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## Research Paper

## Bottle-feeding techniques for children with cleft lip and palate experiencing feeding difficulties

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## ABSTRACT

**Objective:** This study aimed to identify clinical bottle-feeding techniques practiced by nurses for children with cleft lip and palate experiencing feeding difficulties.

**Methods:** A qualitative descriptive design was used. Five anonymous questionnaires were distributed to each hospital, and 1,109 hospitals with obstetrics, neonatology, or pediatric dentistry wards in Japan were enrolled in the survey between December 2021 and January 2022. Participants were nurses working for over 5 years providing nursing care for children with cleft lip and palate. The questionnaire comprised open-ended questions about the feeding techniques across four dimensions: preparation before bottle-feeding, nipple insertion methods, sucking assistance, and criteria for stopping bottle-feeding. The qualitative data obtained were categorized according to meaning similarity and analyzed.

**Results:** A total of 410 valid responses were obtained. The findings regarding the feeding techniques in each dimension were as follows: seven categories (e.g., improving child's mouth movement, keeping child's breath calm), 27 sub-categories in preparation before bottle-feeding; four categories (e.g., closing the cleft using the nipple to create negative pressure in oral cavity, inserting the nipple to not touch the cleft), 11 sub-categories in nipple insertion methods; five categories (e.g., facilitating awakening, creating negative pressure in oral cavity), 13 sub-categories in sucking assistance; and four categories (e.g., reduced awakening level, worsening vital signs), 16 sub-categories in criteria for stopping bottle-feeding. Most participants responded that they would like to learn bottle-feeding techniques for children with cleft lip and palate who have feeding difficulties.

**Conclusion:** Many bottle-feeding techniques were identified to address disease-characterized conditions. However, the techniques were found to be conflicting: some inserted the nipple to close the cleft to create negative pressure in the child's oral cavity, while others inserted it without touching the cleft to prevent ulceration on the nasal septum. Although these techniques were used by nurses, the effectiveness of the methods has not been assessed. Future intervention studies are needed to determine each technique's benefit or potential harm.

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## What is known?

- Children with cleft lip and palate often have feeding difficulties and fall into poor weight gain and malnutrition.

- Reported techniques of bottle-feeding had insufficient or poor evidence and did not contribute to sufficient weight gain in children.
- Caregivers' feeding techniques for these children have not been reported comprehensively.

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## What is new?

- Many bottle-feeding techniques were identified to address disease-characterized conditions in the periods of preparation before feeding, inserting the nipple, assisting sucking, and criteria for deciding to stop feeding.
- The techniques were found to be conflicting: some inserted the nipple to close the cleft to create negative pressure in the child's oral cavity; while others inserted it without touching the cleft to prevent ulceration on the nasal septum.
- Nearly all the participants responded that they would like to learn bottle-feeding techniques for children with cleft lip and palate who have feeding difficulties.

## 1. Introduction

Cleft lip and/or palate (CLP) is one of the most common congenital facial malformations. Epidemiological studies have shown that the prevalence of CLP approximates 9.92 per 10,000 births worldwide, whereas the rate in Japan has been reported to be 20.04, which is the highest reported value worldwide [1]. Many children with CLP present disabilities such as feeding, chewing, and articulation difficulties, as well as impaired facial aesthetics [2]. In particular, feeding difficulties are caused by having shorter sucks, a faster rate of sucking, a higher suck-swallow ratio, and an inability to generate negative intraoral pressure [3]. In addition, children with CLP may have poor swallowing ability, problems with intraoral muscular movements, and insufficient sucking patterns [4]. The feeding difficulties due to these dysfunctions result in poor weight gain [5] and malnutrition [6]. Moreover, if the weight gain is insufficient, cleft-closing surgery must be postponed [7].

The Academy of Breastfeeding Medicine has published feeding protocols to facilitate breastfeeding for all children, including those with CLP [4]. However, the success rate of breastfeeding children with CLP was around 10% [8,9]. Breastfeeding might be difficult not only because of the child's inability to feed but also because of the mother's problems with infections such as the Human Immunodeficiency Virus (HIV), Cytomegalovirus (CMV), Human T-cell Leukemia Virus type I (HTLV-1) [10] or taking anticancer drugs for a period [11]. Most parents tend to choose bottle-feeding over breastfeeding; nonetheless, they remain dissatisfied with the explanations provided to them for addressing their child's feeding difficulties [12]. Previous reviews have identified bottle-feeding–facilitating techniques, including a child's positioning, assisted feeding, pacing, chin support, selecting a special feeding bottle, and thickening milk liquid [3,13]. However, these feeding interventions have insufficient or poor evidence [3,13] and have not contributed to sufficient weight gain in children [14]. Hence, nurses need to know many feeding techniques to accommodate various cleft shapes and child preferences.

To verify the effectiveness of a bottle-feeding technique, we considered that it is first necessary to comprehensively collect information on implicit techniques in clinical settings and define specific technical methods by identifying new techniques. The present study identified bottle-feeding techniques used by nurses for children with CLP, especially focusing on techniques for children with bottle-feeding difficulties in Japan, which has the highest prevalence of CLP. Our fundamental findings could contribute to providing an informative guide to solving feeding difficulties in children with CLP.

## 2. Methods

### 2.1. Study design

The present study adopted a qualitative descriptive design. We distributed an anonymous questionnaire that included qualitative open-ended questions about nursing bottle-feeding skills to hospitals nationwide. The consolidated criteria for reporting qualitative research (COREQ) checklist [15] was followed to guide reporting in this study.

### 2.2. Setting and participants

We used Hospital File, a Japanese hospital search database, which identified hospitals with maternity, neonatology, or pediatric dentistry wards. This database outputted 1,109 hospitals on November 23, 2021. The eligibility criterion for participants was nurses who had over five years of experience in feeding milk to infants with CLP on a maternity, neonatology, or pediatric dentistry ward. The nursing director selected five nurses in their hospital who met this eligibility criterion and distributed the request form and questionnaire. The maximum number of participants was expected to be 5,545 individuals.

### 2.3. Measurements

In the questionnaire, the following questions were listed as participant characteristics: specialized qualification, years of experience in the field, department, position, number of patients with CLP in their department per year, types of feeding bottles used for infants with CLP, and their wish to learn techniques. Regarding feeding bottle types, we asked participants to select the bottle types that they used with infants, as obtained from previous Japanese studies [16]; these included the Pigeon Cleft Palate Soft Bottle, the Pigeon feeder with the long nipple, the Combi Teteo Breastfeeding Bottle, the Medela Special Needs Feeder, the NUK Cleft Palate Teat, the ChuChu Baby Cleft Palate Teat, and the Bean Stalk Baby Bottle. If participants indicated "other" bottles, they were asked to write down the specific feeding bottles. Regarding their wish to learn techniques, we asked participants, "Would you like to learn feeding techniques for children with feeding difficulties?" and asked them to respond on a four-point scale of "would not," "somewhat would not," "somewhat would like to," and "would like to."

As the main outcome, we listed open-ended questions regarding the following aspects of bottle-feeding techniques for infants with CLP experiencing bottle-feeding difficulties: 1) "Please let me know if you have any techniques that you have used to prepare for bottle-feeding." (preparation before bottle-feeding), 2) "What kind of methods do you have for nipple insertion?" (nipple insertion methods), 3) "What techniques do you use to encourage sucking?" (sucking assistance), and 4) "At what point do you decide to stop bottle-feeding the infant?" (criteria for stopping bottle-feeding).

### 2.4. Data collection

To collect data, we distributed five sets of request forms and anonymous questionnaires to the nursing director of each hospital between December 2021 and January 2022. We requested the nursing director to distribute the questionnaires to nurses. The request form explained the aim of the present study and asked nurses to complete the questionnaire. Nurses were requested to

answer within a month after receiving the questionnaire. We arranged for two ways of completing the questionnaire: 1) on paper directly and sending it back or 2) online by scanning a QR code. When each participant received the study documents and questionnaire, they freely responded using either one of the methods.

### 2.5. Data analysis

Data on participant characteristics were inspected using descriptive analysis. The qualitative outcome data on bottle-feeding techniques were assessed using content analysis, which involves applying inductive approaches in an iterative way [17]. Content analysis is suitable for analyzing the multifaceted, important, and sensitive phenomena of nursing [17]. The qualitative data were managed in Excel (version 2108, Microsoft 365 Apps). The first author of this study input the data into the software, repeatedly read the text to familiarize himself with the meaning of the data and separated each answer into meaning units (coding). Next, units were organized by classifying them into each of the four components of bottle-feeding techniques. The first author grouped similar meaning units into categories and labeled the categories. This categorization was conducted in multiple stages and gradually abstracted. Subsequently, he compared and contrasted each category to ensure that units were assigned to the most relevant category. This process was repeated as many times as needed to allow for a deep understanding of the data. After the first author finished analyzing the data, the second author, who was a qualitative study researcher but unfamiliar with the topic of the present study, checked the credibility of the analyzed data and corrected the categorizations through discussions with the first author. Subsequently, the third and fourth authors, who were nursing specialists for children with CLP, checked the data to verify whether there was a gap between the analyzed results and the phenomenon observed in clinical settings. All authors conducted the analysis based on the philosophical background of the factist perspective [18]. We assumed that the explicit content of the data represented an accurate and true index of reality [18].

### 2.6. Rigor

We considered this study’s rigor, which refers to the quality and trustworthiness of our study methodology. The rigor included dependability, credibility, and transferability. Dependability focused on achieving consistent quality [19]. To achieve dependability, we ensured that the research process was logical, traceable, and documented. We described the process of analysis in notes and saved files for every revised analysis to make the analysis process traceable by conducting an audit trail. The assessment of credibility was multi-dimensional for the goodness of fit and representativeness [19]. Credibility is generally promoted by triangulation; however, it was not possible to confirm the results by participants in this study, as the questionnaires were answered anonymously. Therefore, the analysis process carried out by the four authors included two researchers who were familiar with qualitative studies and two nurses who worked for over 20 years at the CLP center of a university hospital. Transferability refers to the extent to which the findings can be transferred to other settings or groups [19]. We thus reported participant characteristics in the results.

### 2.7. Ethical considerations

The present study was reviewed and approved by the corresponding Institutional Review Board (IRB number: 21077–01). We requested study participation by providing written information, including that on the study purpose and method, to nursing

directors and potential participants. Participation was voluntary and free, with no penalty for non-participation. No identifying information was collected from participants. As a result, survey responses were anonymous, with minimal risk to the study participants. Participants who responded to the anonymous questionnaire were considered to have consented to participation. The study was conducted by the World Medical Association Declaration of Helsinki.

## 3. Results

We received a total of 605 completed questionnaires (510 by mail and 95 online), of which we excluded 195 that did not contain answers to the open-ended question items on bottle-feeding techniques. Thus, we analyzed 410 participants’ data.

### 3.1. Participant characteristics

The participants’ characteristics are presented in Table 1. Nurses and midwives participated in almost equal proportions. The most frequent departments were neonatology and maternity, and the participants’ position was most frequently staff nurse and deputy chief nurse. The mean years of experience in the field was 19.53 (SD = 8.47). More than 95% of participants reported under 10 children with CLP hospitalized annually in their department.

Through a multiple-choice question, we asked participants to indicate the type of feeding bottles they used for children with CLP who experience feeding difficulties. They used the Pigeon Cleft Palate Soft Bottle (239, 58.29%), the Medela Special Needs Feeder (117, 28.54%), the NUK Cleft Palate Teat (65, 15.85%), the Bean Stalk Baby Bottle (45, 10.98%), the ChuChu Baby Cleft Palate Teat (36, 8.78%), the Pigeon feeder with long nipple (34, 8.29%), and the Combi Teteo Breastfeeding Bottle (25, 6.10%). The other tools not listed in the questionnaire but mentioned by the participants were the Pigeon breast milk feeling nipple, the Pigeon nipple for weak sucking, the Pigeon low burden and large flow rate nipple, a cup, and a spoon; fewer than 10 participants answered one of these. Of the participants, 96.0% responded that they “would like to” or

**Table 1**  
Participants’ characteristics (n = 410).

Variable	n	%
Specialized qualification		
Nurse	240	58.54
Midwifery	170	41.46
Department		
Maternity	173	42.20
Neonatology	209	50.98
Pediatric dentistry	8	1.95
Pediatrics	14	3.41
Other	4	0.98
Unanswered	2	0.49
Position		
Staff nurse	319	77.80
Deputy chief nurse	70	17.07
Chief nurse	13	3.17
Director of nursing	2	0.49
Unanswered	6	1.46
Number of inpatients with CLP per year		
<1	68	16.59
2–5	296	72.20
6–10	26	6.34
11–50	8	1.95
51–100	5	1.22
>101	3	0.73
Unanswered	4	0.98

Note: CLP = cleft lip and/or palate.

“somewhat would like to” learn bottle-feeding techniques for children with CLP who have feeding difficulties.

### 3.2. Feeding techniques

The bottle-feeding techniques identified were categorized under each of the following components: 1) preparation before bottle-feeding, 2) nipple insertion methods, 3) sucking assistance, and 4) criteria for stopping bottle-feeding. The names of categories and sub-categories are shown in Tables 2–5. Hereafter, raw data is indicated using quotation marks (“”), subcategories using square brackets ([]), and categories using angle brackets (<>).

The preparation before bottle-feeding (Table 2) contained seven categories, 27 sub-categories, and 665 codes. The nurses observed whether the child was ready to be fed, then conditioned the lips, airway, and abdominal distention, and facilitated arousal (or soothed the child if they cried too much). For example, in Category 1) <Facilitating awakening by stimulating in usual care>, the raw data “I wait till the baby cries by changing the diaper or talking to the baby to raise the level of arousal and then feed the baby” was included in the subcategory [Changing diaper]. In Category 3) <Improving child’s mouth movement>, the raw data “I moisturize the cleft lip with Vaseline to prevent dryness and skin damage” was included in the subcategory [Moisturizing lips].

Nipple insertion methods (Table 3) contained four categories, 11 sub-categories, and 913 codes. The nurses hold the child in a feeding posture and insert the nipple when the child’s mouth is open. The position of the nipple in the oral cavity may be to close the cleft or not touch the cleft. In Category 1) <Closing the cleft using the nipple to create negative pressure in oral cavity>, the raw data “position where the cleft is sealed” or “place the tip of the nipple against the cleft” were included in the subcategory [Placing the nipple on the cleft], and “often, air leaks; so, I insert the nipple deeper so that it attaches the cleft” were included in the subcategory [Inserting the nipple deeply]. In Category 2) <Inserting the nipple to not touch the cleft>, the raw data “do not press the nipple too hard against the cleft to prevent ulceration” were included in

the subcategory [Placing the nipple on the area without cleft] and “the nipple should be inserted in the center of the tongue” were included in the subcategory [Inserting the nipple up to the center of the tongue].

Assistance with child’s sucking (Table 4) contained five categories, 13 sub-categories, and 612 codes. When the child’s drinking speed slowed down, they encouraged the child to suck to awaken the child when they were about to fall asleep or took a break when the child was tired. As the child became tired, sucking would decrease, so they tried to create more negative pressure in the mouth, find a nipple position that would make sucking easier, and insert milk gradually so that the child could drink milk without sucking. For example, participants reported “pressing the nipple against the tongue as the child’s tongue moves”; these raw data were included in the subcategory [Pressing the nipple against the tongue according to sucking and swallowing] in Category 1) <Facilitating awakening>. The raw data “pressing against the maxilla to close the cleft to create negative pressure in the oral cavity” was included in the subcategory [Press against the palate to close the cleft] in Category 2) <Creating negative pressure in oral cavity>. Moreover, the raw data “If the child is unable to suck milk from a bottle, nipple pressure may be applied with the child’s mouth movement” were included in the subcategory [Squeezing the nipple or bottle to produce milk] in Category 3) <Adjusting the amount of milk entering the mouth according to the child’s sucking and swallowing ability>.

Criteria for stopping bottle-feeding (Table 5) contained four categories, 16 sub-categories, and 695 codes. The nurses decided to stop feeding when the child’s willingness to feed decreased, such as reduced awakening level or resistance feeding, or when physical symptoms appeared, such as worsening vital signs or imbalances between breathing and swallowing. For example, the raw data “changing in respiratory status, such as percutaneous oxygen saturation being more often up or down” was included in the subcategory [Unstable respiratory conditions] in Category 2 <Worsening vital signs> and “the child is coughing and has possible pulmonary aspiration” were included in the subcategory

**Table 2**  
Categories and sub-categories of preparation before bottle-feeding.

Categories	Sub-categories
Facilitating awakening by stimulating in usual care	Touching Postural change Taking away coverlet Changing diaper
Keeping child’s breath calm	Cradling Using pacifier Feeding before child cries
Improving child’s mouth movement	Massaging around the mouth Stimulating around the mouth Training oral function Moisturizing lips
Cleaning the airway Reducing abdominal distention	Suction in oral and nasal cavity Enema Stimulating by anal swab Belching Abdominal massage
Making it easier to create negative pressure in the oral cavity when sucking	Sticking tape on lip to close cleft Sealing cleft with finger Sealing cleft with wrap Using palatal obturator
Observing to assess whether feeding is possible	Awake status Sucking behavior Crying before feeding Tongue movement Oral cavity (cleft position, redness, ulceration) Respiratory condition Abdominal condition

**Table 3**  
Categories and sub-categories of methods for inserting nipple.

Categories	Sub-categories
Closing the cleft using the nipple to create negative pressure in oral cavity	Placing the nipple on the cleft
Inserting the nipple to not touch the cleft	Inserting the nipple deeply
	Placing the nipple on the area without cleft
Inserting the nipple timely in accordance with the child's motivation to feed	Inserting the nipple straight and holding the bottle not moving the nipple
	Inserting the nipple along the lower lip
	Inserting the nipple up to the center of the tongue
Optimizing the child's posture	Quickly inserting nipple by sliding when child's mouth is opening or tongue is coming out
	Supporting the neck, head, and back to prevent bending the head backwards
	Fitting the child to nurse's body
	Holding the child vertically
	Holding the child in a sitting position

**Table 4**  
Categories and subcategories of assisting child's sucking.

Categories	Sub-categories
Facilitating awakening	Pressing the nipple against the tongue according to sucking and swallowing
Creating negative pressure in oral cavity	Stimulating lower jaw and cheeks
	Stimulating the lips with the nipple
	Stimulating the child's senses
Adjusting the amount of milk entering the mouth according to the child's sucking and swallowing ability	Press the nipple into the mouth deeply to close contact
	Press against the palate to close the cleft
	Facilitating adsorption by supporting the chin and cheeks
	Tilting the feeding bottle
Taking a break	Squeezing the nipple or bottle to produce milk
	Removing the feeding bottle
Adjusting to sucking easily	Exhausting
	Changing the type of nipple
	Adjusting the position and depth of the nipple gradually

**Table 5**  
Categories and sub-categories of criteria for deciding to stop bottle-feeding.

Categories	Sub-categories
Reduced awakening level	Falling asleep even when stimulated
	Not opening mouth
	Keeping mouth open
	Not moving tongue
	Decreasing muscle tone
	Raising tongue
Worsening vital signs	Not sucking
	Unstable respiratory conditions
	Decreasing pulse rate
	Abdominal distension
Resisting feeding	Crying
	Moving the body violently
	Putting out the nipple from the mouth
Losing the balance of breathing, sucking, and swallowing	Miss-swallowing and choking
	Not swallowing
	Not continuing sucking and swallowing

[Miss-swallowing and choking] in Category 4 <Losing the balance of breathing, sucking, and swallowing>.

**4. Discussion**

The present study identified various bottle-feeding techniques that address disease-characterized conditions used by clinical nurses. We discuss these categories below.

As preliminary feeding preparation for children with CLP, observation of the oral cavity to confirm the presence of redness or ulceration was performed. In the case of CLP, there is a passage leading from the oral cavity to the fragile part of the nasal septum. Ulceration is likely to occur when the nipple makes contact near the nasal septum during bottle-feeding [20]. Therefore, the need for

treatment is assessed by confirming whether there are any abnormalities in the oral cavity.

Taping and palatal obturators were used to close the fissure for the purpose of creating negative pressure in the oral cavity during the child's sucking. Taping usually begins within one week of the child's birth and is applied on the cleft while gathering the child's lips together [21]. Taping of the lips has the other effect of helping to reduce the size of the cleft and improving symmetry until the first surgery [22]. Interventions using palatal obturators were also used to reduce the severity of a cleft deformity [21]. Children with CLP tend to have feeding difficulties because of difficulty in adjusting the muscles to create negative pressure in the oral cavity, resulting in regurgitation into the nose [23]. Further research is needed on the effect of using palatal obturators to prevent outflow

to the nasal cavity.

Regarding techniques for nipple insertion, there were two contradictory methods, namely “fitting the cleft” and “not fitting the cleft” when inserting the nipple. This contradiction might be due to different purposes: to create negative pressure and to avoid ulceration, respectively. As mentioned above, ulceration might occur at the nasal septum when the cleft comes in contact with a nipple. In the present study, most participants usually used the Pigeon Cleft Palate Soft Bottle or the Medela Special Needs Feeder, which could provide milk even if the child cannot suck or latch onto the nipple. The risk of ulceration of the nasal septum is reduced by using these types of bottles because it is not necessary to create negative pressure in the oral cavity or to press the nipple against the cleft. However, the shape of these nipples might cause nipple confusion during the transition to breastfeeding [24]. Cup-feeding could provide a more stable heart rate and oxygen saturation for the child than bottle-feeding and increase the breastfeeding rate [25]. However, its performance depends on the nurses’ experience level with cup-feeding [26]. Moreover, Pigeon and Medela bottles have relatively thick nipples, which might be too large for some children’s mouth. Nonetheless, there is a Pigeon feeder with a long nipple for such cases, and its efficacy has been indicated in case reports [27]; however, it is difficult to handle, and the evidence of its effectiveness has been insufficient. Depending on the size and depth of the cleft and swallowing or sucking ability, it is necessary to consult with dentists or speech-language therapists to determine the choice of nipple type and insertion technique. In addition, a bottle-feeding technique suitable for each type of feeding bottle needs to be established.

Reducing arousal was cited as a criterion for deciding to stop bottle-feeding. When the child was stimulated but could not stay awake due to exhaustion of energy for feeding, feeding interruption might be required. The Brazelton Neonatal Behavioural Assessment Scale is often used as a criterion for assessing the child’s arousal level, which provides categorization into six states. Of these, states 1 and 2 are sleep states, and treatment should be avoided at this time [28]. The imbalance of breathing, sucking, and swallowing was also cited as a criterion for the decision to discontinue feeding. Synchronizing the three components is important to prevent regurgitation into the nose [13]. These criteria are necessary observation points for children with CLP.

Our study participants used the technique of stimulating around the child’s mouth; they massaged or stimulated the mouth area to improve mouth movement in preparation before bottle-feeding and to facilitate awakening to assist the child’s sucking. These oral stimulation exercises can improve breathing and swallowing patterns [29]. In addition to these mouth-stimulating exercises, the following methods would be useful to increase feeding amount and shorten feeding time: using a nipple with larger holes, straightening the child’s posture, hugging, rhythmically moving the bottle, putting the lips on the tongue [30]. These techniques were consistent with our results.

## 5. Limitations

One of the limitations of the present study is the low response rate. Many of the potential participants we asked might have been unable to answer the questionnaire because they had no experience feeding children with CLP. Additionally, as the target population was limited to nurses and midwives, the techniques of other CLP specialists are not reflected in the results. Differences in bottle-feeding techniques among specialties should be confirmed in the future. We could not identify the conflicting items that were more effective in improving the child’s feeding or those that had any adverse effects. Therefore, intervention studies should be

conducted in the future to confirm the most effective techniques. Such further research would help to establish effective evidence-based techniques and increase nurses’ confidence in teaching bottle-feeding techniques to parents. In addition, as almost all participants in the present study reported wanting to learn effective bottle-feeding techniques, it is necessary to implement an educational system where such techniques can be learned.

## 6. Conclusions

Through distributing questionnaires to nurses at hospitals where CLP children were hospitalized, we obtained the techniques used for bottle-feeding for children with CLP. Many bottle-feeding techniques were identified that addressed disease-specific conditions. However, there were conflicting techniques: some inserted the nipple to close the cleft to create negative pressure in the child’s oral cavity, while others inserted it so that it did not touch the cleft to prevent ulceration on the nasal septum. Although these techniques are commonly used by nurses, their effectiveness of these methods have not been assessed. Future intervention studies that determine each technique’s benefit or potential harm are needed.

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## Declaration of competing interest

The authors have no conflicts of interest to declare.

## CRediT authorship contribution statement

**Shingo Ueki:** Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft; Writing - review & editing, Funding acquisition. **Ayaka Fujita:** Methodology, Validation, Formal analysis, Investigation, Writing - review & editing. **Yukari Kumagai:** Validation, Supervision. **Yumi Hirai:** Validation, Supervision. **Eri Tashiro:** Supervision, Writing - review & editing. **Junko Miyata:** Supervision, Writing - review & editing.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijnss.2022.12.004>.

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