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Short Communication

Relationship between Changes in Body Weight and Waist Circumference in Japanese

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Abstract

Objectives: We investigated the correlation between changes in body weight and body composition parameters.

Methods: We used the data of 2635 Japanese (40.2±12.2 years) at baseline and at 1-year follow-up from a database of 13522 subjects, which is available at the Okayama Southern Institute of Health in Okayama prefecture, Japan. Body weight, waist circumference at the umbilical level, hip circumference, and body fat percentage were used in the analyses.

Results: Body composition parameters were significantly reduced after 1 year. Changes in body weight significantly correlated with changes in waist circumference, changes in hip circumference, and changes in body fat percentage. A decrease in body weight of 3 kg corresponded to a 3.45 cm decrease in waist circumference in men and a 2.83 cm decrease in that in women.

Conclusion: A decrease in body weight of 3 kg corresponded to an almost 3 cm decrease in waist circumference at the umbilical level in Japanese men and women.

Key words: body weight, waist circumference, hip circumference, body fat percentage

Introduction

Metabolic syndrome has become a public health issue in Japan (1). For example, 30.7% of men and 3.6% of women are diagnosed as having metabolic syndrome (2), and reducing visceral fat is considered to be a critical therapeutic approach (1). In 2006, a 3 kg decrease in body weight and a 3 cm decrease in waist circumference were recommended by the Japan Society for the Study of Obesity (JASSO) (http://wwwsoc.nii.ac.jp/jasso/, accessed on Jan 25, 2007) for the prevention and alleviation of metabolic syndrome. However, the link between changes in body weight and waist circumference still remains to be investigated. Therefore, we evaluated how changes in body weight correlate with changes in body composition parameters, namely, waist circumference, hip circumference, and body fat percentage, using baseline and 1-year follow-up data of a large sample of the Japanese population, which is available at the Okayama Southern Institute of Health in Okayama prefecture, Japan.

Subjects and Methods

Subjects

We used the retrospective data of 2635 Japanese (40.2±12.2 years) from a database of 13522 subjects (42.5±14.9 years) who underwent an annual health check-up from June 1997 to March 2005 at the Okayama Southern Institute of Health in Okayama prefecture, Japan, for the purpose of improving their lifestyle. The selected 2635 subjects met the following criteria: (1) underwent an annual baseline health check-up from June 1997 to March 2005, (2) underwent an annual health check-up after 1 year, (3) received no medication for diabetes, hypertension, or dyslipidemia, and (4) provided written informed consent (Table 1).

At the annual health check-up, all the subjects were instructed by well-trained medical staff to change their lifestyle according to the results.

Approval for the study was obtained from the Ethical Committee of the Okayama Health Foundation.

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Anthropometric and body composition measurements

Anthropometric and body compositions were evaluated on the basis of the following parameters: height, body weight, waist circumference, hip circumference, and body fat percentage (3). The waist 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 as previously described (1, 3). Body fat percentage was measured using an air displacement plethysmograph called the BOD POD Body Composition System (Life Measurement Instruments, Concord, CA, USA) (4, 5). The coefficient variation (CV: %) for same-day tests was 2.48, that for three separate-day tests was 2.27, and that for independent operators was 4.53. There was a clear correlation between the results from BOD POD and those from dual-energy X-ray absorptiometry (DEXA) (r=0.910, $p<0.01$) (4).

Table 1 Clinical parameters at baseline (1997–2005) and at 1-year follow-up (1998–2006)

	Baseline	Follow-up	*p*
Total			
Number of subjects	2635		
Age	40.2±12.2		
Body weight (kg)	60.1±12.0	59.7±11.9	<0.0001
Waist circumference (cm)	74.9±10.7	74.5±10.5	<0.0001
Hip circumference (cm)	92.1±6.0	91.8±5.9	<0.0001
Body fat percentage (%)	28.1±7.3	27.4±7.4	<0.0001
Men			
Number of subjects	856		
Age	39.4±12.1		
Body weight (kg)	70.4±11.0	70.1±11.1	0.0015
Waist circumference (cm)	83.1±9.6	82.4±9.5	<0.0001
Hip circumference (cm)	94.3±5.8	94.1±5.7	0.0020
Body fat percentage (%)	23.6±6.6	22.8±6.6	<0.0001
Women			
Number of subjects	1779		
Age	40.6±12.2		
Body weight (kg)	55.1±5.6	54.7±8.6	<0.0001
Waist circumference (cm)	71.0±8.7	70.6±8.7	0.0001
Hip circumference (cm)	91.0±5.7	90.7±5.7	<0.0001
Body fat percentage (%)	30.2±6.6	29.6±6.7	<0.0001

Mean±SD

Statistical analysis

All data are expressed as mean±standard deviation (SD). Statistical analysis was performed using the paired *t* test: $p<0.05$ was considered to be statistically significant. Relationships of the parameters of interest were determined by univariate regression analysis. Pearson's correlation coefficients were calculated and used to test the significance of the linear relationship among continuous variables.

Results

Clinical parameters at baseline (1997–2005) and at 1-year follow-up (1998–2006) are summarized in Table 1. At 1-year follow-up, anthropometric and body composition parameters, namely, body weight, waist circumference, hip circumference, and body fat percentage were significantly reduced.

We investigated the correlation between body weight and body composition parameters at baseline (1997-2005) by simple correlation analysis (Table 2). Body weight significantly correlated with these parameters in both sexes. In addition, changes in body weight also significantly correlated with the changes in waist circumference, hip circumference, and body fat percentage in both sexes (Table 3, Fig. 1). Furthermore, the slopes of the regression line (change in waist circumference vs change in body weight) for men and women were 1.069 and

Table 2 Simple correlation analysis between body weight and body composition parameters at baseline (1997–2005)

	r	*p*
Total		
Waist circumference (cm)	0.894	<0.0001
Hip circumference (cm)	0.864	<0.0001
Body fat percentage (%)	0.176	<0.0001
Men		
Waist circumference (cm)	0.856	<0.0001
Hip circumference (cm)	0.938	<0.0001
Body fat percentage (%)	0.567	<0.0001
Women		
Waist circumference (cm)	0.848	<0.0001
Hip circumference (cm)	0.912	<0.0001
Body fat percentage (%)	0.631	<0.0001

Table 3 Univariate regression and correlaion analyses between changes in (delta) body weight and body composition parameters in 856 men and 1779 women aged 14–77 years from 1997–2005 and 1998–2006

	r	*p*	Regression formula	y	x
Total					
Delta waist circumference (cm)	0.734	<0.0001	y=1.002x−0.062	Delta waist circumference	Delta body weight
Delta hip circumference (cm)	0.739	<0.0001	y=0.667x−0.038	Delta hip circumference	Delta body weight
Delta body fat percentage (%)	0.670	<0.0001	y=0.764x−0.403	Delta body fat percentage	Delta body weight
Men					
Delta waist circumference (cm)	0.794	<0.0001	y=1.069x−0.243	Delta waist circumference	Delta body weight
Delta hip circumference (cm)	0.742	<0.0001	y=0.557x−0.066	Delta hip circumference	Delta body weight
Delta body fat percentage (%)	0.699	<0.0001	y=0.767x−0.425	Delta body fat percentage	Delta body weight
Women					
Delta waist circumference (cm)	0.689	<0.0001	y=0.950x+0.018	Delta waist circumference	Delta body weight
Delta hip circumference (cm)	0.749	<0.0001	y=0.752x−0.012	Delta hip circumference	Delta body weight
Delta body fat percentage (%)	0.649	<0.0001	y=0.761x−0.392	Delta body fat percentage	Delta body weight

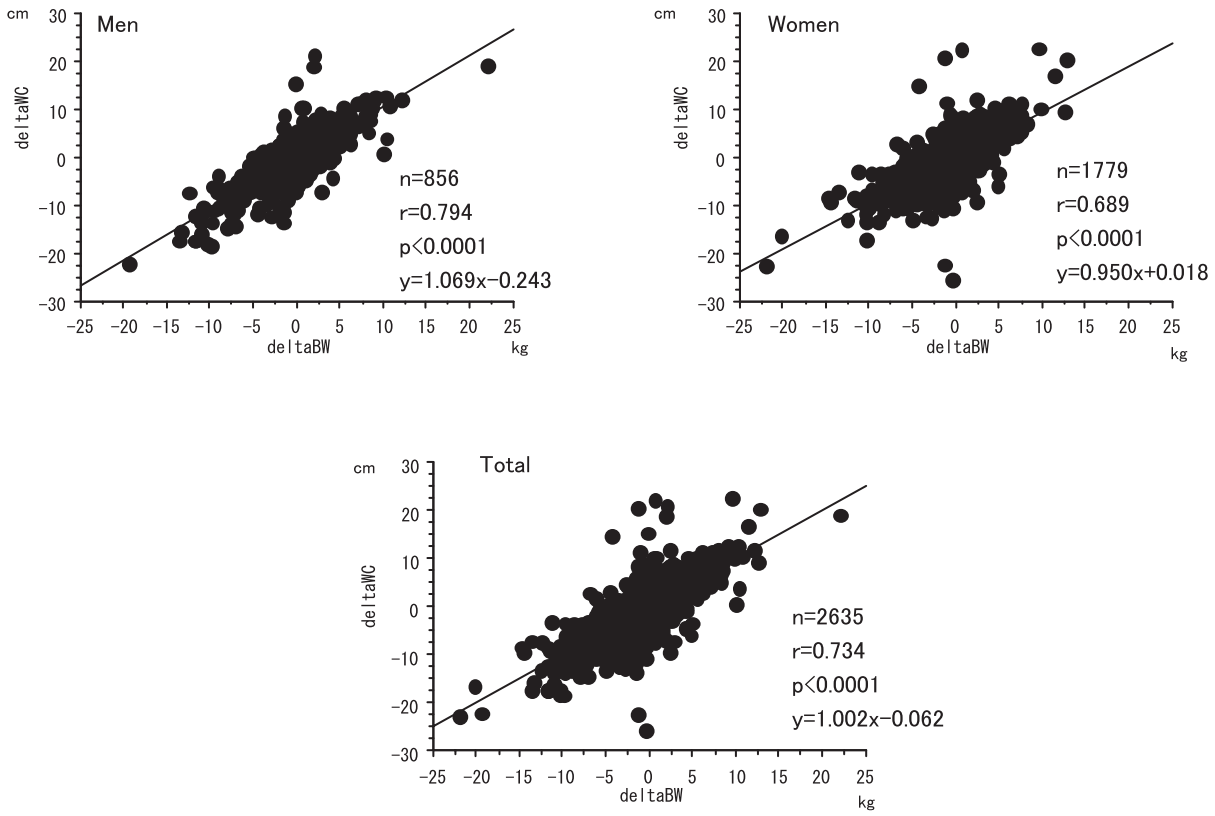

Fig. 1 Univariate regression and correlation analyses of changes in (delta) body weight and waist circumference. BW: body weight, WC: waist circumference.

0.950, respectively (Table 3). Accordingly, we found that a 3 kg decrease in body weight, as recommended by JASSO, corresponded to a 3.45 cm decrease in waist circumference in men and a 2.83 cm decrease in that in women (Fig. 1).

Discussion

The main finding of this study is that a 3 kg decrease in body weight corresponded to an almost 3 cm decrease in waist circumference at the umbilical level after 1 year.

There are few studies on the correlation between change in body weight and change in waist circumference using a large sample of the population. Egger et al. reported that a 1 cm decrease in waist circumference was equivalent to a decrease of about 3/4 kg, but with wide variability, in a study involving 42 retired Caucasian men and 45 indigenous men from Northern Australia who participated in a 1–2 year waist circumference loss program (6). We previously reported that the 1-year weight loss program, in which we instructed 61 overweight Japanese men to increase their number of daily steps per day and join a weekly exercise course, resulted in a 3.3 kg decrease in body weight and a 4.2 cm decrease in waist circumference (7). In this study, we used a large sample of the Japanese population, and body weight significantly correlated with body composition parameters. The average body fat percentage in men (23.6± 6.6%) was lower than that in women (30.2±6.6%). Therefore, the correlation coefficient between body weight and body fat percentage in all the subjects was comparatively lower than that in men and women at the baseline. In addition, a 3 kg decrease in body weight corresponded to an almost 3 cm decrease in waist circumference, which agreed with the JASSO recommendation.

Potential limitations still remain in this study. First, although we confirmed the correlation between changes in body weight and changes in waist circumference, we could not provide the threshold of body weight and waist circumference reduction for preventing and alleviating metabolic syndrome. Second, we neither directly measured the visceral fat accumulation using computed tomography nor investigated the correlation between visceral fat accumulation and body composition parameters. Third, the 13522 subjects in our study voluntarily underwent the annual health check-up; they were therefore more health-conscious than the average person. The selected 2635 subjects underwent an annual health check-up every year with a follow-up duration of 1 year and received no medication; they were therefore more health-conscious than most of the subjects in the database. They were also instructed by well-trained medical staff to change their lifestyle, and as a result their anthropometric and body composition parameters were significantly reduced.

Further intervention studies using other populations are necessary to determine the effects of prevention and treatment on metabolic syndrome.

Acknowledgement

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