Table 1d
Descriptive statistics and comparison by populations on average grip strength (kg).

Ethnic groups	Male							Female						
	n	65–74	*n*	75–84	*n*	≥85	*P*-value[e]	*n*	65–74	*n*	75–84	*n*	≥85	*P*-value[e]
Mean (±SD), *lowest 20th percentile*														
Chinese (Hong Kong)[f]	1295	32.7 (±6.05), *27.5*	543	28.64 (±6.21), *24*	42	25.06 (±6.74), *19.3*	<0.001	1292	21.09 (±4.18), *17.5*	583	18.77 (±3.78), *15.5*	57	17.86 (±3.73), *14.5*	<0.001
Chinese (Beijing)[f]	85	34 (±8.6), *27.2*	77	30.6[h] (±7.5), *23*	10	27.4 (±5.6), *20*	<0.001	197	22.1[j] (±5.3), *17.5*	96	20.9[k] (±6.1), *15.5*	3	16.2 (±3.3), [c]	<0.001
Chinese (Singapore)[a,f]	353	20.6[g] (±6.75), *14*	148	17.8[h] (±6.53), *12.6*	165	17.8[i] (±6.47), *12.7*	<0.001	541	14.2[j] (±4.31), *10.7*	178	12[k] (±3.74), *9*	204	12[l] (±3.66), *9*	<0.001
Japanese[f]	266	35[g] (±6.1), *31*	254	29.6[h] (±6.4), *25*	48	22.9 (±5.7), *18*	<0.001	650	23.1[j] (±5.1), *19*	594	19.8[k] (±4.4), *16*	70	17.3 (±4.2), *15*	<0.001
Malays and Indians (Singapore)[a,f]	41	18[g] (±5.73), *13.5*	27	15.6[h] (±7.04), *10.1*	29	15.7[i] (±6.82), *10.3*	0.155	67	13.4[j] (±5.05), *9.1*	14	10.6[k] (±3.7), *8*	15	10.7[l] (±3.58), *8*	0.023
UK – HSS[b,f]	81	40.4[g] (±8.2), *34.0*	24	33.0[h] (±6.5), *28.0*	[d]			[d]		[d]		[d]		

Lower 20th percentile values are shown in italics.
[a] Lower limb strength was used in Singapore data, measured by average knee extension (kg).
[b] Hertfordshire Sarcopenia Study (HSS) cohort is only comprised of male participants, and is classified into 2 age groups: 68.3 years–74.9 years and 75.0 years–77.4 years, respectively.
[c] Corresponding statistics not available.
[d] Figures not available.
[e] ANOVA test for linear trend was used to examine any significant difference by age group.
[f] Independent 2-sample *t*-test (2-tailed) was used to examine age-specific difference in mean values, with Chinese (Hong Kong) as reference. Only significant difference (P-value < 0.05) is reported.
[g] Significantly different from Chinese (Hong Kong) – Chinese (Singapore) (mean difference −12.1, $P < 0.001$), Japanese (mean difference 2.3, $P < 0.001$), Malays and Indians (Singapore) (mean difference −14.7, $P < 0.001$), and UK Caucasian (mean difference 7.9, $P < 0.001$).
[h] Significantly different from Chinese (Hong Kong) – Chinese (Beijing) (mean difference 1.96, $P = 0.011$), Chinese (Singapore) (mean difference −10.84, $P < 0.001$), Japanese (mean difference 0.96, $P = 0.044$), Malays and Indians (Singapore) (mean difference −13.04, $P < 0.001$), and UK Caucasian (mean difference 5.56, $P < 0.001$).
[i] Significantly different from Chinese (Hong Kong) – Chinese (Singapore) (mean difference −7.26, $P < 0.001$), and Malays and Indians (Singapore) (mean difference −9.36, $P < 0.001$).
[j] Significantly different from Chinese (Hong Kong) – Chinese (Beijing) (mean difference 1.01, $P = 0.002$), Chinese (Singapore) (mean difference −6.89, $P < 0.001$), Japanese (mean difference 2.01, $P < 0.001$), and Malays and Indians (Singapore) (mean difference −7.69, $P < 0.001$).
[k] Significantly different from Chinese (Hong Kong) – Chinese (Beijing) (mean difference 2.13, $P < 0.001$), Chinese (Singapore) (mean difference −6.77, $P < 0.001$), Japanese (mean difference 1.03, $P < 0.001$), and Malays and Indians (Singapore) (mean difference −8.17, $P < 0.001$).
[l] Significantly different from Chinese (Hong Kong) – Chinese (Singapore) (mean difference −5.86, $P < 0.001$), and Malays and Indians (Singapore) (mean difference −7.16, $P = 0.035$).

Table 1e
Descriptive statistics and comparison by populations on walking speed using best time (m/s).

Ethnic groups	Male							Female						
	n	65–74	*n*	75–84	*n*	≥85	*P*-value[c]	*n*	65–74	*n*	75–84	*n*	≥85	*P*-value[c]
Mean (±SD), *lowest 20th percentile*														
Chinese (Hong Kong)	1295	1.12 (±0.22), *0.94*	543	1 (±0.22), *0.81*	42	0.87 (±0.17), *0.73*	<0.001	1292	1 (±0.2), *0.84*	583	0.88 (±0.22), *0.71*	57	0.81 (±0.22), *0.58*	<0.001
Chinese (Beijing)[d]	862	1.092[e] (±0.334), *0.853*	533	1.007 (±0.335), *0.711*	45	0.781 (±0.288), *0.534*	<0.001	1026	0.997 (±0.307), *0.736*	498	0.936[i] (±0.335), *0.647*	43	0.753 (±0.254), *0.516*	<0.001
Chinese (Singapore)[d]	353	1.4[e] (±0.37), *1.11*	148	1.3[f] (±0.37), *0.97*	165	1.2[g] (±0.38), *0.94*	<0.001	541	1.3[h] (±0.32), *1*	178	1.1[i] (±0.32), *0.78*	204	1[j] (±0.33), *0.74*	<0.001
Japanese[d]	266	1.38[e] (±0.24), *1.22*	254	1.23[f] (±0.25), *1*	48	1.06[g] (±0.26), *0.83*	<0.001	650	1.37[h] (±0.25), *1.22*	594	1.21[i] (±0.25), *1*	70	1.03[j] (±0.25), *0.8*	<0.001
Malays and Indians (Singapore)[d]	41	1.4[e] (±0.36), *0.99*	27	1.1[f] (±0.39), *0.71*	29	1.1[g] (±0.39), *0.7*	0.002	67	1.1[h] (±0.27), *0.82*	14	0.9 (±0.36), *0.62*	15	0.9 (±0.35), *0.64*	0.008
UK – HSS[a,d]	81	1.11 (±0.19), *0.95*	24	1.09[f] (±0.22), *0.86*	b			b		b		b		

Lower 20th percentile values are shown in italics.

[a] Hertfordshire Sarcopenia Study (HSS) cohort is only comprised of male participants, and is classified into 2 age groups: 68.3 years–74.9 years and 75.0 years–77.4 years, respectively. Two values were missing.

[b] Figures not available.

[c] ANOVA test for linear trend was used to examine any significant difference by age group.

[d] Independent 2-sample *t*-test (2-tailed) was used to examine age-specific difference in mean values, with Chinese (Hong Kong) as reference. Only significant difference (*P*-value < 0.05) is reported.

[e] Significantly different from Chinese (Hong Kong) – Chinese (Beijing) (mean difference 0.028, *P* = 0.019), Chinese (Singapore) (mean difference 0.28, *P* < 0.001), Japanese (mean difference 0.26, *P* < 0.001), and Malays and Indians (Singapore) (mean difference 0.28, *P* < 0.001).

[f] Significantly different from Chinese (Hong Kong) – Chinese (Singapore) (mean difference 0.3, *P* < 0.001), Japanese (mean difference 0.23, *P* < 0.001), Malays and Indians (Singapore) (mean difference 0.1, *P* = 0.028), and UK Caucasian (mean difference 0.1, *P* = 0.014).

[g] Significantly different from Chinese (Hong Kong) – Chinese (Singapore) (mean difference 0.33, *P* < 0.001), Japanese (mean difference 0.19, *P* < 0.001), and Malays and Indians (Singapore) (mean difference 0.23, *P* < 0.001).

[h] Significantly different from Chinese (Hong Kong) – Chinese (Singapore) (mean difference 0.3, *P* < 0.001), and Japanese (mean difference 0.37, *P* < 0.001), and Malays and Indians (Singapore) (mean difference 0.1, *P* < 0.001).

[i] Significantly different from Chinese (Hong Kong) – Chinese (Beijing) (mean difference 0.056, *P* = 0.001), Chinese (Singapore) (mean difference 0.22, *P* < 0.001), and Japanese (mean difference 0.33, *P* < 0.001).

[j] Significantly different from Chinese (Hong Kong) – Chinese (Singapore) (mean difference 0.19, *P* < 0.001), and Japanese (mean difference 0.22, *P* < 0.001).

Table 1f
Descriptive statistics and comparison by populations on time to complete 5 stands (second).

Ethnic groups	Male							Female						
	n	65–74	*n*	75–84	*n*	≥85	*P*-value[d]	*n*	65–74	*n*	75–84	*n*	≥85	*P*-value[d]
Mean (±SD)														
Chinese (Hong Kong)	1293	12.18 (±3.66)	536	13.31 (±3.81)	41	15 (±5.7)	<0.001	1271	12.79 (±4.3)	574	14.69 (±6.33)	56	13.63 (±3.61)	0.003
Chinese (Beijing)[e]	55	11.2 (±3.5)	26	11.1[g] (±2.8)	1	17[b]	<0.001	95	10.3[i] (±3.7)	40	14.2 (±12.8)	1	12.7[b]	0.135
Chinese (Singapore)[e]	353	10.7[f] (±3.16)	148	12.7 (±5.21),	165	12.9[h] (±5.35)	<0.001	541	11.4[i] (±3.65)	178	13.1[j] (±4.79)	204	14 (±9.03)	<0.001
Japanese[e]	216	8[f] (±1.9)	160	8.5[g] (±2)	12	8[h] (±1.9)	1	422	7.9[i] (±2.5)	270	8.5[j] (±2.6)	6	6.87[k] (±1.4)	<0.001
Malays and Indians (Singapore)[a,e]	41	11.5 (±3.29)	27	14.6 (±6.39)	29	14.5 (±6.22)	0.023	67	14.1[i] (±6.24)	14	17 (±7.65)	15	16.5[k] (±7.62)	0.154
UK – HSS[a,e]	81	17.1[f] (±4.3)	24	17.6[g] (±4.0)	[c]			[c]		[c]		[c]		

[a] Hertfordshire Sarcopenia Study (HSS) cohort is only comprised of male participants, and is classified into 2 age groups: 68.3 years–74.9 years and 75.0 years–77.4 years, respectively. Three values were missing.
[b] Corresponding statistics not available.
[c] Figures not available.
[d] ANOVA test for linear trend was used to examine any significant difference by age group.
[e] Independent 2-sample *t*-test (2-tailed) was used to examine age-specific difference in mean values, with Chinese (Hong Kong) as reference. Only significant difference (P-value < 0.05) is reported.
[f] Significantly different from Chinese (Hong Kong) – Chinese (Singapore) (mean difference –1.48, $P<0.001$), Japanese (mean difference –4.18, $P<0.001$), and UK Caucasian (mean difference 4.92, $P<0.001$).
[g] Significantly different from Chinese (Hong Kong) – Chinese (Beijing) (mean difference –2.21, $P=0.004$), Japanese (mean difference –4.81, $P<0.001$), and UK Caucasian (mean difference 4.09, $P<0.001$).
[h] Significantly different from Chinese (Hong Kong) – Chinese (Singapore) (mean difference –2.1, $P=0.028$), and Japanese (mean difference –7, $P<0.001$).
[i] Significantly different from Chinese (Hong Kong) – Chinese (Beijing) (mean difference –2.49, $P<0.001$), Chinese (Singapore) (mean difference –1.39, $P<0.001$), Japanese (mean difference –4.89, $P<0.001$), and Malays and Indians (Singapore) (mean difference 1.31, $P=0.018$).
[j] Significantly different from Chinese (Hong Kong) – Chinese (Singapore) (mean difference –1.59, $P=0.002$), and Japanese (mean difference –6.19, $P<0.001$).
[k] Significantly different from Chinese (Hong Kong) – Japanese (mean difference –6.76, $P<0.001$), and Malays and Indians (Singapore) (mean difference 2.87, $P=0.04$).

3. Results

The mean body mass index (BMI) for men aged 65–74 and the 20th percentile value for all Asian cohorts were similar. However with increasing age, these values appeared to decline to different degrees among the cohorts, with the Beijing Chinese, Singapore Chinese, Malays and Indians having the least decline, whilst Hong Kong Chinese and Japanese showed a more marked decline in the age 85+ group (Table 1a).

For women, more variations were observed in mean and lowest 20th percentile values for all age groups, with a declining trend with age, the lowest values for the 85+ age group occurring in the Hong Kong Chinese, Malays and Indians. The trend for Singapore Chinese was marginally non-significant. The mean values for UK Caucasian older people were higher than all the Asian values.

Appendicular mass index also showed a declining trend with age in Chinese and Japanese men and women, all values being slightly lower among the Japanese (Table 1b). Mean Caucasian values were higher than all Asian values. However if muscle mass was expressed as a percentage of weight, then Chinese and Japanese values were very similar, and also similar to Caucasian values (Table 1c), although a significant age-related decline was still observed.

For all age and ethnic groups, muscle strength was higher among men compared with women, and showed a decline with age. Excluding the Singapore cohort data, there were variations between Chinese and Japanese, as well as Chinese in different locations (Table 1d). All Asian values were lower than Caucasians. Similarly, walking speed differed between the cohorts, irrespective of ethnicity; Singaporean and Japanese cohorts had faster walking speeds than Chinese in Hong Kong and Beijing (Table 1e). All cohorts showed age-related decline, but the decline in mean values varied between cohorts. Overall walking speed values for Asians and Caucasians were similar. With respect to time for the chair stand, the best performance was observed in the Japanese cohort, while the Hong Kong Chinese and Malays and Indians showed the greatest decline in performance with age (Table 1f). No significant decline with age was observed among Beijing Chinese, Singapore Indian and Malaysian women. Performance for Caucasians was the poorest.

4. Discussion

This descriptive comparison of parameters used for the definition of sarcopenia shows considerable variations within Asian populations that do not fall into any particular pattern according to ethnicity (body size and shape presumably being underlying factors for ethnic difference), or geographic location. Furthermore, while many parameters show age-related decline, some cohorts exhibit greater decline than others, the extent again not following any pattern according to ethnicity or geographic location. These findings would be compatible with within Asian variations being explained by different body size and shape; lifestyle habits (nutrition and pattern of physical activity); cultural traditions such as sleeping and sitting on the floor or low lying furniture among Japanese, etc.; and differing prevalence of frailty with ageing populations. A further complication is that in considering cut-off values for ASM, a value less than 2SD from young adult mean values may be employed, and young adult mean values may also be influenced by lifestyle or early life course factors, such that lower young adult mean values may give rise to lower prevalence of sarcopenia in older adults if muscle mass is considered, as has been pointed out by Lau et al. [10].

The diversity of mean values, approach to diagnosis, and methods used in measurement is highlighted further in a group of papers on research on sarcopenia in Asia published recently as a supplement in *Geriatrics and Gerontology International* (2014, volume 14, supplement 1).

Nevertheless, Asian values for BMI, ASM/height^2, and grip strength were much lower compared with those for Caucasian populations reported in the UK HCS study. Similarly, the mean (SD) BMI for older Italians aged 60–69 was 27.0(3) for men and 26.6(3.8) for women, and for those aged 70–80, 27.1(3.4) for men and 25.6(3.7) for women [20]. The values for ASM/height^2 for the Italian cohort aged 60–69 were also higher, being 8.6(0.9) for men and 6.7(0.9) for women; and for age group 70–80, 8.5(0.9) for men and 6.4(0.8) for women. However, Asian values for walking speed are very similar to those for Caucasians: 0.9(0.1) for men and 0.9(0.2) for women in the UK cohort. On the other hand, physical performance measure as assessed using chair stand was the worst among Caucasian older people. It is uncertain whether the longer chair stand times may be related to the higher BMI for Caucasian older people or just reflect protocol differences between the studies. A point of note is that ASM/ht^2 significantly decline with age in both men and women after age 65 to the same extent, suggesting that achievement of a higher peak muscle mass may attenuate the impact of age-related muscle loss.

The implications for searching for a universal definition of sarcopenia that involves absolute measurements is that possibly one cut-off value for walking speed may be applicable to all ethnic groups and different geographic locations, while different cut-off values for muscle mass, strength and other physical performance measures may be needed. Cut-off values have been proposed recently by the AWGS consensus opinion [8]. The AWGS also recommends a cut-off value for walking speed of 0.8 m/sec. However the cut-off values for muscle mass and grip strength are lower: height-adjusted ASM being 7.0 kg/m^2 for men and 5.4 kg/m^2 for women using DEXA, and 7.0 kg/m^2 for men and 5.7 kg/m^2 for women using BIA; and for grip strength the cut-off values are 26 kg for men and 18 kg for women. The findings also raise the question of the use of ASM/weight being a more universally applicable measurement of muscle mass.

While cut-off values may be used for epidemiological comparisons of sarcopenia prevalence, the most important aspect is the relationship with incident lower extremity physical limitation. It could be argued that the definition should be based on outcomes from longitudinal studies, as had been proposed by Woo et al. with respect to ASM/height^2 [9]. Along similar lines, a new parameter has been proposed recently by the Foundation of the National Institutes of Health to define sarcopenia: the skeletal muscle function deficit which seeks to relate muscle mass, strength and function cut points to mobility limitation [21]. Exact values used may not be as important for intervention studies, since change in outcomes are being measured, so that the criteria would only be used for recruitment of participants for these trials.

It may be that walking speed alone may be used as a single indicator in future, which would be applicable to all population groups.

There are limitations in this descriptive study, since the characteristics of cohorts may be slightly different, although they are matched by gender and age groups. For example, the Japanese cohort excluded those with stroke, while the Hong Kong cohort did not. However, for the latter cohort the numbers with stroke were small, so that the mean values were not affected after participants with history of stroke were excluded. Furthermore, different instruments and protocols were used for measurement: the Japanese cohort used BIA while the Hong Kong Chinese cohort used DEXA. The grip strength instruments were different between cohorts, although this may improve in the future as a standardized approach to measurement has now been developed [22]. No standardizations were made. Only available data were used, and these were few. Nevertheless, this descriptive comparison is of interest in highlighting ethnic and cultural variations for some, but not all the parameters used in the definition of sarcopenia, such that for research and clinical care, appropriate classification should be used. Moreover, future studies may explore the underlying basis for variations in these parameters, and the utility of using a single parameter (walking speed) as a universal method for identification of sarcopenia in relating the syndrome to future adverse outcomes.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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ORIGINAL ARTICLE: EPIDEMIOLOGY, CLINICAL PRACTICE AND HEALTH

Comparison of frailty among Japanese, Brazilian Japanese descendants and Brazilian community-dwelling older women

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Aim: To investigate frailty in Japanese, Brazilian Japanese descendants and Brazilian older women.

Methods: The collected data included sociodemographic and health-related characteristics, and the frailty index Kihon Checklist. We analyzed the differences between the mean scores of Kihon Checklist domains (using ANCOVA) and the percentage of frail women (using χ^2-test). We carried out a binary logistic regression with Kihon Checklist domains.

Results: A total of 211 participants (Japanese $n = 84$, Brazilian Japanese descendants $n = 55$, Brazilian $n = 72$) participated in this research. The Brazilian participants had the highest total Kihon Checklist scores (more frail), whereas the Brazilian Japanese descendants had the lowest scores ($P < 0.001$). Furthermore, the Brazilian group had more participants with oral dysfunction ($P < 0.001$), seclusion ($P < 0.001$), cognitive impairment ($P < 0.001$) and depression ($P < 0.001$). They were more likely to be frail (OR 5.97, 95% CI 2.69–13.3, $P < 0.001$), to have oral dysfunction (OR 3.18, 95% CI 1.47–6.85, $P = 0.003$), seclusion (OR 9.15, 95% CI 3.53–23.7, $P < 0.001$), cognitive impairment (OR 3.87, 95% CI 1.93–7.75, $P < 0.001$) and depression (OR 6.63, 95% CI 2.74–16.0, $P < 0.001$) than the Japanese group.

Conclusions: The older Brazilian women were likely to be more frail than the participants in other groups. More than the environment itself, the lifestyle and sociodemographic conditions could affect the frailty of older Brazilian women. **Geriatr Gerontol Int 2014; ••: ••–••.**

Keywords: cross-cultural study, frailty, Kihon Checklist, older women.

Introduction

Because the aging process is a worldwide trend, frailty has become a global concern. In general, there are two predominant approaches to define frailty: (i) frailty is treated as a count of health impairments;[1,2] and (ii) the frailty phenotype is identified to detect people who find themselves between the independent and the dependent life stages.[3]

Several assessments have been developed to identify frail older adults, such as the "Kihon Checklist" (KCL) proposed by the Japanese Ministry of Health, Labor and Welfare that identifies vulnerable older adults as those who have a higher risk of becoming dependent[4,5] based on the needs of the Japanese long-term care insurance (LTCI) system.[6] The KCL showed a good concurrent validity against the Fried's criteria for evaluating frailty, in which the KCL had a sensitivity of 60% and a specificity of 86.4%.[7] Furthermore, another study verified that the risk groups detected by the KCL were associated with lower ADL, lower subjective quality of life scores and higher scores on the geriatric depression scale.[8]

Despite the global concern on frailty, the features of each country have not been adequately explored. Therefore, it is intriguing to analyze such differences from a cross-cultural perspective. In the present study, we compared Japan and Brazil because of the different ethnic and cultural backgrounds. Brazil is a Latin American country with a miscegenated population. It is the largest and the most populous country in South

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America, and has become South America's leading economic power by exploiting vast natural resources and by utilizing the large labor pool; where Japan is an Asian, modern and industrialized country with a homogeneous population. Despite the recent economic slowdown; it still remains a major economic power.[9] The link between both countries started when the Japanese immigrated to Brazil in 1908, generating a community of approximately 1.3 million people of Japanese descent in Brazil.[10] Thereon, many Japanese descendants have experienced a different lifestyle in Brazil. Because of the lack of evidence regarding frailty in Japanese immigrants, we hypothesized that the living environment and culture play an important role in the aging process and the development of frailty; thus, the present study aimed to investigate frailty in native Japanese, Brazilian Japanese descendants and native Brazilian older adults.

Methods

This was a cross-sectional observational study.

Participants

The inclusion criteria were women living in the community, aged 60 years or older and able to respond to the questionnaires. The participants who did not match these criteria or those who did not want to participate in the research procedures were excluded from the present study.

The Japanese participants were recruited in the western area of Japan through a local press advertisement that requested community-dwelling older female volunteers to collaborate in this research. The Brazilian and Brazilian Japanese descendant participants were recruited by municipal health units and by a recreational club that promotes Japanese culture in the south part of Brazil, chosen because of the large population of Japanese subjects present in the region. Furthermore, the total population (Japanese region with approximately 1 500 000 citizens and Brazilian region with approximately 1 800 000 citizens) and the economic pattern (based on industry and tourism) of both regions were similar.[11,12]

The older women received oral and written explanations about the research procedures. Participation in this study was voluntary, and all participants signed an informed consent form. We recruited the participants from April to November 2012, and conducted data collection from June to November 2012.

A total of 228 older women were recruited to participate in the present study; however, 17 participants were excluded from the analysis (Brazilian $n = 7$, Brazilian Japanese Descendants $n = 4$, Japanese $n = 6$) because of age lower than 60 years and poor responses in questionnaires. The resulting 211 participants who met the criteria for the study (Brazilian $n = 72$, mean age 69.0 ± 6.41 years; Brazilian Japanese descendants $n = 55$, mean age 70.8 ± 8.38 years; and Japanese $n = 84$; mean age 73.2 ± 4.21 years). The study protocol was approved by the university ethical committee where it was carried out (E-1575, E-1470).

Assessments

The participants answered a questionnaire regarding sociodemographic information, such as age, living arrangement, educational level and work status (worker, volunteer, retired); health-related characteristics, such as body mass index (BMI), use and number of medications, frequency of medical consultation in the past 6 months, hospitalization in the past year, self-rated health, life satisfaction and the frailty index KCL. The Japanese participants completed the original KCL version in the Japanese language, and the Brazilian and the Brazilian Japanese descendants completed the translated and validated KCL Brazilian Portuguese version.[13]

The KCL has 25 yes/no questions that are divided into the following domains: instrumental activities of daily living (IADL), physical strength, nutrition, eating, socialization, memory and mood. In the present study, we set the cut-off points based on our previous finding that determined the KCL cut-offs regarding an elevated risk for requiring LTCI service in community-dwelling older adults.[14] For the KCL total score (sum of the scores of all questions: 1–25), we used the cut-off of >6 points; in question number 12 (nutrition domain), we used the cut-off of BMI <20.5; and in the socialization domain, we used the cut-off as having one negative answer in question number 16 or question number 17 or more. To the best of our knowledge, there is no published cut-off point for the IADL domain; therefore, in the present study, we determined the cut-off point as a score higher than two points. For the other domains, the cut-off points remained the same, as scoring three points or more in the physical domain represents the clustering of physical inactivity; scoring two points in the nutrition domain indicates malnutrition; scoring two points or more in the oral domain suggests oral dysfunction; one point or more in the memory domain suggests cognitive impairment; and finally, scoring two points or more in the mood domain indicates depression.[4]

Statistical analysis

Regarding sociodemographic and health-related characteristics, we analyzed the differences of age, BMI, and number of medications among Brazilian, Brazilian Japanese descendants and Japanese using one-way ANOVA and the Tukey post-hoc test. For categorical variables, we used the χ^2-test. In the items that showed a significant difference ($P < 0.05$), we dichotomized the items and carried out a χ^2 analysis separately for each category. Additionally, we analyzed the differences of KCL domains (mean scores) among the three groups using ANCOVA adjusted by age.

We calculated the differences in the percentage of frail older women among the groups using the χ^2-test. Furthermore, we carried out a binary logistic regression analysis adjusted by age with each KCL domain as a dependent variable. The Japanese group was determined to be the reference group; for the total KCL score and for each domain, the robust condition was coded as 0 and frailty was coded as 1. Statistical significance was set at $P < 0.05$. All analyses were carried out using the Statistical Package for the Social Sciences (version 21.0; SPSS, IBM, Chicago, IL, USA).

Results

A total of 211 participants completed the research procedures (Brazilian $n = 72$; Brazilian Japanese descendants $n = 55$; Japanese $n = 84$). The Japanese were the oldest (mean age 73.2 ± 4.21 years), whereas the Brazilians were the youngest (mean age 69.0 ± 6.41 years; $P < 0.001$). There were differences in living arrangement ($P = 0.023$), educational level ($P < 0.001$) and work activity ($P < 0.001$) among the three groups. More Brazilian participants were living alone ($P = 0.029$), whereas more Japanese women were living with a partner ($P = 0.015$). Additionally, more than 50% of the Brazilian participants had received education at the elementary school level ($P < 0.001$), whereas the majority of the Japanese participants had finished high school ($P < 0.001$), and the majority of the Brazilian Japanese descendants had a university degree ($P < 0.001$). In terms of employment, a higher proportion of Brazilian and Brazilian Japanese descendants were retired compared with the Japanese women ($P = 0.042$), who were more engaged in informal work ($P < 0.001$; Table 1).

Regarding the health-related characteristics among the groups, there were differences in BMI ($P < 0.001$), number of medications ($P = 0.028$), frequency of medical consultation ($P < 0.001$) and life satisfaction ($P < 0.001$). The Brazilian participants had the highest BMI ($P < 0.001$) and took the greatest number of medications ($P = 0.028$), whereas the Japanese participants had the lowest BMI and took fewer medications. The Japanese women consulted a doctor more frequently ($P < 0.001$) and had a poorer life satisfaction ($P < 0.001$) than the other groups (Table 2).

We compared frailty among the three groups using the KCL (Japanese or Brazilian Portuguese version).

Table 1 Comparison of sociodemographic characteristics among Brazilian, Brazilian Japanese descendants and older Japanese women

Variables	Brazilian ($n = 72$)	Brazilian Japanese descendants ($n = 55$)	Japanese ($n = 84$)	P
Age (years)	69.0 ± 6.41†	70.8 ± 8.38	73.2 ± 4.21†	<0.001
Living arrangement				0.023
Alone	26.4 (19)	14.5 (8)	10.7 (9)	0.029
With partner	23.6 (17)	27.3 (15)	44.0 (37)	0.015
With child	25.0 (18)	27.3 (15)	17.9 (15)	0.369
With partner and child	15.3 (11)	23.6 (13)	13.1 (11)	0.246
Other	9.7 (7)	7.3 (4)	14.3 (12)	0.242
Educational level				<0.001
Elementary school	68.1 (49)	27.5 (14)	–	<0.001
Junior high school	13.9 (10)	17.6 (9)	28.6 (24)	0.053
High school	9.7 (7)	15.7 (8)	56.0 (47)	<0.001
Technical school	–	2.0 (1)	7.1 (6)	0.035
University	6.9 (5)	33.3 (17)	8.3 (7)	<0.001
Other	1.4 (1)	3.9 (2)	–	0.208
Work activity				<0.001
Formal work	6.2 (4)	13.7 (7)	1.4 (1)	0.016
Informal work	12.3 (8)	3.9 (2)	37.8 (28)	<0.001
Volunteer	9.2 (6)	9.8 (5)	5.4 (4)	0.551
Retirement	72.3 (47)	72.5 (37)	55.4 (41)	0.042

Values represent the mean ± standard deviation and valid percentage (n); $n = 211$. Tukey's post-hoc: †$P < 0.001$.

Table 2 Comparison of health-related characteristics among Brazilian, Brazilian Japanese descendants and older Japanese women

Variables	Brazilian (*n* = 72)	Brazilian Japanese descendants (*n* = 55)	Japanese (*n* = 84)	*P*
BMI (kg/m^2)	28.1 ± 5.39†‡	23.6 ± 2.50†	22.9 ± 2.84‡	<0.001
On medication	84.7 (61)	85.5 (47)	81.9 (68)	0.831
No. medications	2.9 ± 2.1§	2.7 ± 2.4	2.1 ± 1.5§	0.028
Consultations in 6 months				<0.001
None	17.4 (12)	9.3 (5)	14.5 (12)	0.462
1–2 times	50.7 (35)	61.1 (33)	18.1 (15)	<0.001
3–4 times	21.7 (15)	14.8 (8)	16.9 (14)	0.630
5–6 times	8.7 (6)	13 (7)	32.5 (27)	<0.001
7 times or more	1.4 (1)	1.9 (1)	18.1 (15)	<0.001
Hospitalization in 1 year	14.1 (10)	16.4 (9)	7.5 (6)	0.248
Self-rated health				0.467
Very good	11.1 (8)	20.0 (11)	17.1 (14)	
Good	33.3 (24)	34.5 (19)	35.4 (29)	
Normal	34.7 (25)	32.7 (18)	40.2 (33)	
Not so good	18.1 (13)	12.7 (7)	7.3 (6)	
Bad	1.4 (1)	–	–	
Life satisfaction				<0.001
Very satisfied	43.1 (31)	47.3 (26)	21.7 (18)	0.002
Satisfied	41.7 (30)	52.7 (29)	43.4 (36)	0.405
Normal	9.7 (7)	–	30.1 (25)	<0.001
A bit unsatisfied	5.6 (4)	–	3.6 (3)	0.220
Unsatisfied	–	–	1.2 (1)	0.468

Values represent the mean ± standard deviation and valid percentage (*n*); *n* = 211. Tukey's post-hoc: $^{†‡}P < 0.001$; $^{§}P = 0.027$.

Table 3 Comparison of Kihon Checklist scores by analysis of covariance adjusted by age among Brazilian, Brazilian Japanese descendants and Japanese women

Variables	Brazilian (*n* = 72)	Brazilian Japanese descendants (*n* = 55)	Japanese (*n* = 84)	*P*
Total KCL score	6.22 ± 3.83	3.22 ± 2.75	3.43 ± 2.72	<0.001
IADL domain	0.58 ± 0.84	0.29 ± 0.57	0.18 ± 0.50	<0.001
Physical strength domain	1.58 ± 1.15	1.11 ± 1.18	1.38 ± 1.24	0.047
Nutrition domain	0.35 ± 0.48	0.23 ± 0.47	0.40 ± 0.60	0.252
Eating domain	1.07 ± 0.98	0.51 ± 0.77	0.67 ± 0.90	0.001
Socialization domain	0.39 ± 0.52	0.18 ± 0.39	0.01 ± 0.28	<0.001
Memory domain	0.88 ± 0.84	0.51 ± 0.72	0.36 ± 0.61	<0.001
Mood domain	1.42 ± 1.62	0.40 ± 0.78	0.52 ± 0.93	<0.001

Values represent the mean ± standard deviation; *n* = 211. IADL, instrumental activities of daily living; KCL, Kihon Checklist.

The Brazilian participants had the highest total KCL scores (more frail), whereas the Brazilian Japanese descendants had the lowest scores ($P < 0.001$). Additionally, when we compared each domain adjusted by age, the Brazilian participants showed the poorest condition in IADL ($P < 0.001$), physical ($P = 0.047$), oral ($P = 0.001$), socialization ($P < 0.001$), cognitive ($P < 0.001$) and mood ($P < 0.001$) domains (Table 3).

Reviewing the results that identified frailty using our determined cut-off points, we observed that the Brazilian group had the higher prevalence of frail women according to their total KCL score ($P < 0.001$) compared with the other groups. Furthermore, this group also had more participants with oral dysfunction ($P < 0.001$), seclusion ($P < 0.001$), cognitive impairment ($P < 0.001$) and depression ($P < 0.001$). There were no significant

Table 4 Logistic regression analysis of frail condition among Japanese, Brazilian Japanese descendants and Brazilian participants using Kihon Checklist scores as dependent variables and nationality as covariate – adjusted by age

	Frailty % (*n*)	*P*	OR (95% CI)	*P*
Total KCL score (cut-off >6 points)		<0.001		
Japanese (reference for OR)	16.7 (14)		1	
Brazilian Japanese descendants	10.9 (6)		0.65 (0.23–1.84)	0.417
Brazilian	45.8 (33)		5.97 (2.69–13.3)	<0.001
IADL domain (cut-off >2 points)		0.194		
Japanese (reference for OR)	1.2 (1)		1	
Brazilian Japanese descendants	0		–	–
Brazilian	4.2 (3)		5.15 (0.51–52.2)	0.165
Physical strength domain		0.242		
Japanese (reference for OR)	21.4 (18)		1	
Brazilian Japanese descendants	10.9 (6)		0.44 (0.16–1.22)	0.114
Brazilian	20.8 (15)		0.95 (0.42–2.13)	0.892
Nutrition domain (cut-off BMI<20.5)		0.090		
Japanese (reference for OR)	6 (5)		1	
Brazilian Japanese descendants	1.9 (1)		0.22 (0.018–2.57)	0.226
Brazilian	0		–	
Eating domain		<0.001		
Japanese (reference for OR)	19 (16)		1	
Brazilian Japanese descendants	9.1 (5)		0.45 (0.15–1.33)	0.148
Brazilian	37.5 (27)		3.18 (1.47–6.85)	0.003
Socialization Domain (cut-off >1 point)		<0.001		
Japanese (reference for OR)	8.3 (7)		1	
Brazilian Japanese descendants	18.2 (10)		2.70 (0.95–7.73)	0.063
Brazilian	37.5 (27)		9.15 (3.53–23.7)	<0.001
Memory domain		<0.001		
Japanese (reference for OR)	29.8 (25)		1	
Brazilian Japanese descendants	38.2 (21)		1.49 (0.72–3.08)	0.279
Brazilian	61.1 (44)		3.87 (1.93–7.75)	<0.001
Mood domain		<0.001		
Japanese (reference for OR)	10.7 (9)			
Brazilian Japanese descendants	9.1 (5)		0.89 (0.28–2.83)	0.844
Brazilian	38.9 (28)		6.63 (2.74–16.0)	<0.001

Values represent percentage (*n*) and OR (95% CI); $n = 211$. BMI, body mass index; IADL, instrumental activities of daily living; KCL, Kihon Checklist.

differences regarding IADL performance, and physical and nutritional conditions among the groups (Table 4).

The results of the logistic regression confirmed that older Brazilian women were more inclined to be frail than Japanese women. The Brazilian participants were fivefold more likely to be frail (OR 5.97, 95% CI 2.69–13.3, $P < 0.001$), threefold more likely to have oral dysfunction (OR 3.18, 95% CI 1.47–6.85, $P = 0.003$), ninefold more likely to have seclusion (OR 9.15, 95% CI 3.53–23.7, $P < 0.001$), threefold more likely to have cognitive impairment (OR 3.87, 95% CI 1.93–7.75, $P < 0.001$) and sixfold more likely to have depression (OR 6.63, 95% CI 2.74–16.0, $P < 0.001$) than the older Japanese women. However, no difference was found between the Japanese and Brazilian Japanese descendants. No difference was found in terms of IADL, physical or nutritional domains among the groups (Table 4).

Discussion

In the present study, we observed a higher prevalence of frail participants in the Brazilian group ($P < 0.001$); and that older Brazilian women were more inclined to be frail than Japanese women (OR 5.97, 95% CI 2.87–13.3, $P < 0.001$). To the best of our knowledge, the present study is the first that compares frailty among Brazilian, Brazilian with Japanese genetic background and older Japanese women. To substantiate our