

Arm span–height difference is correlated with gastroesophageal reflux symptoms in aged Japanese subjects

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Previous studies have indicated an association between the symptoms of gastroesophageal reflux disease (GERD) and aging plus height. In this study we investigated whether the arm span–height difference was related to GERD symptoms with a focus on aged subjects in the general population, since the arm span reflects the height in young adulthood before decreasing due to vertebral deformities from aging. A total of 285 elderly individuals (105 females) who visited nursing homes for the elderly in Japan were enrolled in this study. The GERD symptoms were evaluated by the Frequency Scale for the Symptoms of GERD (FSSG). The body weight, height and arm span were measured, and information regarding medications and complications were reviewed in each nursing record. 50.5% of women had more than 3 cm of arm span–height difference. In contrast, only 37.3% of men had more than 3 cm of arm span–height difference. The FSSG scores indicated more than 70% of subjects complained of any GERD symptoms. There was a significant correlation between the FSSG score and the arm span–height difference in the subjects with more than 3 cm of arm span–height difference ($r = 0.236$; $p = 0.012$). The correlation between the arm span–height difference and the FSSG score was significant only in women in females in the present study. In conclusion, our findings indicate that vertebral deformity evaluated by the arm span–height difference might have some positive relationship to the pathogenesis of GERD symptoms in elderly Japanese individuals.

Key Words: aging, kyphosis, orthopedics, sex difference, vertebral deformities

A recent study showed that lifestyle including a westernized diet,⁽¹⁾ obesity and alcohol beverage^(2–4) were risk factors contributing to the development of gastroesophageal reflux disease (GERD) in Japan. Some reports indicated that aging, kyphosis and/or low height were risk factors for GERD.^(5,6) The arm span reflects the height in young adults at around 20 years of age,⁽⁷⁾ and the arm span–current height difference indicates loss of height from that of young adulthood because of vertebral deformities.

Previous studies demonstrated that the patients of GERD and/or non-erosive esophageal reflux disease patients complained of various upper gastrointestinal symptoms and that the frequencies of these symptoms were not proportional to the severity of endoscopic reflux esophagitis.^(8–14) The GERD symptoms have been evaluated using several questionnaires, including the Frequency

Scale for the Symptoms of GERD (FSSG).⁽¹⁵⁾ The FSSG is a GERD-specific questionnaire developed in Japan, and is used for screening of GERD patients.

Although many studies focused only on patients visiting medical facilities, there may be elderly individuals who experience upper gastrointestinal symptoms in the general population. Few studies have focused on their clinical symptoms in spite of the fact that many of the elderly individuals have risk factors for a high prevalence of GERD.^(8–11) The aim of this study was evaluating the relationship between the arm span–height difference and GERD symptoms in aged subjects in the general population being treated in nursing homes for the elderly. The present study might show that the same is true in the general population as previous evidence obtained by hospital-based trials that old age and/or low height are risk factors for GERD.

Methods

Subjects. This study included 289 elderly individuals (age range: 55–100 years; mean age: 83.4 ± 7.3 years) who visited nursing homes for the elderly, comprising 6 facilities in Saga prefecture in Japan, Mikazuki, Yuai Village, Kaede, Maple House, Kiyomizuen and Amigia, from May 2010 to March 2011. Informed consent was obtained from all subjects. The present study was conducted under protocol approval from the Ethical Committees of Saga Medical School.

The gastrointestinal symptoms were researched using the FSSG questionnaire.⁽¹⁵⁾ The FSSG is a GERD-specific questionnaire developed in Japan and used for screening of GERD. The FSSG consists of 12 questions, comprising five questions regarding acid reflux-related symptoms and seven questions regarding dyspeptic symptoms, as shown in Fig. 1. The total score of the FSSG was used for evaluation, and scores of ≥ 8 were diagnosed as symptomatic GERD.⁽¹⁵⁾ Detection of the FSSG was difficult in individuals without any support in the present study, and all were questioned vocally by the staff of the facilities using a loudspeaker and a screen on which the FSSG was projected. It took about one minute on each of the 12 questions of the FSSG. Finally, the FSSG scores were successfully obtained 285 of 289 subjects, and the remaining four subjects were omitted from the study. The body

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F-scale F.S.S.G. (Frequency Scale for the Symptoms of GERD) DATE: _____

Do you have any of following symptoms?
Please circle the appropriate response below.

NAME (ID: _____) AGE _____
GENDER M • F

Question	Mark this section				
	NEVER	OCCA-SIONALLY	SOME-TIMES	OFTEN	ALWAYS
1 Do you get heartburn?	0	1	2	3	4
2 Does your stomach get bloated?	0	1	2	3	4
3 Does your stomach ever feel heavy after meals?	0	1	2	3	4
4 Do you sometimes subconsciously rub your chest with your hand?	0	1	2	3	4
5 Do you ever feel sick after meals?	0	1	2	3	4
6 Do you get heartburn after meals?	0	1	2	3	4
7 Do you have an unusual (e.g. burning) sensation in your throat?	0	1	2	3	4
8 Do you feel full while eating meals?	0	1	2	3	4
9 Do some things get stuck when you swallow?	0	1	2	3	4
10 Do you get bitter liquid (acid) coming up into your throat?	0	1	2	3	4
11 Do you burp a lot?	0	1	2	3	4
12 Do you get heartburn if you bend over?	0	1	2	3	4
TOTAL SCORE					
Please describe any other symptoms you experience.	<input type="text"/> + <input type="text"/> + <input type="text"/> + <input type="text"/> = <input type="text"/>				

Acid reflux-related symptoms = POINTS
Dyspeptic (dysmotility) symptoms = POINTS

Fig. 1. The FSSG used in this study. When the scale was used in the study, all the characters were indicated in Japanese.

weight and height were measured in each subject, and the body mass index (BMI, kg/m²) was calculated. The degree of spine shortening was defined as the difference between the arm span (in centimeters) and body height (centimeters), because the arm span was almost equivalent to the adolescent height in each person. The arm span was measured between the middle finger tips when the both arms were spread horizontally. The difference between the arm span and the measured height indicated loss of height from the adolescent height. In a previous study, subjects with arm span–height differences of ≥3 cm were frequently complicated with osteoporosis and vertebral deformities.⁽¹⁶⁾ Information of the present subjects, including medication and complications, was obtained from the charts in each nursing homes for the elderly.

Statistical analysis. The results were expressed as the mean ± SD for each group. Statistical analyses, including the χ^2 -test, were carried out using Statistical Analysis System software version 9.1 (SAS Institute, Cary, NC). Differences between two groups were compared by the Mann-Whitney *U* test. Differences with values of $p < 0.05$ were considered to show statistical significance.

Results

Characteristics of the subjects. The characteristics of the 285 subjects are summarized in Table 1. The mean age was higher in women than in men (84.1 ± 7.1 vs 81.4 ± 7.7 years; $p < 0.01$). Both the body weight and height were larger in men than in women ($p < 0.01$ for each), while the BMI did not differ between men and women. The mean arm span–height difference in the total subjects was 2.86 ± 6.7 cm. The arm span–height difference, indicating shortened height in older age, was significantly higher

in women than in men (3.63 ± 6.3 vs 1.05 ± 7.1 cm, $p < 0.01$). More than half of the female subjects (135; 50.5%) had arm span–height differences of ≥3 cm, indicating an increased risk of complications of osteoporosis and vertebral deformities based on the previously reported criterion of ≥3 cm.⁽¹⁶⁾

Regarding the FSSG, 56 of 285 individuals (19.6%) had significant GERD symptoms (FSSG score ≥8), as indicated in the original publication,⁽¹⁵⁾ and 141 (49.4%) had GERD symptoms but with scores of <7. Therefore, a total of 197 individuals (69%) had some GERD symptoms, and only 88 subjects (30.9%) had no complaints of GERD symptoms. The mean of the total score of the FSSG as well as the acid reflux and functional dyspepsia scores did not differ between men and women.

Correlation between the arm span–height difference and FSSG score. Fig. 2 shows the relationship between the arm span–height difference and FSSG score in all 113 subjects with an arm span–height difference of ≥3 cm. There was significant correlation between the FSSG score and an arm span–height difference of ≥3 cm ($r = 0.236$; $p = 0.012$). No correlation between the arm span–height difference and FSSG score was observed in the subjects with an arm span–height difference of <3 cm (Fig. 3; $r = -0.019$; $p = 0.826$). These findings indicate that subjects with an arm span–height difference of ≥3 cm had more GERD symptoms than the subjects with an arm span–height difference of <3 cm. According to the separate analysis about sex, the relationship between the arm span–height difference and FSSG score in subjects with an arm span–height difference of ≥3 cm was observed in women (Fig. 4; $r = 0.227$; $p = 0.033$). Men did not show such a significant difference (Fig. 5; $r = 0.092$, $p = 0.438$).

Table 1. Characteristics of the subjects in the present study

	Total (n = 285)	Males (n = 81)	Females (n = 204)	p value
Age (years)	83.3 ± 7.4	81.4 ± 7.7	84.1 ± 7.1	0.005
Weight (kg)	48.3 ± 11.1	57.8 ± 9.7	44.6 ± 9.3	<0.0001
BMI (kg/m ²)	21.7 ± 3.9	22.2 ± 3.5	21.5 ± 4.0	0.162
AHD (cm)	2.86 ± 6.7	1.05 ± 7.1	3.58 ± 6.4	0.006
AHD of ≥3 cm (%)	46.7	37	50.5	0.038
FSSG	4.8 ± 6.4	4.79 ± 6.5	4.8 ± 6.4	0.987
ARS	2.69 ± 4.0	2.77 ± 4.0	2.66 ± 4.0	0.837
FDS	2.12 ± 2.8	2.02 ± 2.9	2.15 ± 2.8	0.729
FSSG of ≥8 (%)	20.7	17.3	22.1	0.37

BMI, body mass index; ADH, arm span–height difference; FSSG, frequency scale for the symptoms of GERD; ARS, acid reflux score; FDS, functional dyspepsia score.

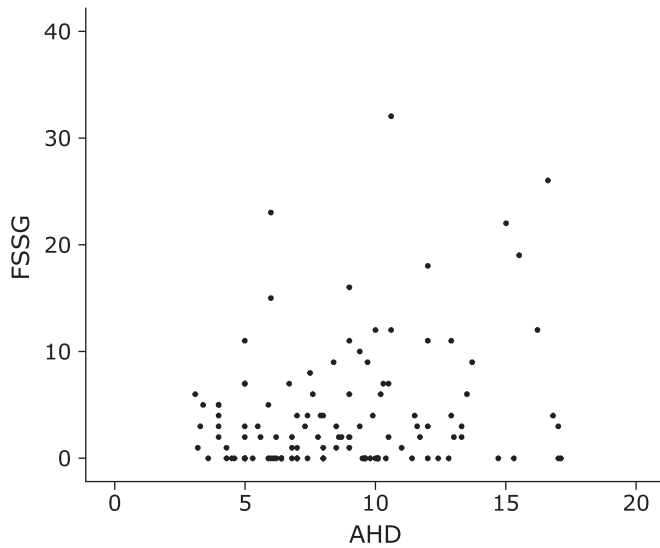


Fig. 2. Relationship between the FSSG score and an arm span–height difference of ≥3 cm in all 113 subjects.

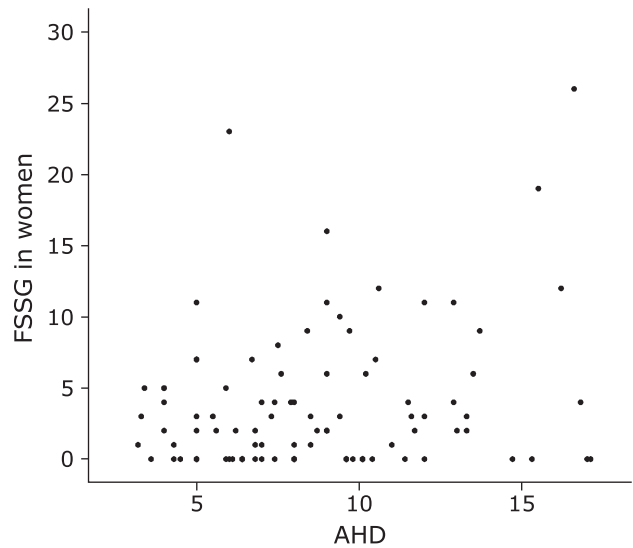


Fig. 4. Relationship between the FSSG and an arm span–height difference of ≥3 cm in all 180 women.

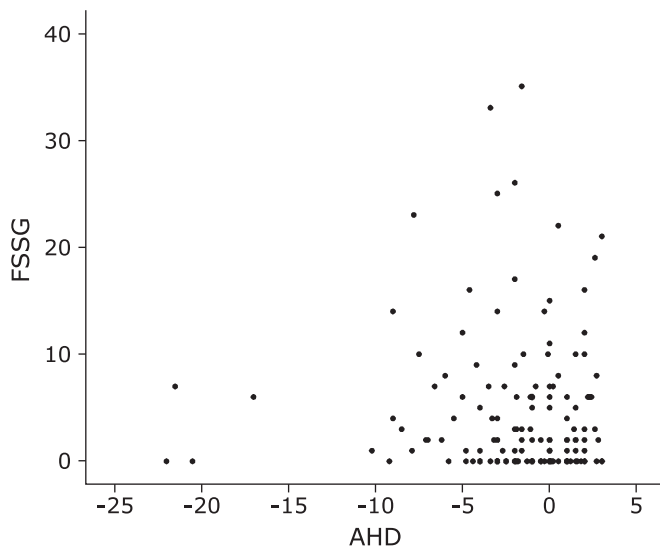


Fig. 3. Relationship between the FSSG score and an arm span–height difference of <3 cm in all 137 subjects.

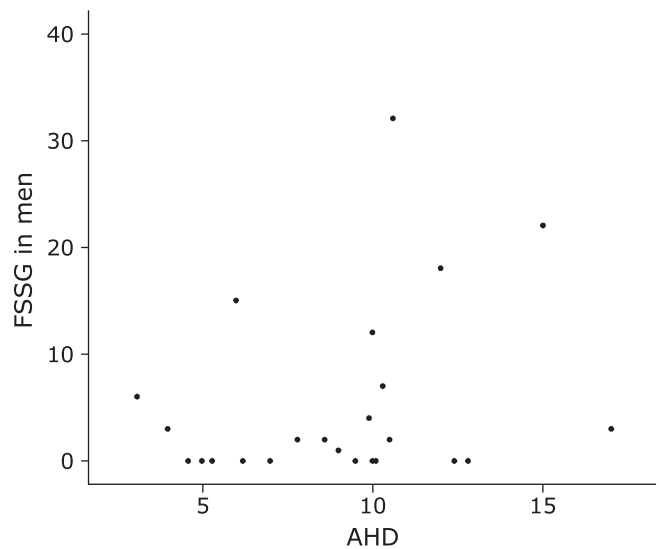


Fig. 5. Relationship between the FSSG score and an arm span–height difference of ≥3 cm in all 73 men.

Discussion

This study have revealed a correlation between the FSSG score and arm span–height difference in aged Japanese subjects, indicating that a decrease in height might be an indicator for complications of GERD. Since the arm span was correlated with height in young adults aged around 20 years.^(6,7) This association might arise through complications of vertebral deformities, which can result in hiatal hernia and GERD in aged Japanese people.⁽¹⁷⁾ The data for the present study were obtained in nursing homes for the elderly in Japan in which endoscopic examination and checking for *Helicobacter pylori* infection was extremely difficult to be performed. There were two major advantages in the present study: i) the difference between arm span and height was measured easily even in the nursing house not in the hospital, and ii) the arm span difference was reproducible and a reliable marker for detection of GERD.

The present study has demonstrated a correlation between an arm span–height difference of ≥ 3 cm and the FSSG acid reflux score only in women. The previous reports in Japan demonstrated prevalence of GERD increased in elder females,^(9–11) whereas prevalence of GERD was not different between males and females reported from Western countries.⁽⁵⁾ High complication rate of kyphosis and hiatal hernia in aged Japanese females might be one of explanation for increase in GERD.^(18–21) These date explained partly the sex difference in this study. In addition, the sex difference might be partly explained by a previous study showing that men tended to have spur formation, while females tended to have flattened discs in their spines.⁽²²⁾ Previous studies reported that an arm span–height difference of ≥ 3 cm⁽⁶⁾ or ≥ 5 cm⁽⁷⁾ reflected the vertebral deformity of kyphosis mainly in women. Another study reported a relationship between kyphosis and hiatus hernia plus GERD.⁽¹⁷⁾ In elderly Japanese subjects, radiographic lumbar

spondylosis and/or vertebral fracture were intimately associated with hiatal hernia and reflux esophagitis.⁽¹⁷⁾ These studies support the present result of a relationship between an arm span–height difference of ≥ 3 cm and the FSSG acid reflux score in elder females.

The detection rate gastroesophageal symptoms by the FSSG reached 69% in the elderly subjects in this study. There have been a few reports describing relationships between gastroesophageal reflux and age, including increases in GERD in the perimenopausal or menopausal period,⁽²³⁾ age-related decreases in sensorimotor response to esophageal acidification⁽²⁴⁾ and impaired esophageal clearance owing to age-related degradation of the gastroesophageal junction.⁽²⁵⁾ The high rate of reflux symptoms may not be clinically linked with the diagnosis and treatment of GERD in aged individuals, since a previous report suggested that the diagnosis of GERD was later in elderly individuals than in younger individuals.^(26,27)

In conclusion, this study has clearly demonstrated a positive relationship between upper gastrointestinal symptoms and decreased height in elderly Japanese subjects, especially women.

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Conflict of Interest

No potential conflicts of interest were disclosed.

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