




Research Article

Development of the Korean Version of the Drooling Infants and Preschoolers Scale

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Objective. This study is aimed at translating and cross-culturally adapting the Drooling Infants and Preschoolers Scale (DRIPS) into Korean cultural context and examine the content validity and reliability of the Korean version, which is referred as K-DRIPS. **Methods.** An iterative forward-backward translation sequence of the DRIPS was performed by 20 Korean health professional experts (i.e., occupational therapists (OTs) and professors) with more than 10 years of experience. The study subjects were 77 children with cerebral palsy (CP) exhibiting drooling symptoms aged 2-7 years. They were recruited from two children's rehabilitation hospitals in Korea and completed the K-DRIPS. The content validity and internal consistency of the K-DRIPS items were examined. **Results.** An assessment with 20 K-DRIPS items was adequately and cross-culturally adapted into Korea. All the items exhibited good content validity (content validity ratio range 4.00-4.95) and good internal consistency (Cronbach's $\alpha = 0.98$). **Conclusion.** The study findings indicated that the K-DRIPS was successfully adapted to the Korean cultural context and demonstrated good psychometric properties. This instrument could be used for drooling assessment tool in Korean children with disabilities.

1. Introduction

Drooling is a pathological symptom in which saliva unintentionally flows out of the mouth or back to the pharynx [1]. It is a normal developmental step up to 18 months of age and disappears when the oral sensorimotor function matures [2, 3]. However, drooling is considered abnormal among children aged 4 years and causes a number of health and social problems [4, 5].

For instance, drooling causes medical, functional, and social problems including aspiration, skin disease, bad odor, inflammation around the mouth, tooth decay, poor oral health issues, and dehydration [4]. In addition, it causes computers and equipment to break and causes the affected children to frequently change clothes; have low self-esteem;

experience isolation, stigma, and bullying; and have a low quality of life [6-9]. Thus, drooling is one of the swallowing and feeding disorders that need to be assessed and managed carefully.

Drooling is caused by comprehensive somatic and sensory issues, such as decreased oral motor functions; sensory processing disorders; lack of coordination when recognizing saliva and swallowing [10]; and postural, cognitive and behavioral problems [11, 12]. Other causes of drooling include tooth eruption, malocclusion, tooth decay, upper respiratory tract infection, nasal congestion, and gastroesophageal reflux disease [11-14]. Due to the varying causes of drooling, accurate diagnosis of drooling is difficult. Unfortunately, drooling is a very common problem among children with disabilities, such as cerebral palsy (CP), developmental

delay, and neuromuscular disease [14–17]. Children with CP usually have oral sensorimotor, cognitive, and behavioral problems [6, 7, 15].

Comprehensive assessment is necessary to identify the main causes of drooling and provide accurate treatment strategies according to the causes [10]. Based on the assessment results, clinicians choose proper drooling treatment strategies among postural control, sensory stimulation, oral motor treatment, and behavioral approaches [10, 16]. So, drooling assessment tools need to be capable of evaluating the degree of drooling in various situations, because it varies depending on the time period, and participation in activities, such as eating and sleeping. However, most of the drooling assessment tools, such as the Drooling Severity and Frequency Scale (DSFS) [18], Drooling Quotient (DQ) [19], and Drooling Impact Scale (DIS) [20], only assess drooling severity and frequency in general situations. Thus, current standardized assessments for drooling are insufficient.

To address these issues, Van Hulst et al. [10] developed a caregiver-reported subjective drooling assessment tool, the Drooling Infants and Preschoolers Scale (DRIPS), for children below 4 years old. The DRIPS consists of 20 items divided into 3 parts: (1) basic information (health status); (2) drooling severity and frequency in various situations, including eating or drinking, participation in activities, sleeping, and talking; and (3) effects of teeth eruption or cold on drooling. Unlike other drooling assessment tools, the DRIPS assesses the severity and frequency of drooling in various situations, such as during feeding, when in the prone position, or while participating in fine motor activities. The advantage of the DRIPS is its ability to provide opinions regarding the effects of drooling in children on their caregivers. Furthermore, it can identify the main causes of drooling and helps clinicians select proper treatment strategies. For example, if a child drools when performing any activities, the instrument could indicate that the cause of drooling is the child's immature motor skills. If the drooling score is high for all parts in the instrument, it indicates a developmental delay [10].

Drooling assessment tools need to adapt to cultural contexts in each country. Many studies have been conducted to identify the effect of drooling interventions in numerous countries using different drooling assessment tools [4, 5, 7]. However, studies on the development and cultural adaptation of such tools are scarce [2, 4]. Most health-related instruments, including drooling assessments, are developed in English [21]. To use the assessment tools developed in other countries, both linguistic interpretation and cross-cultural accommodation are necessary [22].

Especially in South Korea, OTs play a major role in swallowing and feeding therapy and provide various drooling treatment strategies, including oral motor therapy, sensory stimulation, and postural control, in the early stages of drooling management. However, research on drooling assessment tools or identifying effects on drooling in children with CP is limited. Therefore, this study is aimed at cross-culturally adapting and developing a Korean version of the DRIPS (K-DRIPS) in which items have been verified

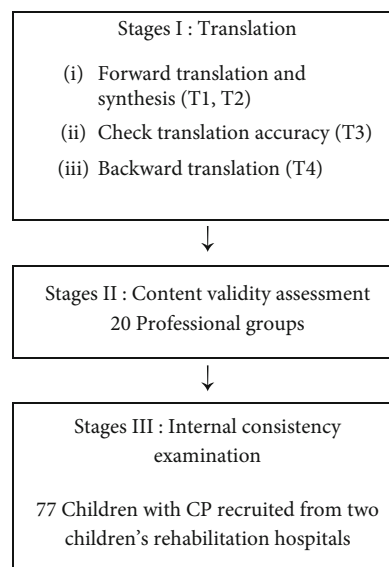


FIGURE 1: Flowchart of the study process.

by a group of professional experts and checking internal consistency for children with CP.

2. Methods

2.1. Overview of the Procedure. This study was conducted in three stages: translation (stage 1), content validity assessment (stage 2), and internal consistency examination (stage 3) (Figure 1). Stage 1 consisted of three steps. In step 1, two authors (T1 and T2) separately translated the assessment items from English to Korean and synthesized their work. One of the translators (T1) is a specialist in pediatric dysphagia rehabilitation. In step 2, bilingual users (T3) who do not know the content of the DRIPS reviewed the accuracy of the translation. In step 3, bilingual users (T4) who do not have any knowledge about the DRIPS performed backward translation. In stage 2, 20 professionals (17 OTs and 3 professors) assessed the content validity of the test items. Finally, in stage 3, the internal consistency of the instrument was examined on 77 children with CP aged 2-7 years who were recruited from two children's rehabilitation hospitals in Seoul, South Korea (Figure 1).

2.2. Instrument Tool. The DRIPS is a drooling assessment tool developed by Van Der Burg et al. [6] to assess the ability of 0-4-year-old typically developing children to control drooling. The DRIPS is a caregiver response questionnaire consisting of 20 items divided into 3 parts: (1) basic information and health status (items 1-7); (2) drooling severity and frequency in various situations including eating or drinking, participation in activities, sleeping, and talking (items 8-16); and (3) effects of teeth eruption or cold on drooling (items 17-20). The DRIPS uses a Likert scale as a scoring system based on the DSFS [18]. Higher scores indicate severe drooling severity and frequency. The factor analysis indicated that the DRIPS consisted of four factors: (1) drooling during activity (when in the prone position and assisted sitting,

participating in gross and fine motor activities, and babbling/talking (items 8-11, 16)); (2) drooling during feeding (item 12); (3) drooling during nonnutritive sucking (items 13 and 14); and (4) drooling when sleeping in various positions (item 15). The DRIPS has been used to identify milestones of drooling development in children below 4 years old [10].

2.3. Translation and Cross-Cultural Adaptation. Prior to the study, one of the instrument developers approved the translation and development of the DRIPS in South Korea. The translation process was carried out according to the international guidelines for the cross-cultural adaptation by Beaton et al. [22]. Two researchers (the first and third authors) translated the DRIPS into Korean. One of the translators (T1) was familiar with child drooling, and the other one (T2) was not. After the first translation, bilingual Korean and English users (T3) with no prior information participated in the translation accuracy examination. For each item, the accuracy of the translation was evaluated on a 5-point Likert scale from “very unsuitable (1)” to “very appropriate (5).” Items with a score of 3 or less were revised and reconfirmed by the researchers, and the criteria for retaining items in the final K-DRIPS was a score of 4 or higher. Bilingual Korean and English-speaking OTs (T4) in the United States without previous experience with the DRIPS reversely translated the test items. Subsequently, the translated content was found to retain the meaning of the original content. Therefore, no items were deleted or added.

2.4. Content Validity Assessment. A group of 20 professionals (17 OTs and 3 professors) with more than 10 years of clinical and educational experience in pediatric occupational therapy or swallowing rehabilitation participated in the content validity assessment. For the content validity ratio (CVR), each item was evaluated on a 5-point Likert scale from “very inappropriate (1)” to “very appropriate (5)” (Equation (1)). The participants provided opinions and suggested additional contents. Content validity was converted to 0.00 for 1 point, 0.25 for 2 points, 0.50 for 3 points, 0.75 for 4 points, and 1.00 for 5 points according to the CVR. Items with an average score of 3 or less were removed [23].

$$\text{CVR} = \frac{n_e - (N/2)}{N/2}, \quad (1)$$

where CVR = content validity ratio; n_e = number of panel members indicating an item “appropriate (4)” and “very appropriate (5)”; and N = number of panel members.

2.5. Internal Consistency Examination. The nine items (items 8-16) in part 2 or the K-DRIPS were examined because part 1 only contains basic information and part 3 contains the simple effect of tooth eruption and a cold on drooling. The internal consistency was examined in children with CP aged 2-7 years who were recruited from two children’s rehabilitation hospitals in Seoul. Children aged 2-7 years were selected because children with disabilities usually have developmental and functional delay compared with typically developing children.

2.6. Data Analysis. The subjects’ general information and the content validity were analyzed through descriptive statistics. The content validity was converted to 0.00 for 1 point, 0.25 for 2 points, 0.50 for 3 points, 0.75 for 4 points, and 1.00 for 5 points according to the CVR. Cronbach’s α was calculated to examine the internal consistency. SPSS version 24.0 was used for statistical analysis.

3. Result

3.1. Translation and Cross-Cultural Adaptation of the K-DRIPS. Four contents (OTs, rehabilitation medicine doctors, others, and never visited (N/A)) were added, 4 (has your child visited, concerning, child, and fine motor) were modified, and 2 (speech therapist and physiologist) were excluded. Table 1 presents the examples of the final translation of the DRIPS form from English to Korean. The most frequently changed contents based on Korean context were in the “basic information” section. For example, “concerning” was changed to “reason for visit”. “Previous visit institution” was converted to “previous visit treatment institution for drooling”. The reason was that parents confused drooling treatment with others, such as occupational therapy or swallowing rehabilitation. In the original version, (pediatric) neurologists, pediatricians, ENT specialists, speech therapists, and physiotherapists were in the “previous visit” items. However, in South Korea, OTs usually provides swallowing and drooling treatment after getting prescription from the rehabilitation medicine doctor. Therefore, OTs and rehabilitation medicine doctors were included, and speech therapists and physiotherapists were excluded. Furthermore, “Others” was added to collect additional information such as other types of therapy institutions. “Child” was changed to a caregiver-friendly Korean expression in all items.

3.2. Content Validity. Table 2 presents the CVR value of the test items. The CVR value ranged from 4.00 to 4.95. In the first content validity assessment, the CVR of all items was 4.00 or higher so no items were removed. The item with the lowest CVR was “Does your child drool while awake and lying on their tummy, for example, when playing on the floor?” Conversely, the item with the highest CVR value item was “What is the level of drooling when your child sleeps on their tummy?”

3.3. Internal Consistency. The nine items (items 8-16) in part 2 of the K-DRIPS were analyzed in 77 children with CP (Table 3). Cronbach’s α was 0.98. The K-DRIPS items were not changed or modified after the internal consistency examination.

4. Discussion

This study cross-culturally adapted and developed the K-DRIPS. The revised instrument exhibited good psychometric properties. In the translation process, the test items were adapted to swallowing and feeding therapy situations in the South Korean context. The K-DRIPS would be a useful drooling assessment tool that reflects swallowing and feeding therapy in the aforementioned context.

TABLE 1: Examples of the final translation of the Drooling Infants and Preschoolers Scale (DRIPS) from English to Korean.

Part	Item no.	Original version	Final Korean version	
1	6	Has your child visited	침흘림 관련 이전 방문(치료) 기관	Modified
		Concerning	방문 사유	Modified
		Occupational therapist, rehabilitation medicine doctors, others	재활의학과, 작업치료사, 기타	Added
		Never visited (N/A)	방문한 적 없음 (해당 없음)	Added
		Speech therapist, physiotherapist	—	Deleted
2	9-20	Child	아이가	Modified
	11	Fine motor	소근육 활동	Modified

TABLE 2: Content validity of the Korean Drooling Infants and Preschoolers Scale (K-DRIPS).

No.	Items	CVR
All	What is the level of drooling?	4.55
	Wet lips	4.6
	Wet lips and chin	4.5
	Also, wet clothes/bib	4.45
	Wet clothes, hands, table, floor, and items	4.4
8	Does your child drool while awake and lying on their tummy, for example, when playing on the floor?	4.0
9	Does your child drool while sitting up and when their body is supported (by a parent or by a chair with a backrest)?	4.3
10	Does your child drool while moving around, for example, rolling over, crawling, walking, jumping, or performing sports activities?	4.45
11	Does your child drool while using fine-motor materials, such as a rattle, blocks, or stringing beads, or while drawing?	4.25
12	Does your child drool while eating and drinking?	4.6
13	Does your child drool while sucking on a teat, thumb, finger, lip, or pacifier during the day?	4.5
14	Does your child drool while sucking on a teat, thumb, finger, lip, or pacifier during the night?	4.7
15	Does your child drool while they are asleep?	4.85
a	What is the level of drooling when your child sleeps on their back?	4.3
	What is the level of drooling when that's the case?	
b	What is the level of drooling when your child sleeps on their side?	4.9
	What is the level of drooling when that's the case?	
c	What is the level of drooling when your child sleeps on their tummy?	4.95
	What is the level of drooling when that's the case?	
16	Does your child drool when babbling/talking?	4.9
17	Has your child had (new) teeth eruptions over the past 2 weeks?	4.8
18	Would you have completed the survey differently if your child had not had (new) teeth eruptions over the past 2 weeks?	4.65
19	Has your child had a cold (e.g., runny nose) over the past 2 weeks?	4.75
20	Would you have completed the survey differently if your child had not had a cold (e.g., runny nose) over the past 2 weeks?	4.6

CVR: Content validity ratio.

The study procedures of the translation, content validity examination, and internal consistency assessment of our study were similar to the previous studies [2, 4]. In the French version of the DIS standardization study, content validity examination was performed in 55 children (33 controls, 22 experimental groups) [4]. In the internal consistency, Cronbach's α was 0.71. Another study on the

translation and standardization of DIS into Brazilian Portuguese [2] also performed translation-reverse translation, and the final confirmation was made by professional group (Cronbach's $\alpha = 0.72$). Although our study demonstrated a higher Cronbach's α value compared to the previous studies, a direct comparison is difficult due to the different evaluation tools. That is because the sample size of our study is

TABLE 3: General information of the participants.

Characteristics	<i>n</i>	%
Age		
2-3 years	27	35.1
4-5 years	27	35.1
6-7 years	23	29.9
Mean ± SD, 56.65 ± 18.83		
Sex		
Male	52	67.5
Female	25	32.5
Prematurity		
Full term	39	50.6
Preterm	38	49.4
GMFCS		
I	9	11.7
II	13	16.9
III	4	5.2
IV	15	19.5
V	36	46.8
Type		
Spastic	63	81.8
Dyskinetic	10	13.0
Ataxic	2	2.6
Others	2	2.6

GMFCS: Gross Motor Function Classification System.

larger than those of previous ones [2, 4], and we recruited subjects who had a single diagnosis.

In South Korea, OTs play a major role in swallowing and feeding therapy. In the translation process, OTs and rehabilitation medicine doctors were included to reflect the South Korean context. However, speech therapists and physiotherapists were excluded as they are not an integral part of the swallowing and drooling treatment in South Korea.

From a functional point of view, specific items are needed for children with severe developmental delay or movement disorders. Because development and gross motor functions levels of CP are various. The original version of the DRIPS was developed for typically developing children below 4 years old with typical development. However, children with disabilities often exhibit developmental and functional delay. Furthermore, drooling is considered a problem for children aged 2 years or older [2]. In this study, the subjects were children with CP aged 2-7 years. Some items like “drooling when in the prone position” and “babbling” are not suited for older children. This indicates that follow-up studies on the applicability of the K-DRIPS for a wider age group as well as various diagnostic groups will be needed.

The limitation of this study is the absence of a sufficient sample size to represent the entire population because only children who visited the two hospitals in

Seoul were included. Second, we did not perform various standardization processes. For example, a control group study or validation process with other drooling assessment tools was not conducted. In other words, further follow-up studies on the applicability of the K-DRIPS for a wider age range and various diagnoses are needed. Additional items are also needed for school-aged children. Moreover, other drooling assessments will need to be standardized. Lastly, the main objective of the translation-reverse translation was to reflect the Korean cultural contexts and linguistic interpretation. In particular, in reverse translation, at least two translators participated and conducted cross-check. However, in this study, only one bilingual user (T4) participated. The verifying process of 20 professional experts indicated construction and understandability of contents and items of K-DRIPS.

To the best of our knowledge, the present study is the first study on cross-cultural adaptation and drooling assessment tool development in South Korea. In addition, since the instrument can reflect the Korean culture and also has good psychometric properties, clinicians could use this tool immediately in clinical settings. In the context of swallowing and drooling treatment in South Korea, the K-DRIPS could help OTs to choose proper treatment strategies. For example, when a child drools while eating, clinicians could provide oral motor therapy, whereas when a child drools when in the prone position, postural control and gross motor approaches could be considered. OTs could assess the drooling control of children with CP in various situations and make appropriate decisions individually using the K-DRIPS.

5. Conclusion

The K-DRIPS was successfully translated into Korean and exhibited good content validity and internal consistency. Clinicians could use this drooling assessment tool for children with CP in the South Korean context. Therefore, the K-DRIPS can be considered a useful drooling assessment tool that clinicians can use for children with CP.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Ethical Approval

Ethical approval for the study was obtained from the Ethics Committee of the Institutional Review Board of Wonkwang University (WKIRB-202105-SB-029).

Consent

Written parent consents were collected.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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