevention. Since the KNHANES IV, the organizers adopted the stratified multistage cluster sampling design via the rolling-survey sampling method for general representation of the Korean population [13].

The subjects with stroke experience were selected through appropriate selection and exclusion criteria. In order to compare factors that affect quality of life of post stroke survivors, confounding factors that directly limit physical activity and performance daily living were strictly controlled. Therefore, the subjects with following criteria were selected. First, in order to compare the subjects in similar sex and age range, only the female subjects aged between 65 to 75 years of age were selected. Second, among the selected sex and age range, the subjects with past stroke experience were selected. Third, the subjects with clinical complications that restrict physical activity were excluded which included COPD (chronic obstructive pulmonary disease), kidney failure, cancer, trauma (due to accident, fracture, or injury), cardiac disease, and dementia. Forth, the subjects who were restricted by muscloskeletal complications and required a long term bed rest were excluded. Fifth, subjects who have conducted the body impedance assessment for the body composition analysis were selected. Finally, the subjects who have completed the EuroQol and questionnaires on the reasons for functional limitation were included. The subjects with stroke experience were grouped based the amount of physical activity participation. The subjects who regularly walk 3 or more times per week were included in the walker group. The subjects who have participated walking exercise less than 3 days a week were included in the non-walker group. In order to clearly, divided non-exercising and exercising groups, the subjects who participant in moderate or vigorous physical activity at all were excluded from the non-walker group. Despite a large number of initial samples, a small number of subjects of 22 non-walkers and 27 walkers were selected (Table 1).

In order to compare the compositional results with that of the healthy peers, healthy peers were groups according to the frequency of physical activity participation as the stroke survivals. Same inclusion and exclusion criteria were applied to obtain 58 healthy non-walkers and 128 healthy walkers. The body composition results are listed in Table 1.

Questionnaires on general status and quality of life

General characteristics and socio-demographic date which included age, BMI (body mass index, education level, family income in quartile, and marital status were first assessed. Family income variable was divided in to four categories of 1) lowest, 2) lower intermediate, 3) higher intermediate, and 4) highest. Education levels were divided in to four categories of 1) elementary school graduate or lower, 2) middle school graduate, 3) high school graduate, and 4) college or greater. Marital status was categorized in to 1) Married and living together, 2) married and living separately, 3) widowed, and 4) divorced.

Following diagnosed clinical conditions were compared between the groups: diabetes mellitus, hypertension, osteoarthritis, depression, dyslipidemia, and thyroid dysfunction. The subjects were asked if the particular clinical condition was diagnosed by a doctor. The subjects answered either 'Yes' or 'No' to the questionnaires which were marked as either '1' or '0.' The subjects with unanswered questions were excluded from the study. Questionnaires on the reason for functional limitation were also included in the study. Items including stroke, diabetes mellitus, hypertension, back or neck problem, and depression/anxiety/emotional distress, old age, obesity, and others (other reasons for functional limitation) were included. The subjects were asked if the particular condition limited their functionality. The subjects answered either 'Yes' or 'No' to the questionnaires which were marked as either '1' or '0.'

Finally, five items of EuroQoL, EQ VAS, EQ-5D index, and subjective health questionnaires were compared between the groups. The EuroQoL is an instrument which evaluates the health-related quality of life (HRQoL) 14). The EuroQoL is composed of two parts 14) First part measures health in three physical, one mental, and one social dimension. The physical dimensions evaluate degree of mobility, self-care, and pain or discomfort. The mental dimension evaluates degree of depression or anxiety and the social dimension evaluates usual activities such as work, study, homework, family, or leisure related activities. Each EuroQoL item were composed of three levels from the best to worst health condition. For example, in terms of mobility, the subjects were allowed to select one of either level one which states that 'I have no problems in walking about,' level two which states that 'I have moderate problems in walking about,' or level three which states that 'I am unable to walk about.' Level one, level two, and level two were coded as 1, 2, and 3, respectively. All other EuroQoL items are also composed of levels one through three. The EQ-VAS with scales from zero to 100 indicates health status from low to high, respectively. The EQ-5D index is similar to the EQ-VAS. It has four categories: .9±1 for satisfied; .6±.9 for little dissatisfied; .3±.6 for moderately dissatisfied; 〈.3 for severely dissatisfied 12).

Body composition

Among the assessed variables, fat content (g), lean mass (g), and fat percent (%) of the upper and lower limbs measured by DXA (Hologic Discovery, Hologic Inc., Bedford, MA, USA) were used for this study. Three variables were utilized to compare the degree of atrophy between the left and right extremities of regularly walking and not walking post-stroke elderly females. Based on the definition proposed in previous studies, the body weight-adjusted appendicular skeletal muscle mass and body fat was used in this study [4]. Absolute differences in both the upper and lower limb fat, fat percent, and lean mass were first calculated and compared followed by upper and lower limb differences (Table 2).

Physical activity

Information on the frequency and intensity of physical activity was acquired using the Korean version of the International Physical Activity Questionnaire acquired by the Health Interview survey. Frequency of walking was acquired by day per week. Intensity of physical activity was acquired by asking if the subjects participated in vigorous physical activity, moderate physical activity, and walking. All intensities were utilized in this study. In order to only compare effects of physical activity by walking, those subjects with multiple answers on type of physical activity for more than 2 days were excluded.

Statistical analysis

Data were analyzed using SPSS 23.0. The subjects were selected based on the inclusion and exclusion criteria mentioned above. The walker and non-walker groups were divided based on the days of walking per week. The variables were assessed for mean and standard error of means (SE). The differences were expressed in percentage (%). The equality or homogeneity assessment of variances was performed with the Levene's test prior the comparative analysis. One-way ANOVA was performed between the body composition variables of lean mass, fat mass, and fat ratio between the right and left limbs (total of upper and lower limbs), right and left upper limbs, and right and left lower limbs. Additional comparative analysis via one-way ANOVA was performed between the physically active (walkers) and non-active (non-walkers) post-stroke subjects. The results were considered significant when the probability was less than .05 (a = .05).

RESULTS

Table 1 shows the general characteristics of the subjects. The mean ages of the walkers and non-walkers of 70.1±.53 and 68.1±.63 years were significantly different between the groups, respectively. BMI, waist circumference, education level, family income, and marital status show no significant differences between the groups. Although BMI was not significantly different between the groups, the mean of the non-walker showed greater than normal range of BMI of 26.4±.94 kg/m2. As for the healthy walkers and non-walkers, mean ages were 69.4±40 and 70.10±.26 years, respectively. Body weights and BMIs did not show significant differences between the groups.

The limb composition differences between the groups were showed no significant differences between the groups for all variables as shown in table 2. As for the percent differences in body composition, fat contents of the right and left limb fat differences and right and left upper limb differences showed 13% and 22.7% greater fat content and 28.3% and 22.3% less lean mass content for the non-walk group in comparison to the walk group, respectively. The total fat content was also great (6.5%) for the non-walk group. As for the healthy peer groups, all the limb difference results did not how significant differences between the groups. As for the percent differences in body compositions, fat and lean mass differences between right and left limbs were −8.5 and 5.1%. The fat and lean mass differences of the right and left upper limbs were −4.8 and −1.8%, respectively. The fat and mean mass differences the right and left lower limbs were −4.3 and 5.4, respectively.

Diagnosed clinical conditions were compared between the groups in Table 3. Diabetes mellitus, hypertension, osteoarthritis, depression, dyslipidemia, and thyroid dysfunction showed no significant differences between the groups. In terms of reason for functional limitation, stroke (.27±.10 vs .56±.10, p=.05) and hypertension (.09±.06 vs .33±.09, p=.05) showed significantly greater values for the walk group in comparison to the non-walk group. Diabetes mellitus, back or neck, depression/ anxiety/emotion, old age, obesity, and others showed no significant differences between the groups. As for the EuroQoL which assess general health quality showed significantly greater self-care level for the walk than the non-walk group (1.78±.11 vs 1.36±.12, p=.02), respectively. In terms of mobility, usual activities, pain/discomfort, and anxiety/depression, significant differences were not shown. The levels were close to 2 which indicate moderate difficulty.

Table 1. Stroke survival characteristics

	Non-walkers (n=22)	Walkers (n=27)	P
Age (years)	68.41±.63	70.11±.53	.50*
Education level	3.50±.21	3.41±.15	.74
Family income (quartile)	1.59±.23	1.85±.20	.41
Marital status	1.77±.21	2.07±.21	.31

*p<.05

Table 2. Limb composition differences between the walkers and non-walkers

Variables	Non-walkers 95% CI	Walkers 95% CI	P	% difference
	Stroke walkers (n=22)	Stroke non-walkers Walk (n=27)		
Body weight (kg)	67.5±3.85(56.02-75.98)	64.7±3.86(56.05-73.26)	.61	2.2
BMI (kg/m2)	26.35±.94(23.41-28.30)	25.25±.68(23.85-26.65)	.34	
Waist Circumference (cm)	89.01±2.59(83.63-94.40)	88.15±2.16(93.70-92.60)	.80	
R-L limb fat diff. (g)	230.11±68.52(79.29-380.93)	176.41±53.88(56.37-296.46)	.55	13.0
R-L limb fat diff. (%)	3.45±.83(1.63-5.27)	3.20±.91(1.19-5.22)	.84	
R-L limb LM diff. (g)	295.53±97.70(130.31-445.93)	529.25±154.90 (158.71-912.12)	.21	-28.3
R-L upper limb fat diff. (g)	113.86±32.76(41.76-185.95)	71.80±15.66(36.89-106.71)	.28	22.7
R-L upper limb fat diff. (%)	2.91±.64(1.51-4.31)	2.43±.53(1.24-3.62)	.58	
R-L upper limb LM diff. (g)	175.83±30.34(109.54-242.13)	276.80±73.31(113.45-440.15)	.20	-22.3
R-L lower limb fat diff. (g)	141.43±41.40(50.32-232.55)	147.84±47.92(41.05-254.63)	.92	-2.2
R-L lower limb fat diff. (%)	1.03±.23(.54-1.52)	1.20±.43(.22-2.18)	.73	
R-L lower limb LM diff. (g)	148.27±39.57(61.17-235.37)	303.92±78.72(78.72-529.13)	.15	-34.4
	Healthy non-walkers (n=58)	Healthy walkers (n=128)	P	% difference
Body weight (kg)	61.9±17.37 (58.39-65.34)	60.1±10.79(57.95-62.22)	.37	1.5
BMI (kg/m2)	24.5±0.47 (23.59-25.46)	24.0±0.29 (23.45-24.58)	.33	1.1
Waist Circumference (cm)	83.6±1.24 (81.10-86.06)	82.6±.84 (80.90-84.22)	.49	
R-L limb fat diff. (g)	165.27±18.64 (127.94-202.59)	195.8±19.83 (156.57-235.04)	.34	-8.5
R-L limb fat diff. (%)	2.4±.23(1.97-2.91)	2.80.34 (2.11-3.45)	.52	
R-L limb LM diff. (g)	365.4±38.69(287.94-442.87)	330.2±24.60 (281.54-378.88)	.43	5.1
R-L upper limb fat diff. (g)	82.1±9.44(63.18-100.98)	90.5±10.52 (69.69-111.34)	.62	-4.9
R-L upper limb fat diff. (%)	2.1±.22(1.63-2.50)	2.2±.24 (1.75-2.70)	.68	
R-L upper limb LM diff. (g)	153.3±15.85(121.55-185.02)	158.8±10.19 (138.59-178.93)	.77	-1.8
R-L lower limb fat diff. (g)	134.8±15.52(103.67-165.83)	146.7±12.99 (121.01-172.42)	.59	-4.3
R-L lower limb fat diff. (%)	1.2±.15(0.90-1.50)	1.2±.12 (0.98-1.47)	.89	
R-L lower limb LM diff. (g)	265.7±31.14(203.34-328.06)	238.5±18.40 (202.10-274.91)	.43	5.4

*p〈.05, LM: lean mass, R-L: difference between right and left limb weight, %difference: ((R-L)/(R+L)) ×100

Table 3. Comparisons of health status of the stroke survivals

	Non–walkers (n=22)(Mean±SE)	Walkers (n=27)(Mean±SE)	P
Diagnosed conditions			
Diabetes mellitus	.32±.10	.26±.09	.41
Hypertension	.73±.10	.74±.09	.92
Osteoarthritis	.50±.11	.52±.10	.80
Depression	.55±.11	.48±.10	.66
Dyslipidemia	.50±.11	.19±.08	.51
Thyroid dysfunction	.05±.05	.11±.06	.41
Reasons for functional limitation			
Stroke	.27±.10	.56±.10	.05*
Diabetes mellitus	0	.15±.07	.06
Hypertension	.09±.06	.33±.09	.04*
Back or neck	.45±.11	.37±.10	.56
Depression/anxiety/emotion	.14±.08	.22±.08	.45
Old age	.05±.05	.04±.04	.89
Obesity	.05±.05	.04±.04	.27
Others	.45±.11	.41±.10	.14
EuroQoL			
Mobility	1.91±.11	2.00±.09	.53
Self–care	1.36±.12	1.78±.11	.02*
Usual activities	2.05±.14	2.11±.10	.70
Pain/discomfort	2.23±.11	2.15±.13	.65
Anxiety/depression	1.73±.14	1.74±.15	.95
EQ VAS	54.77±5.13	48.15±4.74	.35
EQ–5D index	.62±.05	.58±.05	.62
Subjective health	4.45±.18	4.07±.18	.90

*p<.05
.EuroQoL: European Quality of Life Scale, EQ VAS: EuroQoL Visual Analogue Scale, EQ–5D: EuroQoL–5 dimensions

DISCUSSION

This study was conducted to observe the clinical status, functional limitations, and general health quality of physically active and physically inactive elderly female stroke survivors. In addition, limb compositional differences of the two groups were compared to observe the role of physical activity.

In this study, lean mass, fat mass, and fat ratio differences were observed for the physically active and inactive groups. A strong relationship between reduction in muscular strength, functional deterioration, and physical inactivity with progression of age has been repeated reported by credible institutions around the world. Age related changes lead to progressive muscular atrophy or sarcopenia with neulogical deterioration for muscular strength and mass reduction. The foundation for National Institute of Health Sarcopenia project defined sarcopenia as clinically relevant muscle strength and lean mass [15]. Change in body composition a one of the major age related changes. Greater deterioration rate of body composition has been reported for the stroke survivors. Moreover, asymmetrical atrophy has been reported by several studies.

Overall, the total mean weights were similar between with the healthy peers in this study. Although significant differences were not observed between the groups, mean fat mass, lean mass differences of both stroke survival groups were greater than that of the peers. The healthy age-matched peers showed between 1.8 to 8.5% differences in all limb composition differences including fat and lean mass differences. However, the stroke survival groups showed greater compositional differences of 2.2 to 34.4%. Results support the findings of symmetrical changes of body composition in stroke survivals. Another difference was also observed between the stroke survivals and healthy peers. The 95% confidence intervals, which indicate the degree of closeness between the results, showed greater variations for the stroke survivals in comparison to that of the peers. In term of fat contents, both non-walkers and walkers showed BMI greater than that recommended by the World Health Organization (WHO) of Asian-Pacific region for obesity (25 kg/m2) [16]. On the other hand, BMI of the healthy peers were between 23 and 25 kg/m2, which is the range for overweight [16]. In addition, both stroke groups showed greater waist circumferences in comparison to that of the peer groups. According to the guidelines of the Korean Obesity Society, waist circumference greater than 85 cm is considered obesity [17]. The mean waist circumference of the healthy peer groups were less than 85 cm and the stroke survivals were greater than 85 cm. In terms the stroke survivor group comparisons, although significant differences were not observed between the groups, trend for differences was observed. Greater fat mass differences of more than 10% were observed for the non-walkers. Moreover, greater lean mass differences were observed for the walkers. Both the fat mass and lean mass differences were less for the healthy peer groups. Among the four groups of the non-walker and walkers, the fat mass difference was the greatest for the non-walkers with stroke experience. Greater deposition rate of fat mass has been reported with the progression of aging. Fat deposition is one of the signs of sarcopenia [4,18,19]. Increase in fat deposition can be caused by several factors including aging and of physical activity. Although mixed results have been reported, stroke has also been known to accelerate the rate of fat deposition [20-22]. Factors such as nutritional status, hormonal state, inflammation, and physical activity participation have been known to influence physiological state of the stroke survivals [23,24].

Lean mass of the limbs showed interesting results in this study. Regularly walking stroke survivors showed greater lean mass difference than the non-walking stroke survivals. The lean mass differences were even greater than that of the healthy peers. The lean mass differences were less than 5% between the healthy peer groups. On the other hand, the lean mass differences were around 30 percent greater for the walking stroke survivals. Stroke tend to reduce muscle mass and strength greater than the age-matched subjects [20]. Both paretic and nonparetic limbs tend to show reductions in muscle mass and strength [19]. Previous study also showed consistency in increase in muscle content in exercising stroke survivors [18]. However, unlike the previous study, fat content difference seemed to be greater in non-exercising stroke survivor than in the exercising stroke survivals [19]. Previous study observed body compositions of mid-aged to older females, however, this study observed older females only. More fat accumulation may have occurred with age. On the other hand, regular physical activity tends to reduce fat contents and increase or maintain muscle mass in stroke survivals [25]. Stroke occurs by ischemic or hemorrhagic damage to one side of the cerebrum which affects contralateral side of the body. Active individuals may have utilized unaffected side far more than the affected side for performing everyday activities including walking. Repeated occurrence of movements to one side of the body may have increased muscle mass greater in the contralateral side of the hemispheric damage [3,18,19].

This study compared various health conditions, reasons for functional limitation, and health related quality of life between the walkers and non-walkers. This study tried to exclude all the clinical conditions that might directly influence performance of physical activity such as cancer, cardiovascular disease, or orthopedic conditions. Other clinical conditions not mentioned in the study were also observed for possibility exclude all influence of clinical conditions. Additional comparative assessments of smoking and alcohol consumption were also similar between the groups. All the diagnosed conditioned in table 3 were not significantly different between the groups. This study excluded all the possible clinical conditions for not participating in physical activity. As for the reasons for functional limitation, walking stroke survivors had more reasons not to participate in physical activity. Regularly walking stroke survivals reported that stroke itself and hypertension were limiting factors. Among the components of EuroQoL, regularly walking stroke survivals showed greater self-care difficulty than inactive survivals. Interesting, the age-matched healthy walkers and non-walkers showed differences in various factors than the stroke survivors. Significantly greater diagnostic condition of dyslipidemia was shown for the non-walkers. In addition, diabetes and depression/anxiety/emotion were the reasons for functional limitation in non-walkers. In terms of socio-economic characteristic, inactive healthy peers showed significantly less income than the walkers. These results indicate that the elderly female stroke survivals tend to have different reasons for not participating in physical activity. Such differences were reported by several reports [1,14,26,27].

Other previous studies reported various factors such as all dimensions of EuroQoL as the factors for avoiding physical activity in stroke survivors [26, 28]. However, most of the previous studies included all stroke survivors including those with clinical reason for immobility. Studies which observed life style behaviors of the stroke survivors reported that they engaged in comparatively poorer health behaviors than healthy controls [1, 28]. Reasons for not participating in physical activity vary from one report to another report. A study which was conducted survey on factors such as physical activity, smoking, alcohol consumption, BMI, eating and drinking patterns reported that greater rate of 51% of stroke survivors were more likely to be smokers and 14% less likely to consume alcohol [28]. However, other similar studies reported increased alcohol reliance and depression in stroke survivors. Stroke is an event that damages a part of the central nervous system which affects various physiological and cognitive status of a person. Stroke survivors experience depression, emotional lability, aphasia, dementia, or even differentiated energy consumption [29, 30]. Therefore, inability to participate in regular physical activity by a stroke survivor may be influenced by various factors. However, some of the commonly given recommendations for promoting physical activity in stroke survivors were customized education and promotion, self-motivation, and family support to prevent secondary prevention and maintain quality of life [27, 31, 32].

There are several limitations to this study. One of the major limitations of this study is the limited number of subjects. First, although a large national health data across several years were utilized, a limited number of elderly females with stroke experience met the criteria of the study. However, despite the limited number of included subjects, this study observes two ends of the spectrum by clear division of the groups. Second, since the national survey did not focus solely for stroke survivors, survey questionnaires were limited to general findings. There should be more detailed questionnaires that may elucidate reasons for inactivity in the elderly female stroke survivors. Third, information on the stroke survivors such as the onset of stroke nor paretic side were not included in the KNHANES data. Such information would have been critical in elucidating the effects of stroke and developing corresponding rehabilitation program. Elucidating the detailed reasons for asymmetric limb composition and inactivity will allow development of training programs for improvement in quality of life.

CONCLUSION

Body composition analysis showed comparatively tendency for greater body fat accumulation in all stroke survivals in comparison to healthy age-matched peers. Moreover, trend for asymmetrical limb content ratios were observed for the stroke survivals. Inactive stroke survivals tend to accumulate greater fat mass and active stroke survivals tend to accumulate greater lean mass to one side of the body. Furthermore, the active stroke survivors had more reasons for functional limitation and greater difficulty for self-care. However, actual clinical conditions were similar between the walker and non-walkers. The results may indicate greater need of motivation. Therefore, elderly female stroke survivals need to be motivated for physical activity participation and use of both sides of the limbs and weight distribution should be considered during all types of physical activity.

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