“Yubi-wakka” (finger-ring) test: A practical self-screening method for sarcopenia, and a predictor of disability and mortality among Japanese community-dwelling older adults

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Aim: We developed a simple self-screening method, the “Yubi-wakka (finger-ring)” test to assess sarcopenia swiftly. This prospective cohort study aimed to examine the validity of this test as a practical method among community-dwelling older adults for identifying sarcopenia, and for predicting disability and mortality.

Methods: We followed 1904 older adults, and analyzed associations between this “Yubi-wakka” test result at baseline in 2012 and sarcopenia at baseline, new-onset sarcopenia followed until 2014, and new-certification for the long-term care insurance and mortality followed until 2016. The “Yubi-wakka” test checks whether the maximum non-dominant calf circumference is bigger than the individual’s own finger-ring circumference, which is formed by the thumb and forefinger of both hands. We divided participants into three groups, “bigger,” “just fits” and “smaller” based on a comparison between the calf and finger-ring circumference.

Results: Of 1904 participants (mean age 72.8 ± 5.4 years), 53% were grouped as “bigger,” 33% were in “just fits” and 14% were in “smaller.” Relative to “bigger,” the test results statistically associated with sarcopenia (“just fits” OR 2.4, 95% CI 1.4-4.1 and “smaller” OR 6.6, 95% CI 3.5-13), by multivariate analyses. The test results also increased the risk of new-onset sarcopenia (“just fits” HR 2.1, 95% CI 1.2-3.8 and “smaller” HR 3.4, 95% CI 1.8-6.4). Furthermore, the “smaller” had 2.0- and 3.2-fold increased risks for needing long-term care insurance services and mortality, respectively.

Conclusions: The “Yubi-wakka” test is an extremely practical method to identify older adults at risk of sarcopenia, disability and mortality. This test might contribute to increased primary prevention for sarcopenia by serving as an early wake-up call for older adults against becoming sarcopenic. Geriatr Gerontol Int 2018; 18: 224–232.

Keywords: anthropometry, geriatric assessment, long-term care insurance, mortality, sarcopenia.

Introduction

Sarcopenia is a serious problem in countries with large aging populations, as previous studies have suggested that sarcopenia is a clinical condition that results in greater increased risk for physical disabilities, falls, hospitalization and mortality.1-6 Thus, sarcopenia constitutes a key factor of physical disability that prevents older adults from leading independent lives.7 Furthermore, in the 10th revision of the International Classification of Disease (ICD), released in September 2016, the World Health Organization included a new code for sarcopenia (ICD-10-CM code M62.84), confirming that sarcopenia is a distinctly reportable disease in the eyes of the international medical community.

It is important for older adults to have early awareness of the risks of sarcopenia and of the physical functional impairments that can occur, because it is becoming evident that interventions, such as resistance training and nutritional supplements, might be more effective during the early stages of sarcopenia before patients develop physical disabilities.8-11

However, the feasibility of diagnosing sarcopenia is limited because of the requirement for high-priced instruments and trained testers.12,13 Although some screening methods have been developed in recent years, these methods still require instrumentation, a trained tester or only consist of a self-reported questionnaire.14-18 Furthermore, sarcopenia itself is not accompanied by pain, and most older patients who visit clinics for the first time after physical impairments have manifested. Hence, a practical and cost-saving screening method is urgently required that allows older individuals to evaluate their
own risk of sarcopenia without the need for any instruments, and within a local community setting, or even their own home.

Several researchers have reported that calf circumference was positively correlated with muscle mass, and that a small calf circumference was associated with sarcopenia and the risk of mortality.\textsuperscript{19–25} In the present study, we used this information to develop a new, unique self-screening method for sarcopenia named the “Yubi-wakka” (finger-ring) test. It does not require any instrumentation and the procedure is extremely easy.

The aim of the present study was to develop and validate a primary screening method to identify older adults at risk for sarcopenia, even its early stage (presarcopenia), subsequent disability and mortality. Thus, we assessed the cross-sectional and longitudinal validity of the “Yubi-wakka” test using data from the prospective cohort study of community-dwelling older adults.

### Methods

#### Setting and participants

Invitations to participate in the prospective cohort study were distributed to 12,000 randomly selected community-dwelling older adults aged \( \geq 65 \) years in Kashiwa City, Japan. A total of 2044 older adults participated in the baseline examination carried out from September to November 2012 at a health center comparatively near their home address. The exclusion criteria of this present study were: (i) eligibility for Japanese long-term care insurance system;\textsuperscript{26} (ii) missing data; and (iii) pacemaker use. Cross-sectional analysis was carried out in data of older adults who participated in baseline examination. Longitudinal analysis of new-onset sarcopenia was carried out in data of older adults who participated in annual follow-up examinations with a maximum follow-up period of 2 years. The duration of physical independence and survival was assessed using Japanese public data from the long-term care insurance system at the time of certification for long-term care needs, and at the time of all-cause death, from the baseline survey in September 2012 through June 2016. New-onset disability was the first point of the certification for care-needs.\textsuperscript{26,27} This study was approved by the ethics committee of the University of Tokyo (12-8). Data received for analysis had been de-identified, including only ID numbers. The participants’ names and confidential information were excluded to ensure the protection of personal information.

#### Measures

**“Yubi-wakka” (finger-ring) test**

The test was carried out as shown in Figure 1. The finger-ring circumference was determined by measuring each of the patient’s hands individually by grasping a centimeter measuring tape (see Supplementary Fig. 1). The sum of both hands’ circumference was used for the finger-ring circumference.

**Anthropometric measures**

Standing height, weight, limb circumferences (mid-upper arm, thigh, non-dominant calf and calf pedal edema) were
assessed. Circumferences were measured to the nearest 0.1 cm directly over the skin with the participant sitting using a measuring insert-tape (Abbot Laboratories, Irving, Texas, USA). The evaluation was based on the anthropometric measurement criteria of JARD2001 (Japanese Anthropometric Reference Data).26 All items were measured by trained professional staff between 09.00 hours and 14.00 hours on the same day.

Sarcopenia

Criteria recommended by the Asian Working Group for Sarcopenia were used for evaluating presarcopenia and sarcopenia.12 Sarcopenia was defined as low muscle strength or low physical performance in addition to low muscle mass; presarcopenia was defined as low muscle mass only.12,13

Muscle mass and body composition

These items were assessed by bioelectrical impedance analysis using the InBody430 (InBody Japan, Tokyo, Japan), with the participant in a standing position. Appendicular skeletal muscle mass index was calculated by adjusting for the square of the height. Low muscle mass was defined as an appendicular skeletal muscle mass index of <7.0 kg/m² for men and <5.7 kg/m² for women.12

Muscle strength

To evaluate upper extremity strength, handgrip strength was measured for the dominant hand with a grip dynamometer (Grip D; Takei Scientific Instruments, Niigata, Japan).29 Knee extension force was used for the lower extremity strength assessment using a handheld dynamometer (Tension meter D; Takei Scientific Instruments).29 Muscle strength was assessed twice with the support of trained testers; the better of the two scores was used for analysis. Low muscle strength was defined as a handgrip strength of <26 kg for men and <18 kg for women.12

Physical performance

Gait speed was assessed by trained testers. For assessing gait speed, participants were requested to walk 11 m in a straight lane, and the time that it took to walk the middle 5-m distance, between 3 m and 8 m from the start line, was recorded.29 Low physical performance was defined as a normal gait speed of <0.8 m/s for both sexes.12

Basic attributes

Demographic information (age, sex, education, living arrangement and physical inactivity) and present chronic conditions (malnutrition, hypertension, diabetes, hyperlipidemia, osteoporosis, malignant neoplasm and heart disease) were collected using a standardized questionnaire. Malnutrition was assessed using the Mini-Nutritional Assessment-Short Form. Physical inactivity was defined as not having a habitual exercise habit. Present chronic conditions and serum albumin concentrations were assessed through medical interviews by professional nurses.

Statistical analysis

The association between presarcopenia or sarcopenia, and the “Yubi-wakka” test was assessed with a robust group as the reference for multinomial logistic regression. The association between new-onset sarcopenia, new-certification for long-term care insurance, mortality and the “Yubi-wakka” test was assessed with a non-onset group as the reference for Cox proportional hazard modeling. The adjusted odds or hazard ratio and 95% confidence interval were calculated controlling for potential consequences of sarcopenia (age, height, education and physical inactivity), while also controlling for present chronic conditions, for calf pedal edema and body fat percentage. IBM SPSS statistics version 24 for Windows (IBM Japan, Tokyo, Japan) was used to carry out statistical analysis. We considered P < 0.05 statistically significant.

Results

Study participants

The cross-sectional analysis was based on data from 1904 (mean age 72.8 ± 5.4 years, 950 men and 954 women) participants who fulfilled the inclusion criteria. A total of 60 individuals were excluded due to missing values or pacemaker use. The longitudinal analysis regarding new-onset sarcopenia was based on data from 1212 (mean age 72.7 ± 5.5 years, 638 men and 574 women) older adults who participated in follow-up surveys and without baseline sarcopenia.

“Yubi-wakka” test

The participant’s characteristics are summarized in Table 1. Of the 1904 participants, 53% were grouped as “bigger.” Likewise, 33% were in the “just fits” group and 14% were in the “smaller” group. The χ²-test showed no differences in the frequency of grouping between the sexes (P = 0.748). In the “bigger” and “just fits” groups, the participants’ finger-ring circumferences were significantly smaller than their calf circumferences (P < 0.001). In the “smaller” group, the participants’ finger-ring circumferences were significantly bigger than their calf circumferences (P < 0.001).

Associations between physical statuses and the “Yubi-wakka” test

The trend comparisons between physical statuses and the “Yubi-wakka” test results, and the estimated mean values
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Table 1  Basic characteristics of study participants

| Variables (unit)            | Overall | Men     | Women    |
|-----------------------------|---------|---------|----------|
| No. participants            | 1904    | 950     | 954      |
| “Yubi-wakka” test           |         |         |          |
| Bigger                      | 1004    | 496     | 508      |
| Just fits                   | 626     | 320     | 306      |
| Smaller                     | 274     | 134     | 140      |
| Finger-ring circumference (cm)† | 31.9   | 32.6    | 31.0     |
| Basic attributes            |         |         |          |
| Age (years)                 | 72.8    | 73.0    | 72.7     |
| Years of education (years)  | 12.7    | 13.6    | 11.8     |
| Living arrangement (alone)  | 203     | 54      | 149      |
| Physical activity (inactive)| 422     | 188     | 234      |
| Serum albumin (g/mL)        | 4.42    | 4.42    | 4.42     |
| Anthropometric measurements |         |         |          |
| Height (cm)                 | 158     | 164     | 151      |
| Weight (kg)                 | 57.1    | 62.8    | 51.4     |
| BMI (kg/m²)                 | 22.8    | 23.2    | 22.4     |
| Calf circumference (cm)     | 34.9    | 35.8    | 33.9     |
| Pedal edema                 | 83      | 21      | 62       |
| Thigh circumference (cm)    | 41.4    | 41.9    | 41.0     |
| Upper arm circumference (cm)| 27.5    | 28.1    | 26.9     |
| BIA measurements            |         |         |          |
| ASM (kg)                    | 16.6    | 19.7    | 13.4     |
| ASMI (kg/m²)                | 6.55    | 7.28    | 5.84     |
| Body fat rate (%)           | 28.2    | 24.9    | 31.6     |
| Physical function           |         |         |          |
| Handgrip strength (kg)      | 28.8    | 35.0    | 22.6     |
| Knee extension strength (n) | 314     | 385     | 244      |
| Usual gait speed (m/s)      | 1.47    | 1.48    | 1.47     |
| Maximum gait speed (m/s)    | 2.15    | 2.26    | 2.04     |
| Presence of sarcopenia      |         |         |          |
| Presarcopenia               | 612     | 273     | 339      |
| Sarcopenia                  | 115     | 40      | 75       |
| Nutrient status             |         |         |          |
| Malnourished or at risk     | 440     | 219     | 221      |
| Serum albumin (g/mL)        | 4.42    | 4.42    | 4.42     |
| Present chronic conditions  |         |         |          |
| Hypertension                | 819     | 444     | 375      |
| Diabetes mellitus           | 223     | 144     | 79       |
| Osteoporosis                | 208     | 18      | 190      |
| Dyslipidemia                | 728     | 285     | 443      |
| Malignant neoplasm          | 283     | 179     | 104      |
| Heart disease               | 329     | 201     | 128      |
| Chronic renal failure       | 14      | 8       | 6        |

Values are shown as mean (±standard deviation) or number of participants (%). †The value in limited participants; n = 1303. ASM, appendicular skeletal muscle mass; ASMI, appendicular muscle mass index; BMI, body mass index.

of the variables stratified after adjustment for age are shown in Supplementary Table 1. There were significant trends across the order of “bigger,” “just fits” and “smaller” for the following variables: (i) older age; (ii) lower weight, muscle mass and body fat rate, and smaller appendage circumferences (calf, thigh, mid-upper arm); (iii) slightly bigger finger-ring circumference; and (iv) weaker upper and lower extremity strength. There were no significant trends in standing height or physical performance. These findings were consistent in both sexes.
Prevalence and 2-year incidence of sarcopenia

Of 1904 participants, 32% (29% of men and 36% of women) had presarcopenia. Similarly, 6.0% (4.2% of men and 7.9% of women) were identified as having sarcopenia. Of 824 older adults who participated in follow-up surveys, and without both presarcopenia and sarcopenia at baseline, 10.4% of them (9.5% of men and 12% of women) had new-onset presarcopenia including sarcopenia. Similarly, of the 1212 participants without baseline sarcopenia, 5.2% of them (4.5% of men and 5.9% of women) had new-onset sarcopenia. Prevalence rates of presarcopenia, and of sarcopenia, were significantly higher among women (P < 0.001).

Association between sarcopenia and the “Yubi-wakka” test

Table 2 shows associations between sarcopenia and the “Yubi-wakka” test results in both cross-sectional and longitudinal analyses. In cross-sectional analysis, the “Yubi-wakka” test was still significantly associated with a higher prevalence of presarcopenia and sarcopenia, although adjusted by covariates including calf pedal edema. Not only participants in the “smaller” group had a 6.6-fold higher prevalence of sarcopenia, but also those in the “just fits” group had 2.4-fold higher prevalence relative to those in the “bigger” group. Furthermore, in longitudinal analysis, participants with “just fits” or “smaller” measurements were significantly associated with a ≥2.1-fold increased risk of new-onset sarcopenia.

Prediction of disability and mortality risks

A total of 4.1% individuals (78/1904) had new-onset disability, and 3.2% (61/1904) died during the 45-month follow-up period. The cumulative risks of the “Yubi-wakka” test results for new-onset disability and mortality are shown in Table 3. In addition, survival curve estimates adjusted for covariates based on the “Yubi-wakka” test at baseline are shown in Figure 2. The Cox proportional hazards models showed that participants in the “smaller” group had a 2.0-fold increased risk of new-onset disability, and 3.2-fold increased risk of mortality. In sex-stratified analysis, these findings were similar in men. However, there were no significant associations between the test results and new-onset disability in women.

Discussion

We developed a novel self-screening method to identify increased risks of presarcopenia and sarcopenia among a community-dwelling older adult population. Because this extremely simple tool, the “Yubi-wakka” test, is carried out without any technical instruments, older adults can evaluate their risk of sarcopenia with their own hands, anytime and in any conditions, such as at home or in community gatherings. This present study investigated whether the “Yubi-wakka” test is valid to identify sarcopenia in older adults, and the test predicts increased risks of sarcopenia, subsequent disability and mortality, using the database from the longitudinal cohort study on community-dwelling older adults. The results showed the following: (i) the “Yubi-wakka” test was significantly associated with increased risks of presarcopenia and sarcopenia in cross-sectional and longitudinal analyses; (ii) the test has sufficiently discriminant validity to screen out older adults at risk for presarcopenia and sarcopenia when used as a primary self-screening method; and (iii) the “Yubi-wakka” test was also associated with increased risks of subsequent disability and mortality.

Previous studies have shown that a small calf circumference (CC) was significantly associated with lower body mass index, low muscle mass, low muscle strength, sarcopenia, frailty, disability, emerging care need and even risk for mortality. Smaller CC could therefore be useful to evaluate increased risks for major geriatric outcomes. However, the cut-off values of small CC are confusing because of sex, race, population, setting and body size. Various cut-off values of small CC were reported. To identify older adults with low muscle mass, CC <34 cm and <33 cm were appropriate for Japanese men and women, respectively. A CC <31 cm is associated with disability and self-reported loss of physical functions in European older women, and is associated with frailty and motor impairments in the New Mexican older adult population. Furthermore, CC <30 cm in men and <27 cm in women was more effective than body mass index in predicting long-term mortality risk in the Taiwanese older adult population. A smaller CC than the previously described range (from 34 to 30 in men, 27 to 33 in women) was, therefore, expected to be valid in identifying a person with physical problems, such as sarcopenia. We investigated how the “Yubi-wakka” test can be used to evaluate CC by comparing the actual CC and the “Yubi-wakka” (finger-ring) circumferences. The mean ± standard deviation of finger-ring circumferences was 32.6 (±1.8) cm and 31.0 (±1.6) cm for men and women, respectively. While there is a physique-dependent variation, the “Yubi-wakka” test can be considered a screening method that evaluates whether CC is greater than approximately 33 cm or 31 cm for men and women, respectively. Thus, we have now validated the “Yubi-wakka” test because of previous studies. In addition, the estimated mean of the “Yubi-wakka” circumference at “just fits” was the closest criterion that was used in the previous studies.

An advantage of using the “Yubi-wakka” test is that the “Yubi-wakka” circumference has already been adjusted, to an extent, for differences in body size due to differences in hand size. The “Yubi-wakka” circumferences will not change according to age. The “Yubi-wakka” is, therefore, our own custom-made indicator to assess the risk of sarcopenia without any highly technical instruments.
We developed a novel self-screening method to identify sarcopenia in community-dwelling older adults. Because this disease affects the quality of life and daily functioning, early detection and intervention are crucial. We aimed to evaluate the validity of our method using both cross-sectional and longitudinal analyses.

### Table 2: Cross-sectional and longitudinal associations of “Yubi-wakka” test with prevalence and 2-year incidence of the outcomes

| Outcome: Sarcopenia and presarcopenia | Overall | Men | Women |
|--------------------------------------|---------|-----|-------|
| **Cross-sectional analysis**          |         |     |       |
| “Yubi-wakka” test                    | OR†      | OR† | OR†   |
| Bigger                               | 1.00 (Referent) | 1.00 (Referent) | 1.00 (Referent) |
| Just fits                            | 3.05 (2.42–3.85) < 0.001 | 3.44 (2.43–4.88) < 0.001 | 2.91 (2.02–3.83) < 0.001 |
| Smaller                              | 7.08 (5.08–9.87) < 0.001 | 8.83 (5.40–14.4) < 0.001 | 5.66 (3.57–8.99) < 0.001 |
| **Longitudinal analysis**            |         |     |       |
| “Yubi-wakka” test                    | HR‡      | HR‡ | HR‡   |
| Bigger                               | 1.00 (Referent) | 1.00 (Referent) | 1.00 (Referent) |
| Just fits                            | 2.54 (1.64–3.93) < 0.001 | 1.83 (1.01–3.44) 0.041 | 3.43 (1.85–6.35) < 0.001 |
| Smaller                              | 2.83 (1.55–5.18) 0.001 | 2.91 (1.33–6.38) 0.008 | 2.69 (1.05–6.92) 0.048 |
| **Outcome: Sarcopenia**              |         |     |       |
| **Cross-sectional analysis**          |         |     |       |
| “Yubi-wakka” test                    | OR†      | OR† | OR†   |
| Bigger                               | 1.00 (Referent) | 1.00 (Referent) | 1.00 (Referent) |
| Just fits                            | 2.42 (1.44–4.07) 0.001 | 4.31 (1.66–11.2) < 0.001 | 1.83 (1.00–3.35) 0.048 |
| Smaller                              | 6.60 (3.49–12.5) < 0.001 | 14.8 (5.12–43.1) < 0.001 | 3.71 (1.73–7.95) < 0.001 |
| **Longitudinal analysis**            |         |     |       |
| “Yubi-wakka” test                    | HR‡      | HR‡ | HR‡   |
| Bigger                               | 1.00 (Referent) | 1.00 (Referent) | 1.00 (Referent) |
| Just fits                            | 2.09 (1.16–3.77) 0.014 | 1.23 (0.71–2.38) 0.486 | 2.87 (1.29–6.36) 0.010 |
| Smaller                              | 3.36 (1.77–6.36) < 0.001 | 2.58 (1.04–6.41) 0.040 | 4.37 (1.76–10.8) 0.001 |

†The odds ratios of frequency of (Just fits/ Smaller) relative to the bigger with the baseline prevalence of the outcome. ‡The hazard ratio of risk of (Just fits/ Smaller) relative to the bigger with the incidence of presarcopenia or sarcopenia during 2-year follow-up period, and participants having with the outcomes at baseline assessment and absentees with follow-up assessments were excluded from the analysis. ‡The ratios were adjusted by baseline statuses as follows: age, higher education (>12 years of education), physical inactivity, present chronic conditions (malnutrition, hypertension, diabetes, hyperlipidemia, osteoporosis, malignant neoplasm and heart disease), calf pedal edema and body fat percentage; 95% CI, 95% confidence interval; HR, hazard ratio; OR, odds ratio.
Table 3 Longitudinal associations of “Yubi-wakka” test with disability (new certification for long-term care insurance care level ≥3/5) and all-cause mortality

|                      | Overall |                      |                      | Men |                      |                      | Women |                      |
|----------------------|---------|----------------------|---------------------|-----|----------------------|---------------------|-------|----------------------|
|                      | n       | 95% CI               | P                   | n   | 95% CI               | P                   | n    | 95% CI               |
| Disability           |         |                      |                     |     |                      |                     |       |                      |
| “Yubi-wakka” test    | 78/1904 |                      |                     |     |                      |                     |       |                      |
| Bigger               | 33/1004 | 1.00 (Referent)     |                     |     | 13/496               | 1.00 (Referent)     |       | 20/508               |
| Just fits            | 24/626  | 1.11 (0.73–1.68)    | 0.636               |     | 73/200               | 1.09 (0.58–2.06)    | 0.793 | 17/306               |
| Smaller              | 21/274  | 1.96 (1.68–5.93)    | 0.005               |     | 14/314               | 3.55 (1.91–6.59)    | <0.001| 5/134                |
| All-cause mortality  |         |                      |                     |     |                      |                     |       |                      |
| “Yubi-wakka” test    | 61/1904 |                      |                     |     |                      |                     |       |                      |
| Bigger               | 24/1004 | 1.00 (Referent)     |                     |     | 16/496               | 1.00 (Referent)     |       | 8/508                |
| Just fits            | 13/626  | 0.84 (0.43–1.64)    | 0.601               |     | 10/320               | 0.71 (0.39–1.89)    | 0.707 | 3/306                |
| Smaller              | 24/274  | 3.16 (1.68–5.93)    | <0.001              |     | 16/134               | 2.32 (1.07–5.02)    | 0.033 | 8/140                |

†The hazard ratios of risk of (Just-fit/Smaller) relative to the bigger with new-certification for LTCI care-level ≥3/5, and all-cause mortality during 45-months follow-up period, and participants having with pre-sarcopenia or sarcopenia at baseline assessment and absentees with follow-up assessments were excluded from the analysis. The ratios were adjusted by baseline statuses as follow: age, higher education (>12 years of education), physical inactivity, present chronic conditions (malnutrition, hypertension, diabetes, hyperlipidemia, osteoporosis, malignant neoplasm, and heart disease), calf pedal edema, body fat percentage. 95% CI, 95% confidence interval; HR, hazard ratio.

We also identified that this novel self-screening “Yubi-wakka” test has appropriate discriminant validity and mortality. Hence, the true role of the “Yubi-wakka” test was associated with an increased risk for sarcopenia, but also an increased risk for physical disability and mortality during the 45-months follow-up period, and participants having with pre-sarcopenia or sarcopenia at baseline assessment and absentees with follow-up assessments were excluded from the analysis. The ratios were adjusted by baseline statuses as follow: age, higher education (>12 years of education), physical inactivity, present chronic conditions (malnutrition, hypertension, diabetes, hyperlipidemia, osteoporosis, malignant neoplasm, and heart disease), calf pedal edema, body fat percentage. 95% CI, 95% confidence interval; HR, hazard ratio.

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Yubi-wakka test: Sarcopenia screening

Figure 2  Survival curves estimates over 45 months of follow up according to “Yubi-wakka” status at baseline. Each survival curve shows the cumulative all-cause death events adjusted by age among (a) the overall participants, and after being stratified by sex: (b) men and (c) women.

Acknowledgements

This work was supported by the Health and Labor Sciences Research Grant (H24-Choju-Ippan-002) from the Ministry of Health, Labor, and Welfare of Japan. We specially thank the staff members and participants of the study.

Disclosure statement

The authors declare no conflict of interest.

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Supporting Information

Additional Supporting Information may be found online in the supporting information tab for this article.

Supplementary Figure 1. Finger-ring circumference measurement. The finger-ring circumference of each hand was measured by softly grasping a centimeter measuring tape. The sum of the circumferences of both hands was recorded as the finger-ring circumference.

Supplementary Table 1. Age adjusted trends of physical status and function across “Yubi-wakka” (finger-ring) test stratified by sex.