Association between insulin like growth factor-1 and muscle mass, muscle strength and physical performance based on European Working Group on Sarcopenia in Older People guideline

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-ABSTRACT-

Association between insulin like growth factor-1 and muscle mass, muscle strength and physical performance based on European Working Group on Sarcopenia in Older People guideline

Background : Aging is associated with various changes in body composition, such as a decrease in muscle mass, bone mineral density, and an increase in body fat. We assumed that these changes were accompanied by decrease of IGF-1 level. We aimed to define relationship between IGF-1 level and muscle mass, muscle strength and physical function of the middle aged people and the elderly.

Method : In the cross-sectional study, subjects were included who had medical examination in the Ajou University health promotion center. Serum IGF-1 level was measured, and muscle mass was calculated by dual-energy X-ray absorptiometry (DXA). Muscle strength was measured by hand grip strength test and physical performance was tested by 2-m walking test.

Results : Mean IGF-1 level was 191.1 ± 50.8 ng /ml in men and was 168.3 ± 49.0 ng /ml in women respectively. Serum IGF-1 level was associated with muscle mass in both genders. Muscle strength and physical performance were positively associated with IGF-1 in women. We also investigated prevalence of sarcopenia based on the definition of European Working Group on Sarcopenia in Older People (EGWSOP) guideline. The prevalence of sarcopenia was associated with low serum IGF-1 level in women.

Conclusion : We observed IGF-I was associated with muscle mass in both genders and it was related with muscle strength and physical performance in women. In addition, prevalecnce of sarcopenia was associated with low serum IGF-1 level.

Keywords : Insulin like growth factor-1 (IGF-1), Muscle mass, Muscle strength, Physical performance, Sarcopenia

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I. INTRODUCTION

Aging is associated with various changes in body composition, such as a decrease in muscle mass, bone mineral density, and an increase in body fat.(Kelijman, 1991; Leifke et al., 2000; Jakobsdottir et al., 2010) Decrease of muscle mass, muscle strength and impaired physical performance could be defined as sarcopenia.(Cruz-Jentoft et al., 2010) Not only the decrease of muscle mass but also the decrease of muscle strength and impaired physical performance are related with morbidity and mortality of the elderly, therefore many studies have tried to find out what factors are associated with muscle mass, muscle strength and physical performance as the number of elderly population grows rapidly.(Taekema et al., 2011; Mitchell et al., 2012) In spite of interests of sarcopenia, there is not one consensus about definition of sarcopenia and pathophysiology of it is not indentified yet. Hormone change, malnutrition, low physical activity, chronic diseases, inflammation are considered to be associated with aging related changes.(Morley, 2012; Bucci et al., 2013) In a study of Mexican population, muscle mass was significantly associated with serum free-testosterone, physical activity, cardiovascular disease, and insulin like growth factor (IGF-1) in the men.(Baumgartner et al., 1999)

Alteration in the hormonal axis has been proposed as critical, independent mediators of functional decline in older adults. In particular, IGF-1 has been indicated as an important modulator of muscle strength and function. IGF-1 is the major mediator of growth hormone (GH) which has anabolic effects on skeletal muscle cell proliferation and differentiation, facilitate muscle protein synthesis, and inhibit its degradation. In deed there are several studies which showed that low serum levels of IGF-1 and insulin-like growth factor-binding protein 3 (IGFBP3) were reported to be associated with poorer muscular strength, walking speed, mobility tasks, various physical performance, and all-cause mortality in the elderly. (Harris et al., 1997; Cappola et al., 2001; Onder et al., 2006; Taekema et al., 2011) However, there are only a few studies that investigated the relationship between serum IGF-1 level and muscle mass, muscle strength and walking speed in Asian population, therefore the aim of this study was to measure IGF-1 level, muscle mass, muscle strength and gait speed precisely and to investigate the relationship among them. We performed hand grip strength test to calculate muscle strength.

Grip strength is known to be positively correlated with lower-extremity strength and performance in older people, and it has shown to be predictive of major health-related events in older people.(Rantanen et al., 1999; Al Snih et al., 2004; Onder et al., 2006) With these reasons, handgrip strength test has frequently been used as an overall measure of muscle strength in a clinical setting. Physical performance was tested by usual gait speed test. Gait speed is a part of the SPPB, but it can also be used as a single parameter for clinical practice and research.(Guralnik et al., 2000; Cruz-Jentoft et al., 2010) In addition, it has been consistently demonstrated that measures of physical function can predict major health-related outcomes in the elderly, such as disability, death, and institutionalization.(Guralnik et al., 2000; Penninx et al., 2000) For this reason, adding an evaluation of physical function to the traditional clinical examination is particularly important in the assessment of older people. In this study, we hypothesized that serum IGF-1 level would be associated with the decline of muscle mass, poor muscle strength and impaired physical performance in the elderly. In addition, we investigated the prevalence of sarcopenia based on the definition of sarcopenia proposed at European Working Group on Sarcopenia in Older People guideline (EGWSOP).

II. MATERIALS AND METHODS

A. Study Subjects

Subjects were recruited from adults aged over 50 years of age who had health examinations at Ajou University Health Promotion Center in Korea during 1st, January, 2012 ~ 30th, June, 2013. Among them, people who took blood tests including IGF-1 and a dual-energy X-ray absorptiometry (DXA) test, hand grip strength test, gait speed test were included. We excluded subjects who had medical histories of diabetes mellitus (DM), cancer, pituitary gland disease, liver cirrhosis, or renal disease and who had taken prescribed medication for DM, thyroid disease or had taken steroid or had been on hormone replacement treatment. We also excluded participants who had abnormal blood test results, aspartate aminotransferase (AST) or alanine aminotransferase (ALT) > 80 IU/L, fasting blood glucose ≥ 126 mg/dL or HbA1c ≥ 6.5%, thyroid stimulating hormone < 0.30 uIU/mL or >10.00 uIU/mL, free T4 < 0.7 ng/dL or > 1.9 ng/dL, serum creatinine level > 1.5 mg/dL or Urine protein >2+ in urine analysis. As an association between body mass index (BMI) and IGF-1 level was suggested, we excluded subjects whose BMI were ≥30 kg/m^2. The final analysis for the study was performed in 472 (men=201, women=271). This study was designed for non-identical individuals.

B. Body composition and blood test

Body weight (Kg) and height (m) were measured. Body mass index (BMI) was defined as the individual's body weight divided by the square of their height (kg/m^2). Blood samples were collected after subjects underwent a 10~12 hour fast. Fasting blood glucose, triglycerides, high density lipoprotein cholesterol (HDL), creatinine, total protein and albumin, AST/ALT were measured. Serum IGF-1 was measured by immunoradiometric assay.

C. Muscle mass, muscle strength, physical performance

Total and regional lean tissue masses of subjects were determined from dual x-ray absorptiometry (DXA) using a Lunar iDXA scanner (GE Medical Systems Lunar, Madison,WI); Whole body scans were obtained by the same certified technician. DXA provided total and compartmental lean body mass (in grams), fat mass (in grams), and

body bone mineral content (also in grams). Appendicular skeletal muscle mass (ASM) was calculated as the sum of muscle mass in arms and legs, assuming that all nonfat and nonbone tissue was skeletal muscle.

We used hand grip strength as an indicator of muscle strength on the assumption that it could show ones' global muscle strength.(Leifke et al., 2000; Jakobsdottir et al., 2010) In our study, handgrip strength was measured using a Jamar hand dynamometer (Sammons Preston, Inc., Bolingbrook, IL, USA) to the nearest kilograms. All subjects were instructed to maintain an upright standing position, arms down by the side, and hold the dynamometer without squeezing the arm against the body. The width of the dynamometer' handle was adjusted to the hand size of the subjects such that the middle phalanx rested on the inner handle. For both hands tests were performed 2 times, and the best measure was taken for analysis.

Physical performance was tested by usual gait speed test. In our study, gait speed was measured as the walking speed during a 2 meter walk test. Participants were instructed to walk in a line as their usual gait speed. A single walk test was performed.

D. Definition of sarcopenia

We used 2 different muscle mass measurement methods, the height-adjusted ASM and the body weight–adjusted ASM. ASM was divided by the square of height (ASM/Ht^2) to adjust for height and ASM was divided by weight (ASM/Wt) to adjust for weight. The gender-specific mean and standard deviation (*SD*) of the $ASM/height^2$ and ASM/weight × 100 of the young reference group (healthy men and women aged 20 – 39 years) were used to establish the cutoff value of sarcopenia.(Cruz-Jentoft et al., 2010; Kim et al., 2012) Low muscle mass was defined that height- or weight-adjusted ASM was 2 *SD* below the mean for young adults. We used the cutoff value for low muscle mass based on the Fourth Korean National Health and Nutritional Examination Surveys.(Kim et al., 2012) Individual whose muscle mass was low plus whose gait speed was < 0.8m/s or low hand grip strength was diagnosed as sarcopenia.(Cruz-Jentoft et al., 2010) We defined low hand grip strength as 2 *SD* below the mean hand grip strength of young adults (healthy men and women aged 20 – 39 years). We calculated the cutoff value for the low hand grip strength using the result of a study about hand grip strength of Korean population(Han et

al., 2009). Subjects whose muscle mass were 2 SD below the mean for young adults without low muscle strength or low speed gait was defined as presarcopenia.(Cruz-Jentoft et al., 2010) Our definition of sarcopenia and presarcopenia was based on the consensus of the European Working Group on Sarcopenia in Older People (EWGSOP) published in 2010.

E. Statistical analysis

We used independent T-test to compare baseline characteristics between men and women. As it is known that muscle mass, muscle strength, physical performance may have different values in both genders, we analysed all data separately for men and women. To investigate the difference of IGF-1 levels by age, we categorized subjects according to age (50~59, 60~69, ≥ 70 years old) and used ANOVA test to compare IGF-1 level in each group. Pearson's correlation coefficient was calculated to determine the association between serum IGF-1 level and age, muscle mass, muscle strength, and gait speed. Logistic regression analysis was performed to study the association between serum IGF-I level and sarcopenia components, sarcopenia prevalence and to calculate the odds ratio. Subjects were divided into quartile (Q) by serum IGF-1 level, Q1 was the lowest IGF-I quartile group and Q4 was the highest quartile group (reference group). Statistical analyses were carried out using the SPSS for windows 18.0 version. $P < 0.05$ was considered significant.

III. RESULTS

A. Baseline characteristics

General characteristics of participants in men and women are shown in Table 1. Mean ages of participants were 64.5 ± 5.8 in men and 63.4 ± 5.7 in women respectively. Mean IGF-1 level was 191.1 ± 50.8 ng /ml in men and was 168.3 ± 49.0 ng /ml in women, which was significantly higher in men than in women. Muscle mass, muscle strength and gait speed was also different between men and women.

Table 1. General characteristics of participants.

	Male (n=201)	Female (n=271)	P-value
Age (years)	64.5 ± 5.8	63.4 ± 5.7	0.041*
Systolic BP (mmHg)	125.3 ± 14.7	122.9 ± 15.8	0.095
Diastolic BP (mmHg)	81.1 ± 9.7	75.2 ± 10.8	0.000**
Blood Fasting sugar (mg/dL)	95.9 ± 10.4	94.2 ± 9	0.064
Total cholesterol (mmol/L)	187.4 ± 34.2	207.7 ± 38.9	0.000**
Total protein (g/dL)	7.4 ± 0.4	7. 5 ± 0.5	0.033*
Albumin (g/dL)	4.4 ± 0.2	4. 5 ± 0.2	0.669
AST (U/L)	29.3 ± 9.5	28.4 ± 8.4	0.281
ALT (U/L)	27.1 ± 13.4	21.95 ± 9.1	0.000**
Triglyceride (mmol/L)	128.5 ± 77.3	108.5 ± 59.8	0.002*
HDL cholesterol (mmol/L)	48.3 ± 11.6	54.5 ± 12.2	0.000**
IGF-1 (ng/ml)	191.1 ± 50.8	168.3 ± 49	0.000**
Body measurement			
Height (cm)	166.6 ± 5.7	154 ± 5.4	0.000**
Weight (kg)	67.8 ± 8.2	55.8 ± 7.1	0.000**
Waist circumference (cm)	87.0 ± ± 9.4	85.44 ± 7.5	0.046*
BMI (kg/m^2)	24.4 ± 2.4	23.51 ± 2.5	0.000**
Anthropometry			
ASM/Ht^2 (Kg/m^2)	6.9 ± 0.74	5.48 ± 0.58	0.000**
ASM/Wt (%)	28.35 ± 2.11	23.38 ± 1.76	0.000**
Hand grip strength, Right (Kg)	36.7 ± 6.71	22.2 ± 4.5	0.000**
Hand grip strength, Left (Kg)	34.3 ± 6.3	19.9 ± 4.5	0.000**
Gait speed (m/s)	1.24 ± 0.2	1.17 ± 0.2	0.000**

Data are mean ± standard deviation unless otherwise indicated. BP= blood pressure, AST= aspartate aminotransferase, ALT= alanine aminotransferase, HDL= high density lipoprotein, IGF-1=Insulin like growth factor 1, ASM/Ht^2= appendicular skeletal muscle mass/height^2, ASM/Wt= appendicular skeletal muscle mass/weight.

Mean IGF-1 levels in each age group are presented in figure 1. IGF-1 level was lowest in the oldest group and there was significant difference between groups in women.

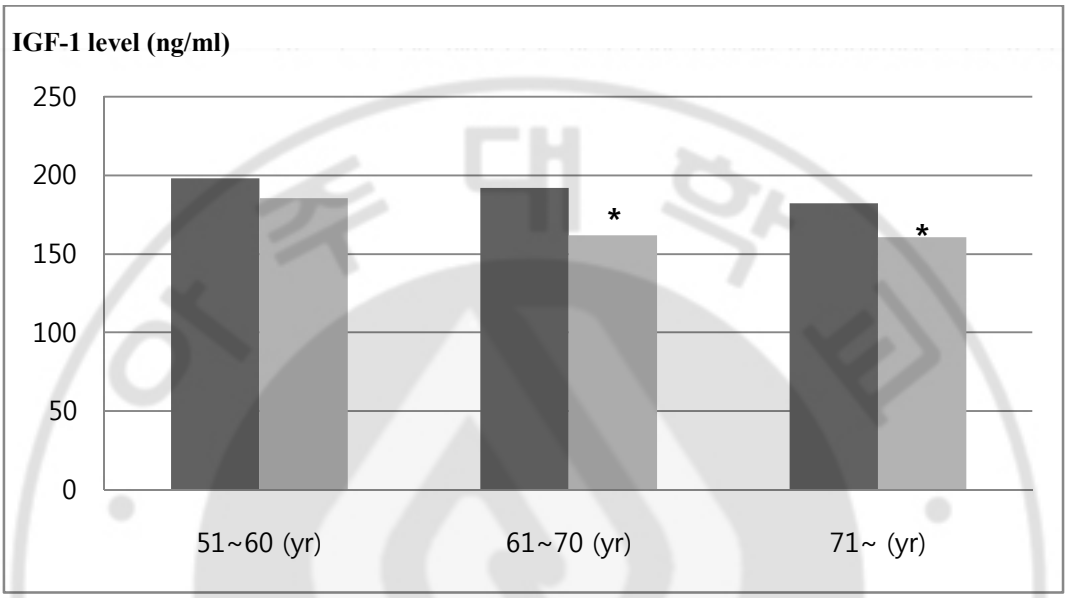

Fig. 1. Serum IGF-1 level in different age groups. Mean IGF-I levels per age category for men and women. Mean IGF-1 level were 197.9, 191.9, 182.2 ng/ml (P=0.399) in each group in men and 185.2, 161.8, 160.4 ng/ml (P=0.001) in each group in Women. * : Significant difference between groups when compared to 51~60 years group
P-for trend are obtained by ANOVA test, P < 0.05

B. IGF-1 level and muscle mass, muscle strength and physical performance

Bivariate correlation between IGF-1 and muscle mass, gait speed and muscle strength is presented in Table 2. In men, IGF-1 had a negative association with age and there was positive correlation between IGF-1 and ASM/Ht^2. In women, IGF-1 also had a negative association with age and there was significant positive correlation between IGF-

1 and ASM/Ht^2, grip strength and gait speed.

Table 2. Correlation serum IGF-1 and muscle mass, muscle strength, physical performance and age

	Men		Women	
	r	P-value	r	P-value
Age	-0.184	0.009*	-0.222	0.000*
ASM/Ht^2	0.163	0.021*	0.128	0.036*
ASM/Kg	0.068	0.339	0.028	0.649
Grip Strength (Right)	0.035	0.617	0.227	0.000**
Grip Strength (Left)	0.037	0.599	0.246	0.000**
Gait speed	0.019	0.793	0.159	0.009*

ASM= Appendicular skeletal muscle mass, Ht=Height, Wt=Weight ASM/Ht2=Height adjusted appendicular muscle mass ASM/Wt=Wight adjusted appendicular muscle mass r=Pearson's correlation coefficient, *: P<0.05, **: P<0.01

C. Sarcopenia

When ASM was adjusted by height, the prevalence of presarcopenia was 21.4% in men and 3% in women respectively. The prevalence of sarcopenia was 11.9% in men and 1.1% in women. When ASM was adjusted by weight, the prevalence of presarcopenia was 43.3% in men and 33.6% in women. The prevalence of sarcopenia was 18.3% in men and 11.1% in women respectively. Fig 2 shows the prevalence of sarcopenia in each IGF-1 quartile.

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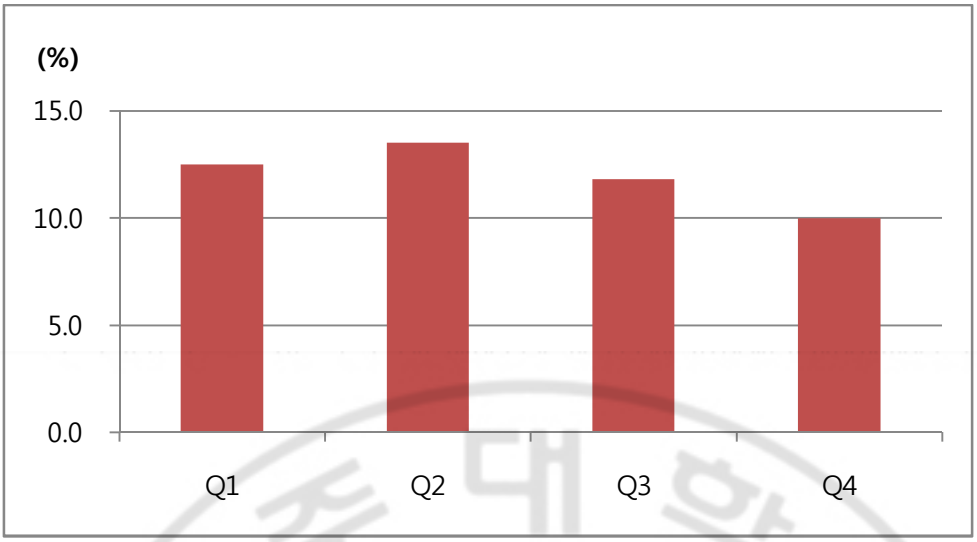

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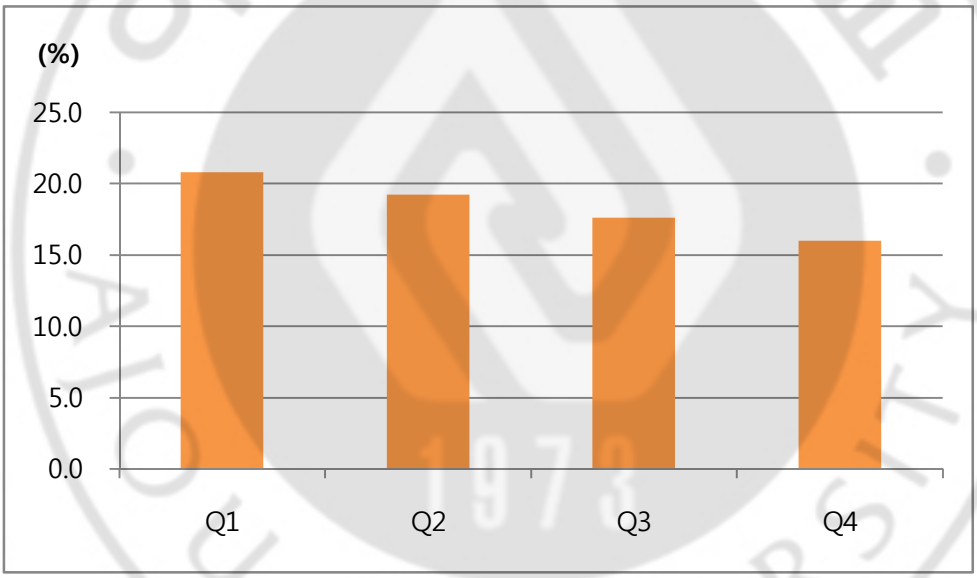

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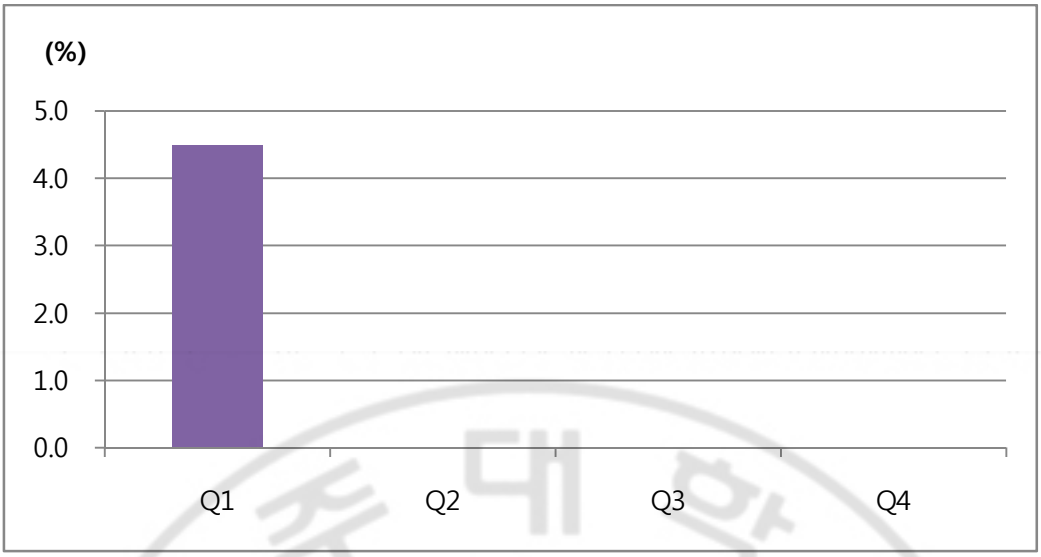

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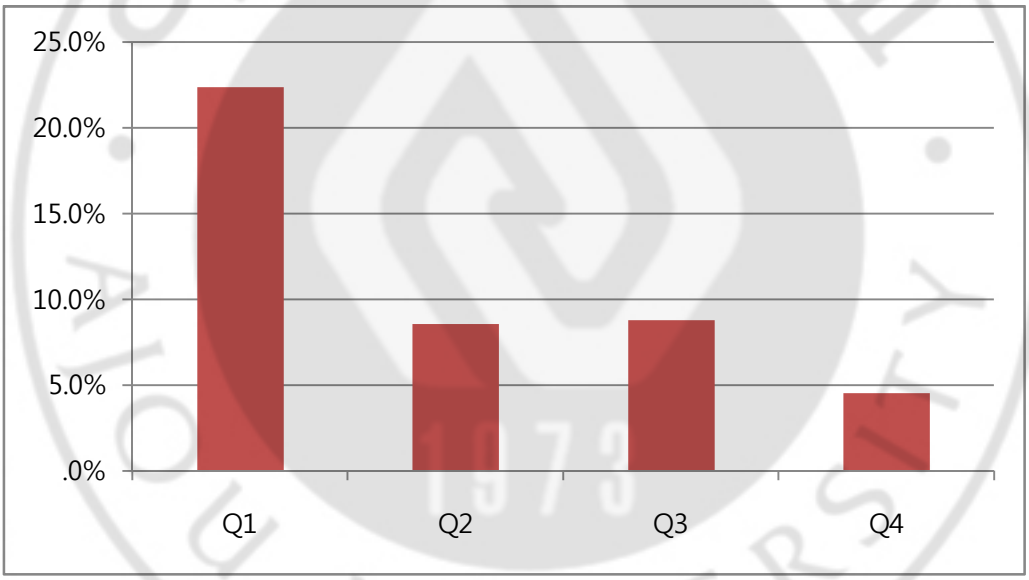

Fig. 2. Prevalence of sarcopenia. <A> Men, Height adjusted sarcopenia <B> Men, Weight adjusted sarcopenia <C> Women, Height adjusted sarcopenia <D> Women, Weight adjusted sarcopenia

D. Sarcopenia and IGF-1 level

An analysis of relationship between IGF-I and sarcopenia components in men and women is presented in Table 3. Odds ratios and 95% CI of IGF-1 quartiles for sarcopenia components were assessed. It shows that ASM/Ht^2 is lower in the lowest IGF-1 quartile compared to the highest quartile in men. In women, there was no significant association between sarcopenic components and serum IGF-1 level. However, when the cutoff value for low gait speed was changed into below 1.0 m/s, it was observed that the odds ratio of the lowest IGF-1 quartile and the third IGF-1quartile were 5.23 and 3.60, when compared to the highest quartile (95% CI, 1.96-13.92, 1.33-9.76).

The relationship between serum IGF-1 level and sarcopenia prevalence in men and women is shown in Table 4. Low IGF-1 level was associated with sarcopenia defined with weight adjusted muscle mass ([OR] =6.06, [CI] = 1.66~22.07, P=0.006) in women.

Table 3. Odds ratio of sarcopenia components according to IGF-1 quartile.

Men	Low muscle mass (Height adjusted)		Low muscle mass (Weight adjusted)		Low gait speed (≤0.8 m/s)		Low gait speed (≤1.0 m/s)		Low grip strength	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Q4	1		1		1		1		1	
Q3	2.11 (0.88-5.06)	0.096	1.45 (0.65-3.25)	0.370	1 (0.00~)	1	0.21 (0.04-1.07)	0.846	0.76 (0.31-1.91)	0.564
Q2	1.58 (0.65-3.84)	0.317	1.07 (0.49-2.35)	0.868	1 (0.00~)	1	0.44 (0.12-1.56)	0.202	0.77 (0.32-1.88)	0.569
Q1	2.76 (1.15-6.64)	0.024†	1.21 (0.54-2.71)	0.649	$3.43*10^7$ (0.00~)	0.998	0.90 (0.30-2.70)	0.060	0.71 (0.29-1.76)	0.455
Women	Low muscle mass (Height adjusted)		Low muscle mass (Weight adjusted)		Low gait speed (≤0.8 m/s)		Low gait speed (≤1.0 m/s)		Low grip strength	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Q4	1		1		1		1		1	
Q3	1.97 (0.17-22.26)	0.584	0.95 (0.48-1.88)	0.880	$2.41*10^7$ (0.00~)	0.997	3.60 (1.33-9.76)	0.012†	1.86 (0.59-5.88)	0.290
Q2	1.91 (0.17-21.60)	0.600	0.80 (0.40-1.59)	0.525	$2.34*10^7$ (0.00~)	0.997	2.28 (0.81-6.41)	0.118	2.28 (075-6.94)	0.149
Q1	6.39 (0.75-54.65)	0.090	1.48 (0.75-2.93)	0.259	$2.51*10^8$ (0.00~)	0.997	5.23 (1.96-13.92)	0.001†	2.94 (0.98-8.78)	0.054

Data are represents odd ratio with 95% confidential interval by logistic regression analysis

OR=Odds ratio, CI=Confidence interval, =Velocity, † : $P < 0.05$

Table 4. Odds ratio of sarcopenia prevalence according to IGF-1 quartile

Men	Height adjusted Sarcopenia		Weight adjusted Sarcopenia	
	OR (95%CI)	p-value	OR (95%CI)	p-value
Q4	1		1	
Q3	1.2 (0.34~4.22)	0.776	1.13 (0.40~3.20)	0.825
Q2	1.4 (0.41~4.74)	0.589	1.25 (0.45~3.48)	0.669
Q1	1.29 (0.37~4.53)	0.696	1.38 (0.49~3.86)	0.538
Women	Height adjusted Sarcopenia		Weight adjusted Sarcopenia	
	OR (95%CI)	p-value	OR (95%CI)	p-value
Q4	1			
Q3	$7.57*10^7$	0.997	2.03 (0.49~8.49)	0.331
Q2	1	1	1.97 (0.47~8.22)	0.353
Q1	1	1	6.06 (1.66~22.07)	0.006*

Low IGF-1 level was associated with sarcopenia defined with weight adjusted muscle mass ([OR] =6.06, [CI] = 1.66~22.07, P=0.006) in women. Data are represents odd ratio with 95% confidential interval by logistic regression analysis. OR=Odds ratio, CI=Confidence interval, *: P <0.05

IV. DISCUSSION

Our results demonstrated that serum IGF-1 level was associated with height adjusted muscle mass in men and women. Moreover serum IGF-1 level was positively associated with muscle strength and gait speed in women. In addition, low serum IGF-1 level was associated with increased prevalence of sarcopenia defined with weight adjusted muscle mass in women.

Mean IGF-I level was significantly higher in men than in women, indicating that the sex difference is still present in older people. This difference may be explained with the diminished estrogen levels with aging in women. Testosterone is aromatized to estradiol, in men, resulting in higher estradiol levels in men than in women after the menopause. It is known that estrogen levels are thought to influence IGF-I levels so IGF-1 levels could be higher in men than in women, conclusively.(Choi et al., 2009; Jakobsdottir et al., 2010) When we categorized subjects by age, we also found out that IGF-I level was lower in the older age category (Figure 1), which was compatible with the results of other studies(Landin-Wilhelmsen et al., 1994; Leifke et al., 2000; Taekema et al., 2011). In a study of Japanese population, IGF-1 levels increased in their puberties and decreased through adulthood to a mean of 100ng/ml at the age of 70 years.(Isojima et al., 2012) IGF-1 was positively associated with muscle mass in both genders however it was significantly associated with muscle strength and physical performance only in women. This result is consistent with other studies. In a study, there was a positive relation between IGF-1 and hand grip strength in women, but not in men.(Baumgartner et al., 1999; Taekema et al., 2011) In addition, two other studies concluded that low circulating IGF-1 level was associated with optimal shortening velocity, and maximal muscle power was associated with lower circulating levels of IGF1 in women only.(Kostka et al., 2000; Cappola et al., 2001; Taekema et al., 2011)

We investigated the prevalence of presarcopenia, sarcopenia by each height- or weight-adjusted ASM definition. In a recent study of sarcopenia prevalence study in Korea, the prevalence of sarcopenia in the elderly population was 12.4% in men, 0.1% in women by height adjusted definition, and 9.7% in men and 11.8% in women by weight adjusted definition(Kim et al., 2012). In our study, the prevalence was of sarcopenia was 11.9% in men, 1.1% in women by height adjusted definition, and 18.3% in men and 11.1%

in women by height adjusted definition. The prevalence of presarcopenia defined low muscle mass without regarding muscle strength or physical performance was 21.4% in men, 3.0% in women by height adjusted definition, and 43.3% in men and 33.6% in women by weight adjusted definition. For women, unlike for men, the prevalence was extremely different by the definitions used in our study. This result is consistent with other study results.(Wen et al., 2011; Kim et al., 2012). A recent study involving the Chinese elderly population also reported similar findings, led the authors to conclude that height-adjusted ASM criteria may not be suitable for diagnosing sarcopenia in the Chinese population(Wen et al., 2011).

In Table 4, there was significant relationship between low serum IGF-1 and high prevalence rate of sarcopenia by weight adjusted method in women. With these results, we can conclude that we can predict that low serum IGF-1 level is associated with high prevalence of sarcopenia in women.

There are some limitations to our study. First of all, the number of samples was not enough to be representative of Korean old age group. Moreover, subjects were composed of relatively healthy middle aged people rather than the older elderly. The results there was tendency that serum IGF-1 level was positively associated with muscle strength and physical performance without statistical significance in men can be explained by lack of power due to the limited number of oldest-old subjects. In addition, when we considered that our study subjects were from those who took their routine health check up there might be a possibility that subjects in this study could be more healthier than people about the same age. Secondly, our study was a cross sectional study, which explains associations but not causality. Third, we measured gait speed by a 2 meter walking test. In EWGSOP, it is recommended to measure one's walking speed with a 4 meter walking test. This difference may affect on the results of this study.

This study has strength in some respects. We investigated the relationship of IGF-1 and physical performance as well as muscle mass or muscle strength. Considering that there were many studies about the association between IGF-1 level and skeletal muscle mass, but a few studies about muscle strength or physical performance, this study has significance because this would be a first study conducted a research of IGF-1 and sarcopenia in Korea. With this concept, we expect to define sarcopenia more precisely in

the future.

V. CONCLUSION

In our study, we observed that serum IGF-I level was positively associated with muscle mass in men and women and was positively associated with muscle strength and physical performance in women. In addition, low serum IGF-1 was related with increased weight adjusted sarcopenia prevalence in women. Further investigations are recommended to find out relationship with IGF-1 levels and muscle mass, muscle strength, and physical performance.

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-국문요약-

European Working Group on Sarcopenia in Older People guideline 에 근거한 혈중 인슐린양 성장인자-1과 근육량, 근력, 신체수행능력과의 상관관계

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연구목적: 노화는 근육량의 감소, 체지방량의 증가와 같이 신체 구성에 있어서 다양한 변화를 동반한다. 이러한 변화는 다양한 원인에 기인하며 호르몬 분비의 변화도 이와 관련이 있는 것으로 여겨진다. 본 논문에서는 이러한 변화가 인슐린양 성장인자-1의 감소와 동반된다는 가정하에 한국의 중년, 노년층 인구를 대상으로 혈중 인슐린양 성장인자-1의 농도와 근육량, 근력, 신체수행능력과의 관련성을 보고자하였다. 또한 European Working Group on Sarcopenia in Older People guideline에서 제시한 근감소증의 정의를 토대로 근감소증의 유병률 및 혈중 인슐린양 성장인자-1와의 관련성에 대해서도 연구하였다.

연구 대상 및 방법: 건강증진센터에서 건강검진을 받은 50세 이상의 남녀 472명을 대상으로 한 단면연구이다. 혈청 인슐린양 성장인자-1의 농도 및 근육량, 근력, 신체수행능력을 측정하여 비교하였으며 근감소증의 유병율을 구하였다.

결과: 남성과 여성 모두에서 혈중 인슐린양 성장인자-1는 근육량과 상관관계가 있었다. 근력과 신체수행능력은 여성에서만 혈중 인슐린양 성장인자-1와

양의 상관관계를 가졌다. 근감소증의 유병률은 키를 이용하여 보정하였을 때에 남녀 각각에서 11.9%, 1.1% 였으며 체중을 이용하여 보정하였을 때에 남성은 18.3%, 여성은 11.1% 였다. 또한 여성에서 낮은 혈중 인슐린양 성장인자-1의 농도는 높은 근감소증 유병률과 상관관계가 있었다.

결론: 혈중 인슐린양 성장인자-1의 농도는 남녀 모두에서 근육량과 양의 상관관계를 보였으며 근력과 신체수행능력은 여성에서만 양의 상관관계를 보였다. 또한, 여성에서 낮은 혈중 인슐린양 성장인자-1는 근감소증의 높은 유병률과 관계가 있었다.

핵심어: Insulin like growth factor-1 (IGF-1), Muscle mass, Muscle strength, Physical performance, Sarcopenia.