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REGULAR ARTICLE

Evaluation of anthropometric parameters and physical fitness in elderly Japanese

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Abstract
Objectives We evaluated anthropometric parameters and physical fitness in elderly Japanese.
Methods A total of 2,106 elderly Japanese (749 men and 1,357 women), aged 60–79 years, were enrolled in a cross-sectional investigation study. Anthropometric parameters and physical fitness, i.e., muscle strength and flexibility, were measured. Of the 2,106 subjects, 569 subjects (302 men and 267 women) were further evaluated for aerobic exercise level, using the ventilatory threshold (VT).
Results Muscle strength in subjects in their 70s was significantly lower than that in subjects in their 60s in both sexes. Two hundred and twenty-nine men (30.6%) and 540 women (39.8%) were taking no medications. In men, anthropometric parameters were significantly lower and muscle strength, flexibility, and work rate at VT were significantly higher in subjects without medications than these values in subjects with medications. In women, body weight, body mass index (BMI), and abdominal circumference were significantly lower, and muscle strength was significantly higher in subjects without medications than these values in subjects with medications.
Conclusion This mean value may provide a useful database for evaluating anthropometric parameters and physical fitness in elderly Japanese subjects.

Keywords Elderly Japanese · Anthropometric parameters · Muscle strength · Ventilatory threshold (VT)

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Introduction

The proportion of elderly people (over the age of 65 years) in Japan has increased and this has become a public health challenge in Japan. For example, in Japan, 28,216,000 people (22.1% of the population) are reported to be over the age of 65 [1].

It has been shown that obese subjects have a high mortality rate [2] and have associated atherogenic risk factors, such as hypertension, coronary heart disease, diabetes mellitus, and dyslipidemia [3, 4]. In addition, Sandvik et al. reported that physical fitness was a graded, independent, long-term predictor of mortality from cardiovascular causes in healthy, middle-aged men [5]. Also, Metter et al. [6] reported that lower and declining muscle strength was associated with increased mortality, independent of physical activity and muscle mass. In order to provide proper management and control of anthropometric parameters and physical fitness in elderly Japanese, precise assessments of these parameters are necessary. However, the evaluation of anthropometric parameters and physical fitness still remains to be investigated in elderly Japanese who are not taking medications.

Therefore, we evaluated anthropometric parameters and physical fitness in elderly Japanese and compared these parameters in subjects with and without medications.

Subjects and methods

Subjects

We used data for all 2,106 elderly subjects (749 men and 1,357 women), aged 60–79 years, among 16,383 subjects in a cross-sectional investigation study. All subjects met the following criteria: (1) they had been wanting to change their lifestyle i.e., diet and exercise habits, and had received an annual health checkup between June 1997 and December 2009 at Okayama Southern Institute of Health; (2) their anthropometric, muscle strength, and flexibility measurements had been taken as part of their annual health checkups; and (3) they provided written informed consent (Table 1).

In a second analysis, among the 2,106 subjects, we further examined the data on 569 subjects (302 men and 267 women) who undertook measurements of aerobic exercise level; we also examined anthropometric, muscle strength, and flexibility measurements in these second-analysis subjects (Table 2).

The study was approved by the Ethics Committee of Okayama Health Foundation.

Athropometric measurements

The anthropometric parameters were evaluated by using the following parameters: height, body weight, body mass index (BMI), abdominal circumference, and hip circumference. BMI was calculated as weight/[height]^2 (kg/m^2). The abdominal circumference was measured at the umbilical level and the hip was measured at the widest circumference over the trochanter in standing subjects after normal expiration [7].

Muscle strength

To assess muscle strength, grip and leg strength were measured. Grip strength was measured using the THP-10 (SAKAI, Tokyo, Japan) device, while leg strength was measured with a dynamometer (COMBIT CB-1; MINATO Co., Osaka, Japan). Isometric leg strength was measured as follows: the subject sat in a chair, grasping the armrest in order to fix the body position. The dynamometer was then attached to the subject's ankle joint with a strap. Next, the subject extended the leg to 60° [8]. To standardize the influence of the total body weight, we calculated the muscle strength (kg) per body weight (kg) [9].

Flexibility

Flexibility was measured as follows in all the participants. Sit-and-reach measurements were obtained to assess the overall flexibility in forward flexion, with the measurements recorded as the distance (in cm) between the fingertips and toes. The subject's knees were kept straight throughout the test and ankles were maintained at 90° by having the soles of the feet pressed against a board perpendicular to the sitting surface [10].

Oxygen uptake at ventilatory threshold (VT)

A graded ergometer exercise protocol [11] had been carried out at the subjects' checkups. After breakfast (2 h), resting

Table 1 Clinical profiles of subjects enrolled in the first analysis

	Men (n = 749)			Women (n = 1,357)		
	Mean ± SD	Minimum	Maximum	Mean ± SD	Minimum	Maximum
Age (years)	65.6 ± 4.6	60	79	64.9 ± 4.2	60	79
Height (cm)	164.4 ± 5.5	145.3	180.2	151.9 ± 5.0	136.2	167.0
Body weight (kg)	65.9 ± 9.3	40.1	112.2	55.3 ± 7.9	33.4	97.3
Body mass index (kg/m^2)	24.3 ± 3.0	16.2	40.9	24.0 ± 3.2	15.4	41.9
Abdominal circumference (cm)	86.1 ± 9.2	61.6	127.0	78.8 ± 9.3	54.7	121.6
Hip circumference (cm)	91.9 ± 5.5	77.8	122.7	90.3 ± 5.4	69.0	120.5
Right grip strength (kg)	36.4 ± 7.0	8.7	60.0	22.3 ± 4.6	4.9	39.9
Left grip strength (kg)	35.0 ± 6.9	5.0	55.7	21.4 ± 4.5	4.3	47.4
Leg strength (kg)	51.0 ± 13.4	11.7	97.0	35.3 ± 8.6	10.7	69.7
Leg strength per body weight	0.78 ± 0.19	0.20	1.50	0.65 ± 0.17	0.15	1.26
Flexibility (cm)	0.6 ± 10.3	−34.0	28.3	11.2 ± 8.1	−22.0	28.4
Number of subjects without medications (%)	229 (30.6)			540 (39.8)		

Table 2 Clinical profiles of subjects enrolled in the second analysis

	Men ($n = 302$)			Women ($n = 267$)		
	Mean ± SD	Minimum	Maximum	Mean ± SD	Minimum	Maximum
Age (years)	65.3 ± 4.3	60	79	64.7 ± 4.0	60	77
Height (cm)	164.6 ± 5.1	149.1	178.3	152.4 ± 4.2	142.2	164.2
Body weight (kg)	68.6 ± 9.7	47.6	112.2	59.3 ± 8.8	37.6	97.3
Body mass index (kg/m^2)	25.3 ± 3.1	18.9	40.9	25.5 ± 3.7	16.7	41.9
Abdominal circumference (cm)	88.8 ± 9.8	62.5	127.0	83.4 ± 10.6	60.0	121.6
Hip circumference (cm)	93.2 ± 6.0	79.7	122.7	92.4 ± 6.4	72.5	120.5
Right grip strength (kg)	36.3 ± 6.8	13.4	60.0	22.1 ± 4.7	6.6	34.9
Left grip strength (kg)	35.1 ± 6.4	15.6	54.1	21.2 ± 4.5	6.9	33.0
Leg strength (kg)	51.0 ± 13.1	19.0	92.0	35.2 ± 9.0	11.0	69.7
Leg strength per body weight	0.75 ± 0.19	0.26	1.17	0.60 ± 0.15	0.16	1.08
Flexibility (cm)	−0.9 ± 10.1	−34.0	23.7	9.7 ± 8.3	−22.0	26.4
Oxygen uptake at VT (ml/kg/min)	12.5 ± 2.0	5.9	21.6	11.9 ± 1.7	7.6	16.8
Work rate at VT (watt)	53.6 ± 13.8	5.0	100.0	38.7 ± 10.5	5.0	70.0
Heart rate at VT (beats/min)	95.7 ± 12.9	64.0	146.0	99.0 ± 12.8	67.0	137.0
Number of subjects without medications (%)	33 (10.9)			55 (20.6)		

VT ventilatory threshold

ECG was recorded and blood pressure was measured. All subjects were then given a graded exercise after 3 min of pedaling on an unloaded bicycle ergometer (Excalibur V2.0; Lode, Groningen, The Netherlands). The profile of incremental workloads was automatically defined by the methods of Jones et al. [11], in which the workloads reach the predicted maximum rate of oxygen consumption ($\dot{V}O_{2max}$) in 10 min. A pedaling cycle of 60 rpm was maintained. Loading was terminated when the appearance of symptoms forced the subject to stop. During the test, ECG was monitored continuously, together with recording of the heart rate. Expired gas was collected, and rates of oxygen consumption ($\dot{V}O_2$) and carbon dioxide production ($\dot{V}CO_2$) were measured breath-by-breath using a cardiopulmonary gas exchange system (Oxycon Alpha; Mijnhrdt, The Netherlands). The VT was determined by the standards of Wasserman et al. [12] and Davis et al. [13], and the V-slope method of Beaver et al. [14] from $\dot{V}O_2$, $\dot{V}CO_2$, and minute ventilation (VE).

Medications

The data on medications were obtained at interviews conducted by well-trained staff using a structured method. The subjects were asked if they were currently taking medications, i.e., those for diabetes, hypertension, dyslipidemia, and/or orthopedic diseases. When the answer was "yes", they were classified as subjects with medications. When the answer was "no", they were classified as subjects without medications.

Statistical analysis

Data are expressed as means ± standard deviation (SD) values. There were sufficient numbers of subjects, except for subjects in their 70s without medications in the second analysis. A comparison of parameters between subjects in their 60s and those in their 70s, between subjects with and without medications, and between subjects in their 60s and those in their 70s without medications was made using an unpaired t-test: $p < 0.05$ was considered to be statistically significant.

Results

Clinical profiles of the subjects in the first and second analyses are summarized in Tables 1 and 2. Two hundred and twenty-nine men (30.6%) and 540 women (39.8%) in the first analysis and 33 men (10.9%) and 55 women (20.6%) in the second analysis were not taking medications.

We compared the clinical parameters between subjects in their 60s and those in their 70s (Table 3). In men, height, body weight, BMI, and hip circumference in those in their 60s were significantly higher than the values in men in their 70s. However, abdominal circumference in men in their 60s was similar to that in men in their 70s. Muscle strength, flexibility, oxygen uptake at VT, work rate at VT, and heart rate at VT in men in their 60s were higher than the values in men in their 70s. In women, height was significantly

Table 3 Changes in anthropometric and physical fitness parameters in the first and second analyses in all subjects

	Men			Women		
	60–69	70–79	*p*	60–69	70–79	*p*
First analysis						
Number of subjects	604	145		1,158	199	
Height (cm)	164.8 ± 5.3	162.7 ± 5.9	**<0.0001**	152.2 ± 4.9	149.9 ± 4.9	**<0.0001**
Body weight (kg)	66.5 ± 9.0	63.3 ± 9.9	**0.0002**	55.3 ± 7.8	54.8 ± 7.9	0.3793
Body mass index (kg/m^2)	24.5 ± 3.0	23.9 ± 3.0	**0.0313**	23.9 ± 3.2	24.4 ± 3.3	**0.0373**
Abdominal circumference (cm)	86.2 ± 9.1	85.6 ± 9.5	0.4998	78.3 ± 9.1	81.9 ± 10.2	**<0.0001**
Hip circumference (cm)	92.2 ± 5.4	90.7 ± 5.6	**0.0030**	90.3 ± 5.4	90.0 ± 5.4	0.5006
Right grip strength (kg)	37.3 ± 6.8	32.6 ± 6.9	**<0.0001**	22.5 ± 4.5	20.9 ± 4.4	**<0.0001**
Left grip strength (kg)	36.0 ± 6.6	30.8 ± 6.5	**<0.0001**	21.6 ± 4.4	20.0 ± 4.3	**<0.0001**
Leg strength (kg)	53.2 ± 12.9	41.9 ± 11.3	**<0.0001**	35.9 ± 8.5	31.8 ± 8.7	**<0.0001**
Leg strength per body weight	0.81 ± 0.19	0.67 ± 0.19	**<0.0001**	0.66 ± 0.16	0.59 ± 0.17	**<0.0001**
Flexibility (cm)	1.0 ± 9.9	−1.1 ± 11.3	**0.0278**	11.4 ± 8.0	10.7 ± 8.4	0.3205
Second analysis						
Number of subjects	255	47		228	39	
Oxygen uptake at VT (ml/kg/min)	12.7 ± 1.9	11.5 ± 1.7	**<0.0001**	12.0 ± 1.7	11.1 ± 1.5	**0.0024**
Work rate at VT (watt)	56.0 ± 12.6	40.4 ± 12.5	**<0.0001**	40.2 ± 10.2	29.7 ± 8.8	**<0.0001**
Heart rate at VT (beats/min)	96.6 ± 12.5	91.2 ± 14.0	**0.0080**	99.3 ± 12.8	96.9 ± 12.7	0.2747

Values are means ± SD. *p* values in boldface are significant

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greater, and BMI and abdominal circumference were significantly lower in those in their 60s than the values in women in their 70s. Muscle strength, oxygen uptake at VT, and work rate at VT in those in their 60s were significantly higher than the values in women in their 70s.

We further analyzed clinical parameters, comparing them between subjects with and without medications (Table 4). There were significant differences in anthropometric parameters (except for height), muscle strength, flexibility, and work rate at VT between men with and without medications. In women, there were also significant differences in body weight, BMI, abdominal circumference, and muscle strength between the two groups.

In addition, in men in their 60s, muscle strength and flexibility in subjects without medications were significantly higher than these values in subjects with medications. In women, body weight, BMI, abdominal circumference, and hip circumference were significantly lower, and grip strength and leg strength per body weight were significantly higher in subjects without medications than these values in subjects with medications (Table 4).

In men in their 70s, anthropometric parameters were significantly lower and leg strength per body weight was significantly higher in men without medications than these values in men with medications. Muscle strength in women without medications was significantly higher than that in women with medications (Table 4).

We found that there were significant differences in some parameters between subjects with and without medications. We finally compared parameters between subjects in their 60s and subjects in their 70s in without medications (Table 5). In men, anthropometric parameters and muscle strength in those in their 70s were significantly lower than these values in men in their 60s. In women, only abdominal circumference in those in their 70s was higher than that in women in their 60s. There were no differences in other parameters between subjects in their 60s and those in their 70s.

Discussion

We evaluated anthropometric parameters, muscle strength, flexibility, and aerobic exercise levels in elderly Japanese. Especially in elderly subjects without medications, this mean value for those in their 60s and 70s may provide a useful database for evaluating anthropometric parameters and physical fitness.

It has been well reported that there is significant loss in muscle strength with aging [15, 16]. Aging is associated with alterations in body composition; there is an increase in body fat percentage and a concomitant decline in lean body mass [17]. Aging, therefore, results in substantial alterations in body composition, with a marked reduction in

Table 4 Comparison of anthropometric and physical fitness parameters between subjects with and without medications as classified by age groups

	Men			Women		
	Medication (−)	Medication (+)	*p*	Medication (−)	Medication (+)	*p*
All subjects						
First analysis						
Number of subjects	229	520		540	817	
Height (cm)	164.2 ± 5.4	164.5 ± 5.5	0.4997	152.0 ± 5.2	151.8 ± 4.9	0.3762
Body weight (kg)	64.6 ± 8.7	66.5 ± 9.5	**0.0097**	54.4 ± 7.6	55.8 ± 8.0	**0.0015**
Body mass index (kg/m^2)	23.9 ± 2.7	24.5 ± 3.1	**0.0076**	23.6 ± 3.1	24.2 ± 3.3	**0.0002**
Abdominal circumference (cm)	84.7 ± 9.0	86.7 ± 9.2	**0.0055**	77.4 ± 9.0	79.8 ± 9.4	**<0.0001**
Hip circumference (cm)	91.3 ± 5.0	92.2 ± 5.6	**0.0305**	89.9 ± 5.2	90.5 ± 5.5	0.0646
Right grip strength (kg)	37.5 ± 6.6	35.9 ± 7.2	**0.0028**	23.0 ± 4.4	21.8 ± 4.6	**<0.0001**
Left grip strength (kg)	35.8 ± 6.7	34.6 ± 7.0	**0.0213**	22.0 ± 4.2	21.0 ± 4.6	**<0.0001**
Leg strength (kg)	53.1 ± 12.8	50.2 ± 13.5	**0.0059**	36.2 ± 8.0	34.7 ± 9.0	**0.0013**
Leg strength per body weight	0.83 ± 0.19	0.76 ± 0.19	**<0.0001**	0.67 ± 0.15	0.63 ± 0.17	**<0.0001**
Flexibility (cm)	2.3 ± 10.8	−0.2 ± 9.9	**0.0023**	11.7 ± 8.0	11.0 ± 8.1	0.1189
Second analysis						
Number of subjects	33	269		55	212	
Oxygen uptake at VT (ml/kg/min)	12.9 ± 1.8	12.4 ± 2.0	0.2280	11.8 ± 1.6	11.9 ± 1.7	0.7549
Work rate at VT (watt)	59.0 ± 12.8	52.9 ± 13.8	**0.0176**	40.4 ± 9.2	38.2 ± 10.8	0.1651
Heart rate at VT (beats/min)	96.7 ± 9.9	95.6 ± 13.2	0.6505	99.7 ± 12.5	98.8 ± 12.8	0.6563
60–69						
First analysis						
Number of subjects	195	409		490	668	
Height (cm)	164.8 ± 5.0	164.8 ± 5.5	0.9816	152.2 ± 5.1	152.2 ± 4.8	0.8692
Body weight (kg)	65.7 ± 8.2	66.9 ± 9.4	0.1204	54.5 ± 7.6	56.0 ± 7.9	**0.0016**
Body mass index (kg/m^2)	24.2 ± 2.6	24.6 ± 3.1	0.0755	23.5 ± 3.1	24.1 ± 3.3	**0.0010**
Abdominal circumference (cm)	85.4 ± 8.8	86.6 ± 9.2	0.1416	77.2 ± 8.8	79.2 ± 9.2	**0.0002**
Hip circumference (cm)	91.8 ± 4.7	92.4 ± 5.7	0.1956	89.9 ± 5.2	90.6 ± 5.5	**0.0304**
Right grip strength (kg)	38.2 ± 6.2	36.8 ± 7.0	**0.0168**	23.1 ± 4.5	22.1 ± 4.5	**0.0006**
Left grip strength (kg)	36.8 ± 6.3	35.6 ± 6.7	**0.0427**	22.0 ± 4.3	21.3 ± 4.5	**0.0117**
Leg strength (kg)	54.7 ± 12.4	52.5 ± 13.1	**0.0472**	36.3 ± 8.0	35.5 ± 8.9	0.1073
Leg strength per body weight	0.84 ± 0.19	0.79 ± 0.19	**0.0028**	0.67 ± 0.15	0.64 ± 0.17	**0.0018**
Flexibility (cm)	2.5 ± 10.5	0.2 ± 9.6	**0.0087**	11.6 ± 8.0	11.1 ± 8.0	0.3002
Second analysis						
Number of subjects	30	225		53	175	
Oxygen uptake at VT (ml/kg/min)	12.9 ± 1.8	12.7 ± 1.9	0.5373	11.8 ± 1.7	12.1 ± 1.7	0.3367
Work rate at VT (watt)	59.5 ± 12.5	55.6 ± 12.6	0.1052	40.5 ± 9.4	40.1 ± 10.2	0.7872
Heart rate at VT (beats/min)	97.1 ± 10.2	96.5 ± 12.8	0.8199	99.6 ± 12.6	99.3 ± 12.8	0.8459
70–79						
First analysis						
Number of subjects	34	111		50	149	
Height (cm)	160.7 ± 6.3	163.3 ± 5.7	0.0243	150.4 ± 5.5	149.7 ± 4.7	0.4049
Body weight (kg)	58.2 ± 8.8	64.9 ± 9.7	**0.0005**	53.8 ± 7.4	55.1 ± 8.1	0.3041
Body mass index (kg/m^2)	22.5 ± 3.0	24.3 ± 2.9	**0.0025**	23.9 ± 3.5	24.6 ± 3.2	0.1770
Abdominal circumference (cm)	80.5 ± 9.4	87.2 ± 9.0	**0.0003**	80.0 ± 10.9	82.6 ± 9.9	0.1158
Hip circumference (cm)	88.2 ± 5.9	91.5 ± 5.3	**0.0029**	90.2 ± 4.7	90.0 ± 5.6	0.7944
Right grip strength (kg)	33.4 ± 7.4	32.3 ± 6.8	0.3916	22.7 ± 4.0	20.3 ± 4.4	**0.0006**
Left grip strength (kg)	30.6 ± 6.5	30.9 ± 6.6	0.8323	21.9 ± 3.9	19.4 ± 4.3	**0.0004**

Table 4 continued

	Men			Women		
	Medication (−)	Medication (+)	p	Medication (−)	Medication (+)	p
Leg strength (kg)	43.5 ± 11.3	41.5 ± 11.4	0.3593	34.8 ± 8.1	30.8 ± 8.6	**0.0043**
Leg strength per body weight	0.76 ± 0.21	0.65 ± 0.17	**0.0015**	0.65 ± 0.16	0.57 ± 0.16	**0.0010**
Flexibility (cm)	1.0 ± 12.4	−1.8 ± 11.0	0.2127	12.1 ± 8.0	10.3 ± 8.6	0.1793
Second analysis						
Number of subjects	3	44		2	37	
Oxygen uptake at VT (ml/kg/min)	12.8 ± 1.8	11.4 ± 1.7	0.1685	11.9 ± 1.0	11.1 ± 1.5	0.4774
Work rate at VT (watt)	53.3 ± 17.6	39.5 ± 11.9	0.0642	37.5 ± 3.5	29.2 ± 8.8	0.1980
Heart rate at VT (beats/min)	93.0 ± 7.2	91.0 ± 14.4	0.8183	100.5 ± 13.4	96.7 ± 12.8	0.6887

Values are means ± SD. p values in boldface are significant

VT ventilatory threshold

Table 5 Changes in anthropometric and physical fitness parameters in the first and second analyses in subjects without medications

	Men			Women		
	60–69	70–79	p	60–69	70–79	p
First analysis						
Number of subjects	195	34		490	50	
Height (cm)	164.8 ± 5.0	160.7 ± 6.3	**<0.0001**	152.2 ± 5.1	150.4 ± 5.5	0.0189
Body weight (kg)	65.7 ± 8.2	58.2 ± 8.8	**<0.0001**	54.5 ± 7.6	53.8 ± 7.4	0.5481
Body mass index (kg/m^2)	24.2 ± 2.6	22.5 ± 3.0	**0.0012**	23.5 ± 3.1	23.9 ± 3.5	0.4736
Abdominal circumference (cm)	85.4 ± 8.8	80.5 ± 9.4	**0.0035**	77.2 ± 8.8	80.0 ± 10.9	**0.0383**
Hip circumference (cm)	91.8 ± 4.7	88.2 ± 5.9	**0.0001**	89.9 ± 5.2	90.2 ± 4.7	0.7027
Right grip strength kg)	38.2 ± 6.2	33.4 ± 7.4	**<0.0001**	23.1 ± 4.5	22.7 ± 4.0	0.5974
Left grip strength (kg)	36.8 ± 6.3	30.6 ± 6.5	**<0.0001**	22.0 ± 4.3	21.9 ± 3.9	0.8747
Leg strength (kg)	54.7 ± 12.4	43.5 ± 11.3	**<0.0001**	36.3 ± 8.0	34.8 ± 8.1	0.1953
Leg strength per body weight	0.84 ± 0.19	0.76 ± 0.21	**0.0250**	0.67 ± 0.15	0.65 ± 0.16	0.3706
Flexibility (cm)	2.5 ± 10.5	1.0 ± 12.4	0.4562	11.6 ± 8.0	12.1 ± 8.0	0.6805
Second analysis						
Number of subjects	30	3		53	2	
Oxygen uptake at VT (ml/kg/min)	12.9 ± 1.8	12.8 ± 1.8	0.9404	11.8 ± 1.6	11.9 ± 1.0	0.9520
Work rate at VT (watt)	59.5 ± 12.5	53.3 ± 17.6	0.4342	40.5 ± 9.4	37.5 ± 3.5	0.6526
Heart rate at VT (beats/min)	97.1 ± 10.2	93.0 ± 7.2	0.5071	99.6 ± 12.6	100.5 ± 13.4	0.9253

Values are means ± SD. p values in boldface are significant

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skeletal muscle mass. It has also been well reported that there is significant loss in oxygen uptake at the ventilatory threshold (VT) –which is also considered an accurate and reliable parameter of aerobic exercise level [13]–with aging [18, 19]. Miura reported that oxygen uptake at VT was significantly correlated with age (men, $r = -0.626$; women, $r = -0.578$) in 610 Japanese [18]. Sanada et al. reported that a negative correlation was noted between oxygen uptake at VT and age in 1,463 Japanese [19]. However, there are few reports of the evaluation of physical fitness in elderly Japanese. In the previous studies noted above, the number of subjects over the age of 70 was 20 in men and 16 in women [18], and 65 in men and 13 in women [19]. Especially, there are no accurate reference data for physical fitness in Japanese subjects over the age of 70 without medications. We have previously reported on changes in maximal oxygen uptake in subjects aged 20–69 years [20]. In the present study, we evaluated anthropometric parameters, muscle strength, flexibility, and aerobic exercise levels in subjects over the age of 60. We measured anthropometric parameters, muscle strength, and flexibility in 145 men and 199 women in their 70s.

In addition, we compared parameters between subjects with and without medications. Although we evaluated VT in only 3 men and 2 women in their 70s without medications, this information gathered should serve as quite a useful database for evaluating anthropometric parameters, muscle strength, flexibility, and aerobic exercise levels in elderly Japanese subjects.

We found a difference in anthropometric parameters and muscle strength between men with and without medications in their 60s and 70s. However, in women, abdominal circumference in those in their 70s was higher than that in women in their 60s, while other parameters in women in their 70s were similar to values in those in their 60s. Sanada et al. [19] also reported that, in women, fat-free body mass in those in their 70s (41.5 ± 3.5 kg) was similar to that in women in their 60s (40.0 ± 4.4 kg), while in men, fat-free mass in those in their 70s (52.9 ± 4.1 kg) was lower than that in men in their 60s (55.3 ± 52.9 kg). Previous exercise habits, current exercise habits, and sample size may affect the results.

There are potential limitations in the present study. First, our study was a cross-sectional and not a longitudinal study. Second, the 2,106 elderly subjects, all of whom wanted to change their lifestyle, underwent measurements for this study: they were therefore more health-conscious than the average person. The 569 subjects selected in the second analysis underwent aerobic exercise testing; they were therefore more health-conscious than most of the subjects in the first analysis. Third, the small sample size, especially of subjects in their 70s without medications, might make it difficult to compare aerobic exercise levels between subjects with and without medications, and to compare these levels between subjects in their 60s and those in their 70s. In addition, the death rate in subjects aged 75–79 is higher than that in those aged 70–74 [21]. Therefore, it is well expected that there are differences in physical fitness between subjects aged 70–74 and those aged 75–79. Further large-sample-size and prospective studies are needed in elderly Japanese.

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