表 5　ペット飼育者による運動機能低下との関連

	ペット飼育者		
	飼育していない	家族飼育	本人飼育
運動機能低下あり[a], % (case/n)	31.3 (848/2,712)	36.7(80/218)	19.8(83/420)
Model 1 (あり/なし)	ref.	1.24 (0.90 - 1.70)	0.72 (0.55 - 0.94)
Model 2 (あり/なし)	ref.	1.23 (0.89 - 1.69)	0.70 (0.53 - 0.92)

Model 1:性・年齢を調整

Model 2:Model 1に加えて, 調査方法(郵送・訪問), 慢性疾患の有無, 運動制限の有無を調整

[a]運動機能関連5項目のうち, いずれか3項目以上に該当したものを「運動機能低下あり」とした.

表 6　ペット飼育者による【認知機能】関連項目該当者の割合

	全体 (n=3,350)	ペット飼育者			p値
		飼育していない (n=2,712)	家族飼育 (n=218)	本人飼育 (n=420)	
認知機能関連3項目, 人数(%)					
周りの人から「いつも同じことを聞く」などの物忘れがあると言われますか(はい)	619 (18.5)	484 (17.8)	54 (24.8)	81 (19.3)	0.036
自分で電話番号を調べて電話をかけることをしていますか(いいえ)	188 (5.6)	153 (5.6)	14 (6.4)	21 (5.0)	0.751
今日が何月何日か分からないときがありますか(はい)	618 (18.4)	494 (18.2)	51 (23.4)	73 (17.4)	0.138
認知機能低下あり[a], 人数(%)	1,057 (31.6)	843 (31.1)	79 (36.2)	135 (32.1)	0.278

離散量はχ^2検定を用いて検定した.

[a]認知関連3項目のうち, いずれか1項目以上に該当したものを「認知機能低下あり」とした.

表 7　ペット飼育者による【うつ】関連項目該当者の割合

	全体 (n=3,350)	ペット飼育者			p値
		飼育していない (n=2,712)	家族飼育 (n=218)	本人飼育 (n=420)	
うつ関連5項目, 人数(%)					
(ここ2週間)毎日の生活に充実感がない(はい)	428 (12.8)	351 (12.9)	26 (11.9)	51 (12.1)	0.835
(ここ2週間)これまで楽しんでやれていたことが楽しめなくなった(はい)	302 (9.0)	247 (9.1)	24 (11.0)	31 (7.4)	0.293
(ここ2週間)以前は楽にできていたことが今ではおっくうに感じられる(はい)	666 (19.9)	536 (19.8)	51 (23.4)	79 (18.8)	0.365
(ここ2週間)自分が役に立つ人間だと思えない(はい)	510 (15.2)	423 (15.6)	32 (14.7)	55 (13.1)	0.403
(ここ2週間)わけもなく疲れたような感じがする(はい)	783 (23.4)	636 (23.5)	57 (26.1)	90 (21.4)	0.400
うつ傾向あり[a], 人数(%)	704 (21.0)	571 (21.1)	54 (24.8)	79 (18.8)	0.214

離散量はχ^2検定を用いて検定した.

[a]うつ関連5項目のうち, いずれか2項目以上に該当したものを「うつ傾向あり」とした.

表８　ペット飼育者による【主観的健康感】該当の割合

	全体 (n=3,350)	ペット飼育者 飼育していない (n=2,712)	家族飼育 (n=218)	本人飼育 (n=420)	p値
主観的健康感, 人数(%)					0.005
とても健康	275 (8.2)	219 (8.1)	11 (5.0)	45 (10.7)	
まあまあ健康	2,336 (69.7)	1,886 (69.5)	144 (66.1)	306 (72.9)	
あまり健康でない	618 (18.4)	504 (18.6)	54 (24.8)	60 (14.3)	
健康でない	121 (3.6)	103 (3.8)	9 (4.1)	9 (2.1)	
良好な主観的健康感[a], 人数(%)	2,611 (77.9)	2,105 (77.6)	155 (71.1)	351 (83.6)	0.001

離散量はχ^2検定を用いて検定した.

[a]主観的健康感に関する問いに対して,「とても健康」もしくは「まあまあ健康」と回答した者を「良好な主観的健康感」とした.

表９　ペット飼育者による認知機能低下・うつ傾向あり・良好な主観的健康感との関連

	ペット飼育者		
	飼育していない	家族飼育	本人飼育
認知機能低下あり[a], %(case/n)	31.1 (843/2,712)	36.2 (79/218)	32.1 (135/420)
Model 1 (あり/なし)	ref.	1.23 (0.92 - 1.65)	1.17 (0.94 - 1.47)
Model 2 (あり/なし)	ref.	1.23 (0.92 - 1.65)	1.17 (0.93 - 1.46)
うつ傾向あり[b], %(case/n)	21.1 (571/2,712)	24.8 (54/218)	18.8 (79/420)
Model 1 (あり/なし)	ref.	1.20 (0.87 - 1.66)	1.01 (0.78 - 1.32)
Model 2 (あり/なし)	ref.	1.23 (0.88 - 1.72)	1.00 (0.76 - 1.31)
良好な主観的健康感[c], %(case/n)	77.6 (2,105/2,712)	71.1 (155/218)	83.6 (351/420)
Model 1 (良好/不良)	ref.	0.72 (0.53 - 0.98)	1.37 (1.04 - 1.81)
Model 2 (良好/不良)	ref.	0.72 (0.52 - 0.99)	1.43 (1.07 - 1.89)

Model 1:性・年齢を調整

Model 2:Model 1に加えて, 調査方法(郵送・訪問), 慢性疾患の有無, 運動制限の有無を調整

[a]認知関連3項目のうち, いずれか1項目以上に該当したものを「認知機能低下あり」とした.

[b]うつ関連5項目のうち, いずれか2項目以上に該当したものを「うつ傾向あり」とした.

[c]主観的健康感に関する問いに対して,「とても健康」もしくは「まあまあ健康」と回答した者を「良好な主観的健康感」とした.

表 10　ペット飼育者による【閉じこもり】関連項目該当者の割合

	全体 (n=3,350)	ペット飼育者 飼育していない (n=2,712)	家族飼育 (n=218)	本人飼育 (n=420)	p値
外出頻度関連2項目, 人数(%)					
週に1回以上は外出していますか(いいえ)	593 (17.7)	493 (18.2)	46 (21.1)	54 (12.9)	0.012
昨年と比べて外出の回数が減っていますか(はい)	974 (29.1)	806 (29.7)	73 (33.5)	95 (22.6)	0.004
閉じこもり傾向あり[a], 人数(%)	593 (17.7)	493 (18.2)	46 (21.1)	54 (12.9)	0.012

離散量はχ^2検定を用いて検定した.

[a]外出頻度関連2項目のうち, [週に1回以上は外出していますか]に該当したものを「閉じこもり傾向あり」とした.

表 11　ペット飼育者による【社会活動】関連項目該当者の割合

	全体 (n=3,350)	ペット飼育者 飼育していない (n=2,712)	家族飼育 (n=218)	本人飼育 (n=420)	p値
社会活動関連3項目, 人数(%)					
友人宅を訪問している	1,938 (57.9)	1,541 (56.8)	141 (64.7)	256 (61.0)	0.030
ボランティア活動をしている	725 (21.6)	563 (20.8)	41 (18.8)	121 (28.8)	0.001
地域活動(自治会、町内行事、老人クラブなど)へ参加している	2,261 (67.5)	1,799 (66.3)	150 (68.8)	312 (74.3)	0.005
活発な社会活動[a], 人数(%)	1,681 (50.2)	1,325 (48.9)	116 (53.2)	240 (57.1)	0.004

離散量はχ^2検定を用いて検定した.

[a]社会活動関連3項目のうち, いずれか2項目以上に該当したものを「活発な社会活動」とした.

表 12　ペット飼育者と閉じこもり傾向・活発な社会活動との関連

	ペット飼育者 飼育していない	家族飼育	本人飼育
閉じこもり傾向あり[a], %(case/n)	18.2 (493/2,712)	21.1 (46/218)	12.9 (54/420)
Model 1 (あり/なし)	ref.	1.15 (0.81 - 1.64)	0.85 (0.63 - 1.17)
Model 2 (あり/なし)	ref.	1.15 (0.81 - 1.64)	0.86 (0.63 - 1.17)
活発な社会活動[b], %(case/n)	48.9 (1,325/2,712)	53.2 (116/218)	57.1 (240/420)
Model 1 (活発/不活発)	ref.	1.21 (0.92 - 1.60)	1.33 (1.08 - 1.60)
Model 2 (活発/不活発)	ref.	1.22 (0.92 - 1.61)	1.33 (1.08 - 1.65)

Model 1:性・年齢を調整

Model 2:Model 1に加えて, 調査方法(郵送・訪問), 慢性疾患の有無, 運動制限の有無を調整

[a]外出頻度関連2項目のうち, [週に1回以上は外出していますか]に該当したものを「閉じこもり傾向あり」とした.

[b]社会活動関連3項目のうち, いずれか2項目以上に該当したものを「活発な社会活動」とした.

表 13　対象者を 70 歳以上・慢性疾患がある者・同居者ありの者に限定したペット飼育者と運動機能・主観的健康感・社会活動との関連：サブ解析

	ペット飼育者					
	飼育していない		家族飼育		本人飼育	
運動機能低下あり[a]						
（再掲）全体*	31.3% (848/2,712)	ref.	36.7% (80/218)	1.23 (0.89 - 1.69)	19.8% (83/420)	0.70 (0.53 - 0.92)
70歳以上*	36.0% (756/2,101)	ref.	42.9% (72/168)	1.22 (0.86 - 1.73)	23.3% (66/283)	0.66 (0.49 - 0.90)
慢性疾患あり*	36.0% (729/2,026)	ref.	40.5% (66/163)	1.12 (0.78 - 1.60)	23.1% (71/307)	0.67 (0.50 - 0.91)
同居者あり*	30.6% (726/2,369)	ref.	36.3% (78/215)	1.20 (0.86 - 1.66)	20.2% (77/381)	0.73 (0.55 - 0.98)
良好な主観的健康感[b]						
（再掲）全体*	77.6% (2,105/2,712)	ref.	71.1% (155/218)	0.72 (0.52 - 0.99)	83.6% (351/420)	1.43 (1.07 - 1.89)
70歳以上*	76.4% (1,606/2,102)	ref.	70.2% (118/168)	0.76 (0.53 - 1.08)	82.0% (232/283)	1.38 (0.99 - 1.91)
慢性疾患あり*	72.7% (1,472/2,026)	ref.	64.4% (105/163)	0.70 (0.50 - 0.99)	79.8% (245/307)	1.48 (1.10 - 2.00)
同居者あり*	77.2% (1,828/2,369)	ref.	70.7% (152/215)	0.73 (0.53 - 1.00)	84.0% (320/381)	1.51 (1.12 - 2.04)
活発な社会活動[c]						
（再掲）全体*	48.9% (1,325/2,712)	ref.	53.2% (116/218)	1.22 (0.92 - 1.61)	57.1% (240/420)	1.33 (1.08 - 1.65)
70歳以上*	48.7% (1,023/2,101)	ref.	56.0% (94/168)	1.41 (1.01 - 1.95)	58.0% (164/283)	1.33 (1.03 - 1.71)
慢性疾患あり*	48.3% (979/2,026)	ref.	52.8% (86/163)	1.15 (0.66 - 2.01)	55.7% (171/307)	1.49 (0.98 - 2.25)
同居者あり*	48.6% (1,152/2,369)	ref.	53.5% (115/215)	1.25 (0.94 - 1.66)	55.9% (213/381)	1.27 (1.02 - 1.58)

*性，年齢，調査方法（郵送・訪問），慢性疾患の有無，運動制限の有無を調整

[a]運動機能関連5項目のうち，いずれか3項目以上に該当したものを「運動機能低下あり」とした．

[b]主観的健康感に関する問いに対して，「とても健康」もしくは「まあまあ健康」と回答した者を「良好な主観的健康感」とした．

[c]社会活動関連3項目のうち，いずれか2項目以上に該当したものを「活発な社会活動」とした．

表 14　イヌの飼育者による運動機能低下との関連：サブ解析

	イヌの飼育者		
	飼育していない	イヌ以外のペット飼育	イヌ飼育
運動機能低下あり[a]，% (case/n)	31.3 (848/2,712)	24.8(83/334)	26.3(80/304)
Model 1（あり/なし）	ref.	0.85 (0.64 - 1.13)	0.94 (0.70 - 1.25)
Model 2（あり/なし）	ref.	0.82 (0.62 - 1.10)	0.93 (0.69 - 1.25)

Model 1:性・年齢を調整

Model 2:Model 1に加えて，調査方法（郵送・訪問），慢性疾患の有無，運動制限の有無を調整

[a]運動機能関連5項目のうち，いずれか3項目以上に該当したものを「運動機能低下あり」とした．

別紙４

研究成果の刊行に関する一覧表

書籍

著者氏名	論文タイトル名	書籍全体の編集者名	書　籍　名	出版社名	出版地	出版年	ページ
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山田実	フレイルで特に注目すべき身体機能	葛谷雅文・天海照祥	フレイル　超高齢社会における最重要課題と予防戦略	医歯薬出版	東京都	2014	121-126
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雑誌

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Yukutake T, Yamada M, Fukutani N, Nishiguchi S, Kayama H, Tanigawa T, Adachi D, Hotta T, Morino S, Tashiro Y, Aoyama T, Arai H	Arterial stiffness can predict cognitive decline in the Japanese community-dwelling elderly: A one year follow-up study	J Atheroscler Thromb			In Press
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Nishiguchi S, Yamada M, Fukutani N, Adachi D, Tashiro Y, Hotta T, Morino S, Aoyama T, Tsuboyama T.	Spot the Difference for Cognitive Decline: a quick memory and attention test for screening cognitive decline.	Journal of Clinical Gerontology and Geriatrics			In Press
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Original article

Spot the Difference for Cognitive Decline: A quick memory and attention test for screening cognitive decline

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ABSTRACT

Background: Dementia is currently one of the most common conditions in older adults, and early detection of cognitive decline is crucial for identifying dementia. We developed a new type of short-term memory and attention test that uses a spot-the-difference task: Spot the Difference for Cognitive Decline (SDCD). The purpose of the present study was to examine the accuracy of the SDCD test for the identification of cognitive impairment in community-dwelling older adults.
Methods: The participants were 443 Japanese community-dwelling older adults. The SDCD test uses two scenery pictures. Participants were instructed to memorize the details of the first picture for 30 seconds, after which the first picture was taken away and the second picture was shown. Next, the participants were asked to identify as many differences as possible between the first and second pictures, which were presented sequentially. The number of correct responses comprises the SDCD score (scores: 0–10). The Mini-Mental State Examination and Scenery Picture Memory Test were used to measure the participants' cognitive function. We used receiver-operating characteristic analysis to examine the power of the SDCD test and identify the optimal cutoff value of the SDCD score.
Results: Of the 443 participants, 30 (6.77%) had some cognitive impairment based on the Mini-Mental State Examination scores. Participants without cognitive impairment had higher SDCD scores than those with cognitive impairment ($p < 0.001$). The SDCD scores were significantly associated with the Mini-Mental State Examination ($r = 0.333$) and Scenery Picture Memory Test ($r = 0.402$) results. The receiver-operating characteristic curve used for the identification of cognitive impairment had a comparatively high area under the curve (0.798) for the SDCD score with a cutoff value of 1/2 (with >1 being normal; sensitivity: 70.5%; and specificity: 80.0%).
Conclusion: The present study found that the SDCD test could be an effective clinical tool for the identification of cognitive impairment in older adults.

1. Introduction

Dementia can drastically influence one's daily life and is currently one of the most common conditions in older adults. Dementia affects 5–8% of the population over 65 years of age[1] and up to 30% of the people aged ≥85 years.[2] Currently, the number of people with dementia is increasing. It has been estimated that approximately 48% of the patients with Alzheimer's disease (AD), the most common form of dementia, live in Asia, and this percentage is projected to grow to 59% by 2050.[3] Dementia and AD have been associated with mortality[4]; therefore, prevention and early detection of cognitive decline are crucial.

The presence of cognitive decline increases the risk of progression to mild cognitive impairment (MCI) and AD.[5,6] It is generally agreed that older adults with early AD, compared to healthy older adults, exhibit a greater decline in memory function[7] and working memory[8] than in other major domains of cognitive function._ENREF_7 A central feature of AD is the decline in episodic memory.[9] Visual memory, which is included in episodic memory, is

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an important component of daily life. There are several well-established visual memory tests, such as the Benton Visual Retention Test[10] and the Rey–Osterrieth Complex Figure Test,[11] that can be used to assess nonverbal visual memory. However, these tests are not reflective of situations and activities encountered in daily life, are time consuming, and have complex scoring systems.

Deficits in working memory functions (e.g., attention and executive function) caused by AD are thought to contribute to a range of significant problems such as impairments in performing everyday tasks (e.g., keeping track of conversations, walking while talking, and packing a bag). Thus, the attentional function would appear to be important for the early detection of cognitive decline, as this function decreases with the progression of cognitive decline.[12]

We developed a new short-term visual memory and attention test called the Spot the Difference for Cognitive Decline (SDCD) test. The SDCD test is a brief and simple test that uses pictures of familiar-looking sceneries. Examinees are asked to find the differences between two scenery pictures. This test can be used in clinical or community-based settings with a large population. In a previous study, it was reported that poor visual memory predicts the onset/progression of dementia.[13] The spot-the-difference task has been used as a cognitive test in previous studies,[14–16] although its usefulness for detecting cognitive impairment had not been described. These spot-the-difference tasks have often been used in memory function training for older adults with dementia in many countries, including Japan. However, the effects of this training have not been examined empirically. We hypothesized that the SDCD score would be associated with cognitive function, and this test would be able to identify community-dwelling older adults with cognitive impairment. The purpose of the present study, therefore, was to examine the accuracy of the SDCD test for the identification of cognitive impairment in community-dwelling older adults.

2. Methods

2.1. Participants

Participants for this study were recruited through advertisements in the local newspaper. A total of 443 Japanese people aged ≥65 years (mean age, 73.1 ± 5.3 years) responded. We included only community-dwelling older adults who were able to perform their activities of daily living independently. A screening interview was conducted to exclude participants with severe cardiac, pulmonary, or musculoskeletal disorders, as well as those using medications that affect attention (e.g., psychoactive drugs or drugs prescribed for sleep). Written informed consent was obtained from each participant in accordance with the guidelines of the Kyoto University Graduate School of Medicine, Kyoto, Japan and the Declaration of Helsinki, 1975. The study protocol was approved by the Ethics Committee of the Kyoto University Graduate School of Medicine.

2.2. SDCD test protocol

The SDCD test uses two scenery pictures (Figs. 1 and 2) on A4 size papers. Fig. 1 is called the "first picture" and Fig. 2 the "second picture." There are 10 differences between the two pictures: the shape of the chimney smoke, shape of the doorknob, height of the fountain, shape of the mountain (seen between the house and the fountain), number of fruits on the tree, direction that the dog on the right is facing, shape of the leftmost flower, shape of the child's mouth, presence of a bird versus a butterfly, and presence of the father's backpack. First, the examinees are instructed to memorize

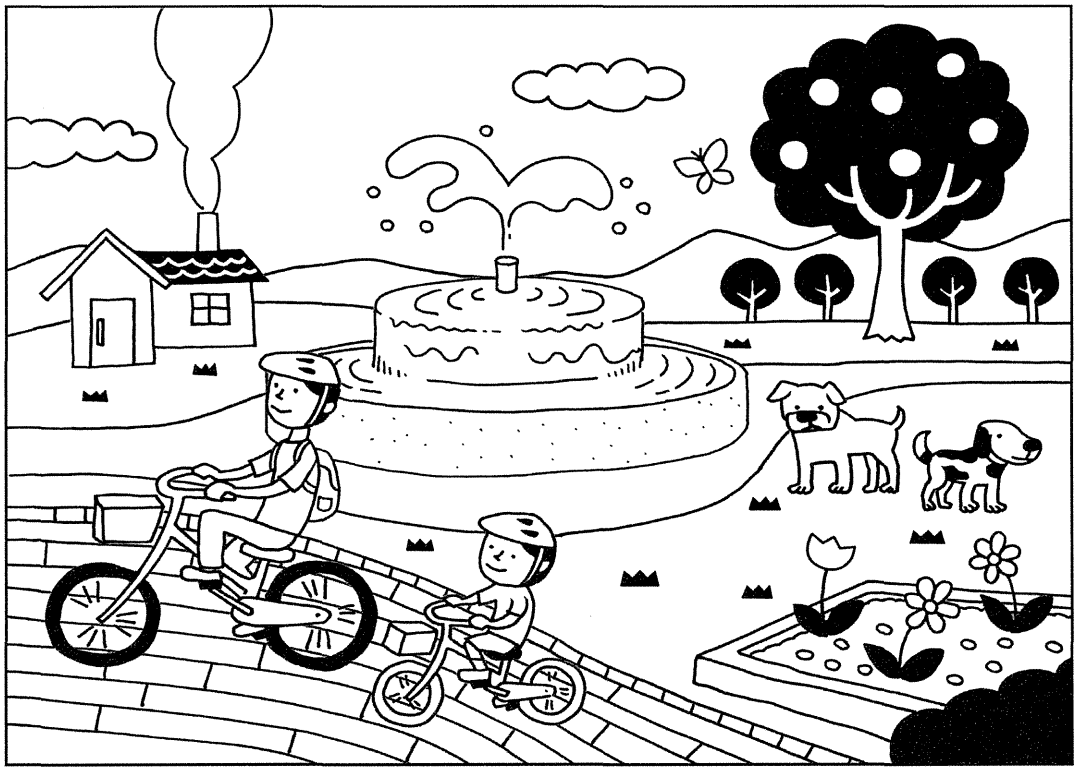

Fig. 1. First picture used in the Spot the Difference for Cognitive Decline test. The examinees were instructed to memorize the details of the picture, which was presented for 30 seconds.

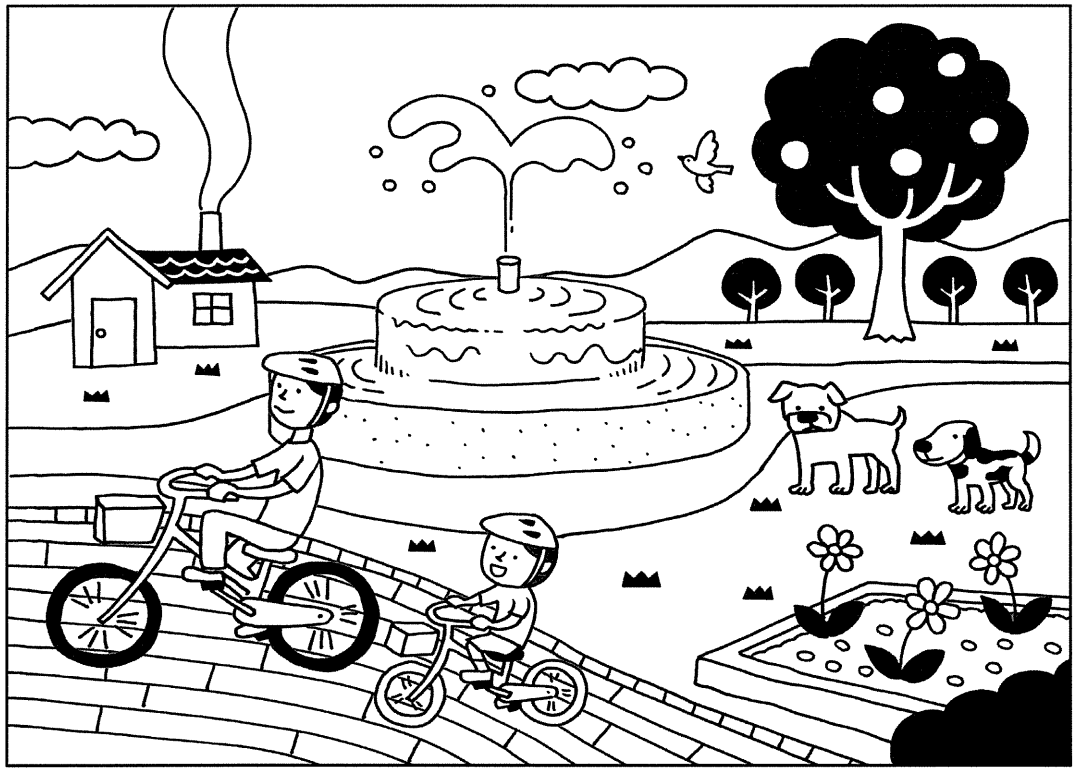

Fig. 2. Second picture in the Spot the Difference for Cognitive Decline test. This picture has 10 differences when compared with the first picture (Fig. 1). After studying the first picture for 30 seconds, the examinees were asked to find as many of the differences between the first and second pictures as they could within 1 minute.

the details of the first picture for 30 seconds. They are also told that there are "some" differences between the first and second pictures. The examiners do not inform the participants that there are 10 differences in total. After showing the first picture, the examiner takes the first picture away and shows the participants the second picture. The examinees are then asked to find the differences in the second picture, within 1 minute and without any hints. The number of the correct answers is then counted to determine the SDCD score. If the examinees' answers are close but not exactly correct (e.g., a flower type or increase in the fruit), these answers are marked as incorrect and not included in the SDCD score. In a sample of 21 participants, the SDCD had a high test–retest reliability [intertrial correlation coefficient (ICC) = 0.801; $p < 0.001$] between the two measurements with a 1-week interval.

2.3. Cognitive function

Participants' cognitive function was measured by two neuropsychological tests: the Mini-Mental State Examination (MMSE)[17] and the Scenery Picture Memory Test (SPMT).[18]

Global cognitive function was assessed using the MMSE, a standard test used in cognitive aging research for assessing mental status. Five areas of cognitive function—orientation, registration, attention and calculation, recall, and language—are tested. It has 11 questions in total and a maximum possible score of 30.

The SPMT is a simple memory test that assesses visual memory combined with verbal responses. This test uses a line drawing of a living room in a house on an A4-size paper, depicting 23 objects that are commonly observed in daily life. The examinee is instructed to look at the picture for 1 minute and remember the items. After this encoding period, participants are given a distractor task (a brief forward digit-span test). Participants are then asked to recall the objects in the picture without a time limit. Recall of the items usually takes approximately 2 minutes. The number of items recalled is the SPMT score. Higher scores indicate a better cognitive function.

2.4. Statistical analysis

We divided the participants into two groups (normal and cognitive impairment groups) based on the cutoff score of the MMSE (23/24). Differences between these two groups were statistically analyzed, using the unpaired t test for continuous variables and the χ^2 test for categorical variables. Differences between the SPMT and SDCD scores were examined using an analysis of variance. When a significant effect was found, the Tukey–Kramer *post hoc* test was used to examine the differences. In addition, the criterion-related validity was determined by evaluating the correlation between the SDCD score and the two neuropsychological tests using Spearman's rank correlation coefficient. Following this, we performed a multiple logistic regression analysis to determine whether the SDCD score was associated with cognitive impairment independently. For this analysis, the two groups (i.e., the normal group and the cognitive impairment group) were the dependent variables, and the SDCD score was the independent variable. We controlled age, gender, body mass index, medications, and the length of education. Furthermore, a receiver-operating characteristic (ROC) analysis was used to examine the power of the SDCD score and determine the optimal cutoff value of the SDCD score as a state variable. The area under the curve, sensitivity, and specificity of the SDCD score were calculated based on the ROC curve. The cutoff value for the SDCD score was determined based on the optimal sensitivity and specificity. Consequently, we performed a univariate logistic regression analysis to determine the correlation

between the SDCD and the five subtests of the MMSE (orientation, registration, attention and calculation, recall, and language). For this analysis, the groups formed on the basis of the cutoff value of the SDCD were the dependent variables and each subtest of the MMSE was the independent variable.

Data were analyzed using SPSS Statistics for Windows, version 20.0 (SPSS Inc., Chicago, IL, USA). A p value of <0.05 was considered statistically significant.

3. Results

Of the 443 participants, 30 (6.77%) were identified as having cognitive impairment based on an MMSE cutoff score of 23/24. Demographic characteristics of the participants are shown in Table 1. The normal group had a higher SDCD score (2.21 ± 1.38) than the cognitive impairment group (0.77 ± 0.86; $p < 0.001$). The normal group also had a higher SPMT score than the cognitive impairment group ($p < 0.001$). The education level of the normal group was also higher than that of the cognitive impairment group ($p = 0.002$). There were no significant differences in age, gender, body mass index, or the use of medication between the two groups.

The participants were reclassified into five groups according to their SDCD scores; differences in the MMSE and SPMT scores between the groups are shown in Figs. 3 and 4. There were significant differences in the MMSE scores ($F = 15.7$, $p < 0.001$) as well as in the SPMT scores ($F = 22.6$, $p < 0.001$) between the five groups. Results of the *post hoc* tests are shown in Figs. 3 and 4. In addition, the SDCD scores were moderately and positively correlated with the MMSE ($r = 0.333$) and SPMT ($r = 0.402$) scores ($p < 0.001$). These analyses indicated that a higher SDCD score was associated with higher cognitive function. In the logistic regression analysis, the SDCD score was significantly associated with cognitive impairment after adjusting for age, gender, body mass index, medications, and the length of education (odds ratio: 0.388; 95% confidence interval: 0.257–0.584; $p < 0.001$).

The ROC curve for the SDCD scores used for the identification of cognitive impairment was based on the MMSE cutoff score (23/24). The area under the curve was comparatively high for the SDCD scores (0.798, $p < 0.001$), and the cutoff value of the SDCD score was 1/2 (with ≥1 being considered normal) with a 70.5% sensitivity and 80.0% specificity. A univariate logistic regression analysis showed that there were significant correlations between the SDCD scores and the four subtests of the MMSE ($p < 0.05$), except for the registration subtest (refer to Table 2).

Table 1
Characteristics of participants with and without cognitive impairment.[a]

	Normal ($n = 413$, MMSE ≥ 24, 27.4 ± 2.0)	Cognitive impairment ($n = 30$, MMSE < 24, 22.4 ± 1.1)	p
Age, y	72.9 ± 5.3	74.4 ± 5.3	0.160
Female	269 (65.3%)	20 (66.7%)	> 0.99
BMI, kg/m^2	22.7 ± 3.1	22.2 ± 2.8	0.384
Number of medications taken, n	2.53 ± 2.59	2.48 ± 2.46	0.237
Education			0.002**
<6 y	3 (0.7%)	0	
6–9 y	98 (23.7%)	17 (56.7%)	
10–12 y	212 (51.3%)	10 (33.3%)	
>12 y	100 (24.2%)	3 (10.0%)	
SDCD	2.21 ± 1.38	0.77 ± 0.86	<0.001**
SPMT	13.8 ± 3.5	10.1 ± 2.8	<0.001**

Data are presented as n (%) or mean ± SD.
* $p < 0.05$.
** $p < 0.01$.
BMI = body mass index; MMSE = Mini-Mental State Examination; SDCD = Spot the Difference for Cognitive Decline; SPMT = Scenery Picture Memory Test.
[a] Normal and cognitive impairment groups were defined according to the MMSE cutoff score of 23/24.

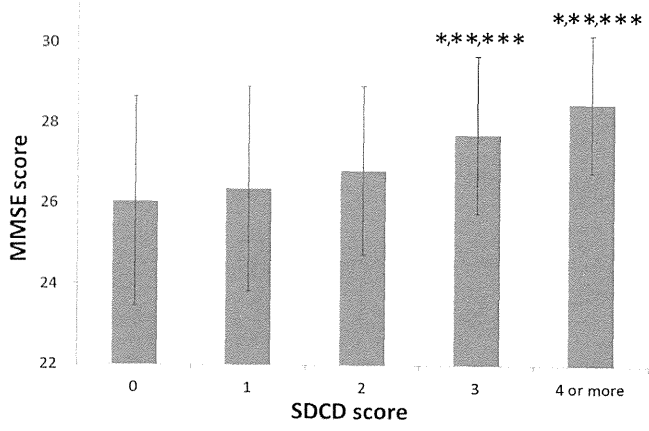

Fig. 3. Comparison of the MMSE scores between the groups formed based on the SDCD scores. There were significant differences in the MMSE scores across the five groups ($F = 15.7$, $p < 0.001$). * Significant difference from Group 0. ** Significant difference from Group 1. *** Significant difference from Group 2. MMSE = Mini-Mental State Examination; SDCD = Spot the Difference for Cognitive Decline.

4. Discussion

We examined a new type of short-term memory and attention test, the SDCD, which used a spot-the-difference task to identify cognitive impairment. In the present study, we showed that the SDCD test is a very quick and reliable screening tool for the identification of cognitive impairment in community-dwelling older adults.

The SDCD test is moderately and positively correlated with global cognitive and memory functions. The SDCD test includes a "memory" phase and a "recall and name the differences" phase. These phases require not only memory functions, but also other cognitive functions, such as attention. Some studies in the past have used similar spot-the-difference tasks as cognitive tests,[14,15] and only one previous study[16] has investigated brain activation in a test

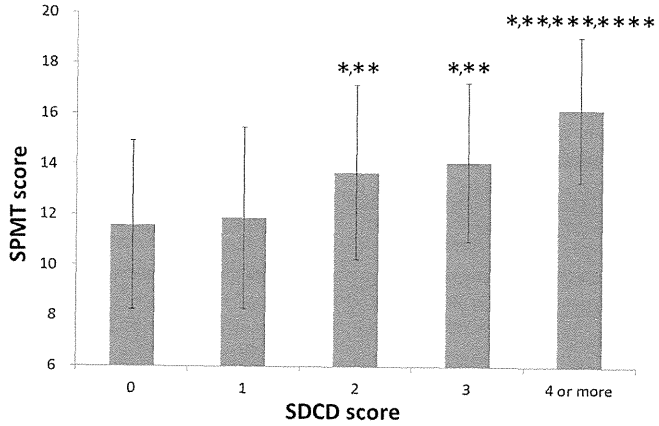

Figure 4. Comparison of the SPMT results between the groups formed based on the SDCD scores. There were significant differences in the MMSE scores across the groups ($F = 22.6$, $p < 0.001$). * Significant difference from Group 0. ** Significant difference from Group 1. *** Significant difference from Group 2. **** Significant difference from Group 3. MMSE = Mini-Mental State Examination; SDCD = Spot the Difference for Cognitive Decline; SPMT = Scenery Picture Memory Test.

Table 2
Correlation between SDCD score and subtests of MMSE.[a]

Subtests (total score)	Subtest score	SDCD score < 2 (n = 146) n (%)	OR (95% CI)
Orientation (10)	≤8	20 (13.7)	Reference
	9	30 (20.5)	0.26 (0.11–0.62)**
	10	96 (65.8)	0.21 (0.10–0.46)**
Registration (3)	≤2	4 (2.7)	Reference
	3	142 (97.3)	0.61 (0.16–2.30)
Attention and calculation (5)	≤2	69 (47.3)	Reference
	3	10 (6.8)	1.10 (0.47–2.59)
	4	18 (12.3)	1.19 (0.61–2.34)
	5	49 (33.6)	0.57 (0.36–0.88)*
Recall (3)	≤1	22 (15.1)	Reference
	2	51 (34.9)	0.21 (0.09–0.50)**
	3	73 (50.0)	0.13 (0.06–0.31)**
Language (9)	≤7	14 (9.6)	Reference
	8	38 (26.0)	0.18 (0.06–0.59)**
	9	94 (64.4)	0.12 (0.04–0.36)**

* $p < 0.05$.
** $p < 0.01$.
CI = confidence interval; MMSE = Mini-Mental State Examination; OR = odds ratio; SDCD = Spot the Difference for Cognitive Decline.
[a] For each univariate logistic regression analysis, SDCD scores <2 or ≥2 were the dependent variables and each subtest of the MMSE was the independent variable.

using a spot-the-difference task. Although the abovementioned test did not include a memory phase (unlike that included in the SDCD test), the results indicated that the brain areas related to visual information and attention was activated while carrying out the task. Our results indicated that the SDCD was associated with most of the subtests of the MMSE. Thus, the SDCD test appears to be associated not only with attention and memory, but also with global cognitive function. We need to minutely assess and investigate other cognitive functions (e.g., executive function and processing speed) and their association with the SDCD test in future studies.

The ROC curve for the SDCD score indicated that the SDCD test identified cognitive impairment with a high degree of accuracy. Previous studies have reported that some picture-based memory tests can reliably detect dementia.[18–20] These studies support the results of the present study. Moreover, the SDCD test is able to detect dementia in less time compared to other tests studied previously. Picture-based memory tests have some advantages over verbal memory tests. First, pictures are remembered better than words, a phenomenon known as the "picture superiority effect."[21] Previous studies showed that superiority of memory for pictorial material was often applied as a mnemonic aid for older adults.[22,23]_ENREF_17. Second, picture-based memory tests are not limited by the patient's level of education. Some verbal memory tests cannot be used for a population that has a low level of education.[19] Most of the verbal-based screening measures have not been validated in people with low education levels or illiterate individuals,[24,25] and it has been shown in previous studies that a low level of education can result in cognitively unimpaired people screening positive for dementia.[24] Furthermore, the SDCD test takes only approximately 2 minutes to assess short-term memory and attention functioning, in addition to its abovementioned merits. In the present study, the participants took approximately 10 minutes and approximately 5 minutes to complete the MMSE and the SPMT, respectively. The SDCD test appears as an easy game for patients, because of the simplicity of the differences, but it is actually quite a difficult cognitive task. It is possible that this characteristic makes the SDCD test fun for the participants to complete, thereby making its widespread use possible. Thus, we believe that the SDCD test can be used to identify cognitive impairment in older adults in a clinical or community-based setting.

The present study has several limitations. First, although we assessed global cognitive and memory functions with the MMSE and the SPMT, other cognitive functions, such as executive functions and processing speed, were not assessed in this study. We need to assess these cognitive functions and investigate their association with the SDCD test in future studies. Second, participants in the present study were community-dwelling older adults who had not received a diagnosis of dementia or MCI, and we did not confirm the test–retest reliability for older adults with dementia or MCI. In the future, we need to include older adults diagnosed with dementia to ascertain whether the SDCD test can discriminate between normal cognitive function and MCI in older adults.

5. Conclusion

We developed a new type of short-term memory and attention test that uses a spot-the-difference task for the identification of cognitive impairment. The present study indicates that the SDCD test can be an effective clinical tool for the identification of cognitive impairment in older adults.

Conflicts of interest

The authors declare no conflicts of interest.

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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: $^{\dagger\ddagger}P < 0.001$; $^{\S}P = 0.027$.

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