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Research article

Relationship between pulmonary function, throw distance, and psychological competitive ability of elite highly trained Japanese boccia players via correlation analysis

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ABSTRACT

Background: Boccia players have severe quadriplegia; nonetheless, detailed aspects of the physical function of individual players have not been evaluated.
Aims: This study aimed to detetmine the relationship between pulmonary function, pitching distance, and psychological competitive ability of Japanese boccia players.
Methods: Participants were athletes from the Japan Boccia Association (10 males, 3 females; average age, 32.9 ± 12.0 years) who could independently perform pitching motions. We measured pulmonary function, respiratory muscle force, and diaphragm movement using ultrasonography, pitching distance, and psychological competitive ability.
Outcomes and results: In all participants, pulmonary function, respiratory muscle force, and diaphragm displacement were low, whereas respiratory function was very low compared to the normal range (i.e., the value calculated from the subjects' height, weight, and age). However, boccia players with high level of competitive ability performed well.
Conclusions and implications: The results raise the question as to whether focusing on the development of boccia players' competitive ability and physical function will improve their overall performance. This question warrants future investigation.

What this paper adds?

Respiratory muscles are involved not only in respiration but also in the maintenance of the trunk. In this study, respiratory function, pitching distance, and psychological competitive ability of highly trained elite boccia athletes were evaluated. With respect to respiratory function, the normal vital capacity value is 4–5 L for men and 3–4 L for women. However, in this study, no participants were within the normal range, and 11 out of 13 participants were considered to have restrictive ventilatory disorders. In all participants, pulmonary function, respiratory muscle force, and diaphragm displacement were low, whereas respiratory function was very low. We believe that by focusing on the competitive ability of boccia players and further evaluating their physical function, improvements in overall performance can be achieved.

1. Introduction

Boccia is a target sport in which individuals with severe quadriplegia, mainly cerebral palsy and upper cervical spinal cord injury, can participate. The aim of boccia is to place colored balls (six red balls and six blue balls) as close as possible to a white target ball called a Jack. Since 1988, boccia has been an official event at the Paralympic Games. In the game, players are classified into classes (BC1 to BC4) according to their degree of disability. Only athletes with severe extremity disorders (such as spasticity, ataxia, and athetosis) can participate in the official competition (Boccia International Sports Federation, 2017).

BC 1–2 players have encephalitic disorders and BC 1 players are those who play with their hands or feet, with poor trunk balance. These players have a higher dysfunction level than BC 2 players who can throw on their own and have good trunk control. Unlike BC 2 players, BC 1 players can employ a competition assistant to assist them with the game. BC 3 is the

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most severe class of players and these players cannot throw by themselves. These are players with severe dysfunction of the limb/trunk due to lesions other than neurogenic ones. Therefore, it is necessary for these players to use assistive tools, such as ramps, and to receive support from a competition assistant. Furthermore, BC 4 players have a major neuromuscular disease, such as cervical spinal cord injury, severe dysfunction of the limb/trunk due to some lesion other than brain neuropathy, muscular dystrophy, or multiple sclerosis (Boccia International Sports Federation, 2017).

At the Rio de Janeiro Paralympic Games in 2016, Japanese athletes won the first silver medal in the Boccia Sports Organization Battle (BC 1/BC 2 mixed), and these athletes are expected to win medals at the Tokyo Olympics and Paralympic Games in 2020. Further improvement in the competitiveness and performance of players is required to win medals. However, because participants in the boccia competition have severe quadriplegia, with conditions such as cerebral palsy, cervical spinal cord injury, and muscular dystrophy, improving their physical function through training is exceedingly difficult from a functional and medical perspective. The scope for strenuous exercises during training for these players is limited; accordingly, it is not possible to apply a program similar to the reinforcement training undertaken by healthy athletes in this population.

Until now, boccia players have improved their accuracy by repeated pitching, improving tactics and creativity, and improving competitive performance rather than by enhancing physical function. However, in recent years, boccia has developed such that strongly and quickly throwing the opponent's ball further away from the Jack has become as important as placing one's own ball close to the Jack. The stability of the trunk, which is the basis for generating power as well as for the functioning of the upper limbs, determines the distance achieved when throwing a ball. Rule changes in 2013 concerning the flatness of the ball have placed emphasis not only on control but also on power. There is a need to incorporate training that takes into consideration power enhancement; however, there are currently no detailed evaluations of the physical function of individual players to measure whether training is effective and efficient. Additionally, there are no reports on whether training is safe. Therefore, the authors chose to evaluate the physical function of boccia athletes considering various factors, such as breathing and psychological factors in addition to exercise, with a view to implementing a more effective training regimen in the future.

Patients with cerebral palsy, who are the main players of boccia, are generally classified as having restrictive ventilatory disorders on pulmonary function tests (Seddon and Khan, 2003; Strauss et al., 1999). One study on the pulmonary function of spastic children, in which spirometry was used to measure vital capacity (VC), reported that reduction in VC was larger in spastic children than in children with hemiplegia and healthy children (Kwon and Lee, 2013).

Reduction in VC does not result from changes in pulmonary parenchyma, but from restriction in the movement of the thorax and diaphragm because of spastic muscle tone, muscle weakness, and respiratory muscle incoordination (Rothman, 1978). Expansion of the chest wall may affect pulmonary function (Ersöz et al., 2006). There are specific rhythm abnormalities and irregularities in the respiratory pattern of patients with cerebral palsy at rest (Hardy, 1964). Given this information, boccia players are expected to have not only physical but also respiratory challenges; however, no detailed research on pulmonary function in these athletes has been published.

Along with physical fitness and skill, psychological factors have a great influence on performance in sports, but are less commonly measured and reported (Junge, 2000; Steffen et al., 2009). Accordingly, we hypothesized that not only physical ability but also pulmonary function and psychological ability are necessary for improving competitive skills.

Therefore, this study aimed to evaluate the pulmonary function, psychological competitive ability, and pitching distance of elite players from the Japan Boccia Association to provide useful information for the development of future training programs for these athletes.

2. Material and methods

This study was conducted in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki). After obtaining approval from our Institutional Ethics Committee (approval no. 29-9), the purpose and content of this prospective cohort study and the method of personal information management were explained to all participants. This is a cross-sectional study. All participants provided written informed consent. Participants were highly conditioned, elite athletes belonging to the Japan Boccia Association. The 13 participants (10 males, 3 females; average age, 32.9 ± 12.0 years) were placed in BC 1, 2, and 4. No player from BC 3 was included in the analysis as these players cannot throw by themselves. All included players could perform pitching action on their own, including eight patients with cerebral palsy, two with cervical spinal cord injury, two with muscular dystrophy, and one with bipolar spine (Table 1).

2.1. Pulmonary function

Respiratory function was evaluated using an electronic spirometer (AS-507; MINATO Medical Science Co., Ltd., Osaka, Japan), and 20 items were measured including VC, %VC, forced expiratory volume in 1 s (FEV_1), and forced expiratory volume in 1 s percent ($FEV_{1.0\%}$). A

Table 1. Characteristics of participants.

Participant	Age (years)	Height (cm)	Weight (kg)	BMI (kg/m^2)	Sex	Diagnosis
A	35	165	40	14.69	Male	Cerebral palsy
B	32	158	62	24.84	Male	Cerebral palsy
C	44	147	42	19.44	Female	Cerebral palsy
D	22	156	48	19.72	Male	Cerebral palsy
E	47	165	58	21.30	Male	Cerebral palsy
F	54	140	35	17.86	Female	Cerebral palsy
G	44	160	58	22.66	Female	Cerebral palsy
H	21	159	48	18.99	Male	Cerebral palsy
I	26	180	79	24.38	Male	Cervical spinal cord injury
J	38	177	68	21.71	Male	Cervical spinal cord injury
K	16	157	54	21.91	Male	Muscular dystrophy
L	31	158	34	13.62	Male	Muscular dystrophy
M	18	157	47	19.07	Male	Spina bifida

BMI, body mass index.

respiratory muscle strength meter (AAM 377; MINATO) was attached to the electronic spirometer and the respiratory muscle strength was measured. Respiratory muscle strength was classified according to the method described by Black et al. (Black and Hyatt, 1969). Measurements of respiratory muscle power—maximum inspiratory pressure (Pl_{max}) at residual volume and maximum expiratory pressure (PE_{max}) at total lung volume—were performed in sets of four in a sitting position. Respiratory muscle strength was maintained for at least 1.5 s and measured three times, and the highest value was used in the analysis (Aizawa and Kudou, 2007).

Diaphragm thickness was measured using ultrasonography (ARIETTA Prologue; Hitachi, Ltd., Tokyo, Japan) with a linear probe in the B mode. The measurement positions were the 8th–10th intercostal spaces on the right axillary line, and diaphragm thickness at the zone of apposition (origin of the diaphragm contacting the chest wall) was measured. The measurements included diaphragm thickness and movement during resting inspiration, resting expiration, maximal inspiration, and maximal expiration.

Lung age is an index of lung function that is easy to understand. It is obtained via a formula based on FEV_1 measured by a pulmonary function test. The lung age of a male can be calculated with the following formula: $(0.036 \times \text{height (cm)} - 1.178 - FEV_1(L))/0.028$, and the lung age of a female with: $(0.022 \times \text{height (cm)} - 0.005 - FEV_1(L))/0.022$ (Aizawa, 2008; Tokunaga, 1999).

2.2. Psychological competitive ability

The Diagnostic Inventory of Psychological-Competitive Ability for Athletes (DIPCA.3) was used to evaluate psychological aspects (Morris and Temple, 1985; Tokunaga, 2004a, 2004b). DIPCA.3 is a self-evaluation questionnaire developed to evaluate the psychological state in sports competition, with questions regarding statements such as "The more major games I'm in, the greater fighting spirit I have," "I can put up with a tough game even in a difficult situation," and "However painful a scene is, it can be judged calmly". There are 52 items in total, including four "lie scale" items that judge the reliability of answers. If the lie scale score is 12 or less, reliability is poor. Participants were asked to respond to each question on a five-point scale ranging from "It is always the case" (5) to "It is almost never the case" (1). There are 12 categories (Patience, Aggressiveness, Volition for self-realization, Volition for winning, Self-control, Ability to relax, Concentration, Confidence, Decision, Predictive ability, Judgment, and Cooperation). Each category is evaluated with a full score of 20 points, with a possible maximum score of 240 points in total.

2.3. Pitching distance

The distance at which the ball was thrown was also measured and the average value of three throws was used for the analysis.

For statistical analysis, SPSS for Windows version 20.0 (IBM Corp., Armonk, NY, USA) was used. The Pearson correlation coefficient was used to determine whether there was a correlation among respiratory function, throwing distance, and psychological function. The level of statistical significance was set at $p < 0.05$.

3. Results

3.1. Pulmonary function

The results of pulmonary function for each participant are shown in Table 2. VC was 1.46–3.06 L, and no participant was within the normal range. However, $FEV_{1.0\%}$ was 76.07–99.20%, and all participants were within the normal range, indicating no obstructive airway disease. %VC was 35.5–92.3% and based on the index of %VC and $FEV_{1.0\%}$, as a classification of ventilatory disorders, only two participants were normal, and 11 out of 13 showed restrictive ventilatory disorders. Furthermore,

Table 2. Pulmonary function (spirometry).

	VC (L)	%VC (%)	FEV_1 (L)	$\%FEV_1$ (%)	$FEV_1\%$ (%)	$\%FEV_1\%$ (%)	Vt (L)	IRV (L)	ERV (L)	IC (L)	FVC (L)	%FVC (%)	PEFR (L/s)	%PEFR (%)	MMF (L/s)	%MMF (%)	V25/Ht (L/s/m)	%V25/Ht (%)	Lung age (years)	Ventilatory disorder
A	1.92	43.9	1.72	45.5	96.09	110.1	0.49	1.10	0.33	1.59	1.79	41.6	7.82	74.8	4.31	92.6	1.24	111.3	109	Restrictive
B	3.00	72.8	2.13	58.9	76.07	86.8	0.58	1.90	0.52	2.48	2.80	68.6	5.47	53.9	1.69	36.3	0.48	42.1	85	Restrictive
C	2.52	92.3	2.32	102.6	84.98	97.8	0.39	1.27	0.87	1.66	2.73	104.4	5.16	81.6	2.92	94	1.09	136.3	41	Normal
D	2.71	63.7	2.37	62.0	93.31	104.3	0.19	1.68	0.84	1.87	2.54	59.9	4.28	41.3	3.49	68.8	1.14	90.7	74	Restrictive
E	3.06	74.9	2.09	60.7	88.19	103.7	0.52	2.25	0.29	2.77	2.37	59.0	4.28	42.8	2.59	63.1	0.61	61.1	95	Restrictive
F	1.46	62.6	1.22	64.7	90.37	106.3	0.71	0.45	0.30	1.16	1.36	61.1	2.28	38.9	1.16	44.5	0.6	84.6	84	Restrictive
G	2.79	88.4	2.29	89.9	90.51	105.6	0.42	1.52	0.85	1.94	2.53	83.8	3.82	55.5	2.93	88.2	1.01	126.4	56	Normal
H	2.43	55.0	1.93	50.0	92.96	103.5	0.59	0.84	0.99	1.44	2.13	48.5	4.65	43.8	3.39	65.4	1.24	98.3	92	Restrictive
I	2.92	55.7	2.56	56.0	93.09	104.1	0.81	1.32	0.79	2.13	2.75	53.4	5.54	46.9	3.56	66.3	1.08	89.1	98	Restrictive
J	2.94	60.9	2.70	65.4	94.41	108.5	0.48	1.46	1.00	1.95	2.86	60.4	6.81	61.4	3.91	82.1	1.31	121	89	Restrictive
K	2.53	70.6	2.32	71.5	97.07	106.3	0.69	1.17	0.67	1.86	2.39	66.7	4.68	67.8	2.95	74.3	1.09	92.3	77	Restrictive
L	1.47	35.5	1.25	34.3	99.20	112.9	0.98	0.44	0.05	1.42	1.26	30.7	4.47	43.9	3.59	76.3	1.36	117.2	116	Restrictive
M	2.72	62.0	1.18	29.7	90.77	100.5	0.53	1.48	0.72	2.01	1.30	29.7	3.77	35.6	1.35	25.6	0.5	38.4	118	Restrictive

VC, vital capacity; FEV_1, 1 s amount; $FEV_{1.0\%}$, 1 s rate; Vt, tidal volume; IRV, inspiratory reserve volume; ERV, expiratory reserve volume; IC, inspiratory capacity; FVC, forced vital capacity; PEFR, peak flow rate; MMF, maximum mid-expiratory flow rate; V25/Ht, flow at 25% forced vital capacity/height.

Table 3. Pulmonary function (respiratory muscle strength and diaphragm displacement).

	PI_{max} (cmH_2O)	PE_{max} (cmH_2O)	Resting inspiration (mm)	Resting expiration (mm)	Maximal inspiration (mm)	Maximal expiration (mm)
A	37.5	23.8	0.9	0.8	1.9	0.6
B	112.3	105.0	2.1	1.8	5.7	1.0
C	76.0	69.5	1.5	0.9	3.6	0.7
D	25.0	21.1	1.5	1.0	2.6	0.9
E	67.3	74.8	1.7	1.6	2.6	1.4
F	27.2	38.2	1.1	0.7	3.0	0.6
G	62.2	80.3	2.0	1.8	3.8	1.2
H	24.1	38.2	1.7	1.4	5.0	1.2
I	50.2	43.5	2.6	2.4	5.6	1.5
J	74.3	56.9	2.1	1.5	6.2	1.1
K	56.7	43.7	1.8	1.5	3.4	0.8
L	43.1	25.1	2.1	1.5	4.4	1.3
M	34.6	39.1	1.8	1.6	2.9	1.4

PI_{max}, maximal inspiratory pressure; PE_{max}, maximal expiratory pressure.

the range of lung ages was 41–118 years and only one participant was below their actual age.

The results of respiratory muscle strength for each athlete and diaphragm displacement are shown in Table 3. The range of PI_{max} measurements was 24.1–112.3 cmH_2O, with only one participant within the normal range. The range of PE_{max} measurements was 21.1–105.0 cmH_2O, with no participants within the normal range. With respect to diaphragm displacement, the range of resting expiration was 0.7–2.4 mm, with three participants within the normal range. The range of maximal inspiration was 1.9–6.2 mm, with three participants within the normal range. The range of maximal expiration was 0.6–1.5 mm, with no participants within the normal range.

3.2. Pitching distance

The results of pitching distance measurements are shown in Table 4. The range of average distances was 10.31–32.87 m and three participants were unable to reach 12.5 m, which is the maximum distance of the boccia court. The maximum pitching distance range was 10.62–37.01 m, and only one participant could not reach 12.5 m.

A significant correlation was found among diaphragm displacement, body weight, and pitching distance. The maximum pitching distance correlated positively with resting expiration, resting inspiration, and maximal inspiration ($r = 0.569$, $r = 0.585$, and $r = 0.554$, respectively; $p < 0.05$), and body weight ($r = 0.768$; $p < 0.01$).

Table 4. Throwing distance.

	Mean of three measurements (m)	Maximum (m)
A	13.30	13.46
B	28.91	33.15
C	10.31	10.62
D	16.29	17.50
E	11.98	12.93
F	13.53	14.66
G	11.41	12.76
H	12.67	14.63
I	29.62	37.01
J	32.87	34.29
K	24.13	26.66
L	15.63	16.40
M	14.55	16.71

Similarly, the average pitching distance correlated positively with resting expiration, resting inspiration, and maximal inspiration ($r = 0.598$, $r = 0.620$, and $r = 0.589$, respectively; $p < 0.05$), and body weight ($r = 0.721$; $p < 0.01$).

3.3. Psychological competitive ability

The results of DIPCA.3 are shown in Table 5. For overall scores, three participants were judged to be excellent (5 points), four were judged to be good (4 points), three were judged to be average (3 points), two were judged to be low (2 points), and one was judged to be considerably low (1 point).

A significant correlation was observed between the lie scale score ($r = 0.717$; $p < 0.01$), the total DIPCA.3 score, and the following individual factors: volition for competition, mental stability and concentration, confidence, and strategic ability ($r = 0.965$, $r = 0.888$, $r = 0.928$, and $r = 0.859$, respectively, $p < 0.001$). However, no significant correlation was found between the overall score and cooperation.

4. Discussion

In this study, respiratory function, pitching distance, and psychological competitive ability of highly trained elite boccia athletes were evaluated. With respect to respiratory function, the normal VC value is 4–5 L for men and 3–4 L for women. However, in this study, the range was 1.47–3.06 L for male boccia players and 1.46–2.79 L for female boccia players; hence, no participants were within the normal range. Eleven out of 13 participants were considered to have restrictive ventilatory disorders. This result is similar to that of a previous study, which showed that individuals with cerebral palsy are generally classified as having restrictive ventilation disorders (Seddon and Khan, 2003; Strauss et al., 1999).

Mazic et al. (2015) reported that FEV_1 decreases over time as the lung ages, and FEV_1 is the most useful parameter for measuring lung age. The actual age range of participants in this study was 16–54 years; nevertheless, the lung age range was 41–118 years, with only one participant with a lung age below their actual age, showing that the respiratory function of boccia players is relatively low compared to those of other athletes. Although research on the respiratory function of athletes is quite limited, the VC of top athletes of basketball and water polo has been reported to be 6.5–6.8 L (Ohya et al., 2016).

The normal range of PI_{max} is 80–100 cmH_2O and the PE_{max} is 150–200 cmH_2O (Ohya et al., 2017; Ueki et al., 1995). In this study, only one participant was within the normal range for PI_{max}, and no participants were within the normal range for PE_{max}. The same was found for

Table 5. DIPCA.3

Factor	Synthesis		Volition for competition						Mental stability and concentration					Confidence				Strategic ability				Cooperation		Lie scale
Scales	Overall score	Judgement	Patience	Aggressiveness	Volition for self-realization	Volition for wining	Total	Judgement	Self-control	Ability to relax	Concentration	Total	Judgement	Confidence	Decision	Total	Judgement	Predictive ability	Judgement	Total	Judgement	Cooperation	Judgement	
			Scoring	Scoring	Scoring	Scoring			Scoring	Scoring	Scoring			Scoring	Scoring			Scoring	Scoring			Total		
A	226	5	19	20	18	19	76	5	20	18	20	58	4	17	16	33	4	19	20	39	5	20	5	18
B	220	5	18	20	18	19	75	4	20	20	18	58	4	16	17	33	4	18	17	35	4	19	4	18
C	171	3	16	18	17	16	67	4	12	12	12	36	2	14	13	27	4	11	12	23	3	18	3	19
D	211	5	19	19	20	18	76	5	16	15	20	51	4	15	18	33	4	16	15	31	4	20	5	20
E	163	2	12	14	16	16	58	2	17	12	15	44	3	12	10	22	2	13	11	24	3	15	2	17
F	200	4	15	20	18	16	69	4	17	14	15	46	3	14	20	34	5	16	15	31	4	20	5	20
G	224	4	20	19	20	19	78	5	17	18	20	55	4	16	18	34	5	18	19	37	5	20	5	20
H	118	1	9	6	12	17	44	1	7	4	6	17	1	8	10	18	2	11	8	19	2	20	5	14
I	187	4	15	17	17	18	67	3	14	14	15	43	3	15	16	31	4	15	14	29	3	17	3	19
J	178	3	11	12	17	18	58	2	15	12	12	39	2	13	17	30	3	18	17	35	4	16	3	20
K	144	2	12	12	15	12	51	1	11	11	14	36	2	10	9	19	2	11	11	22	2	16	3	16
L	170	3	14	16	18	14	62	3	18	13	17	48	3	13	12	25	3	11	13	24	3	11	1	16
M	189	4	19	19	16	15	64	3	20	17	20	57	4	13	13	26	3	11	12	23	3	19	4	20

Judgement: 5, excellent; 4, good; 3, average; 2, low; 1, considerably low.
DIPCA.3, Diagnostic Inventory of Psychological-Competitive Ability for Athletes.

respiratory muscle strength, and the respiratory muscle strength of boccia players was low overall compared to that of other athletes, as mentioned above (Ohya et al., 2016).

McNair et al. (1992) reported a normal value of diaphragm displacement as 1.7 $\pm$ 0.2 mm for resting expiration, 4.5 $\pm$ 0.9 mm for maximal inspiration, and 1.6 $\pm$ 0.2 mm for maximal expiration. In this study, only three participants were within the normal range of resting expiration, three were within the normal range for maximal inspiration, and no participants were within the normal range for maximal expiration. Therefore, this study has demonstrated not only a reduction in breathing function but also a reduced respiratory muscle strength and a decreased diaphragm displacement in boccia players.

Various tools are available for evaluation of an individual's mood and emotion within the short period immediately before administration, such as the Profile of Mood States (West, 2001); nonetheless, the DIPCA.3 is specifically designed to assess the psychological state of athletes and to also show higher scores for athletes with higher competitive ability and higher self-evaluation (Aizawa and Kudou, 2007; Morris and Temple, 1985; Tokunaga, 2004b). Of the three participants who were judged to be excellent on the DIPCA.3, two had been awarded medals at the Rio de Janeiro Paralympics. A similar trend was observed in a previous study conducted on women's college handball athletes, in which athletes with high competitive ability had high DIPCA.3 scores (Kashizuka et al., 2011).

Respiratory function, respiratory muscle strength, and diaphragm displacement were all low in boccia players and significant correlations were found between diaphragm displacement, weight, and pitching distance. Respiratory muscles are involved not only in breathing but also in maintaining the trunk; therefore, reduced respiratory muscle strength may affect the stability of the trunk function and pitching distance. An association between psychological aspects and a high level of competitive ability was also demonstrated. Respiration can also be related to psychological effects, such as relaxation and concentration.

This study had several limitations. First, the small sample size reduced the statistical power of the research and might have introduced a type II statistical error. Second, we did not separate the participants based on BC classification because of the small sample size. Third, because none of the participants in this study were BC 3 players, we could not draw any conclusions about this class of competitors. Fourth, it has been reported that patients with spinal cord injuries can experience exaggerated sleep hypoventilation, such as obstructive sleep apnea (Bascom et al., 2015). Furthermore, associations between the prevalence of obstructive sleep apnea and increasing age, BMI, and neck circumference have been reported in tetraplegic patients (Berlowitz et al., 2012; Burns et al., 2001).

In conclusion, the authors believe that further evaluation of physical function and respiratory muscle strengthening via targeted breathing exercises may help improve the competition performance and psychological aspects of boccia players.

Declarations

Author contribution statement

T. Ichiba: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

K. Okuda, M. Kataoka and K. Yahagi: Performed the experiments.

T. Miyagawa: Analyzed and interpreted the data.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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