Reliability of the Assessment of Mother–Infant Sensitivity—Chinese Version for Preterm and Term Taiwanese Mother–Infant Dyads

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ABSTRACT

Purpose: The objectives of this study were to translate and modify the Assessment of Mother–Infant Sensitivity scale into a Chinese version (modified AMIS-C) and to examine its reliability with preterm and term Taiwanese mother–infant dyads.

Method: A total of 241 mother–infant pairs (179 preterm dyads and 62 term dyads) were prospectively recorded and their behaviour in feeding assessed using the modified AMIS-C when infants were at 4 and 6 months corrected age. A subset of the sample was used for interrater reliability testing, and the whole sample was used for assessment of internal consistency.

Results: Interrater reliability was high for the modified AMIS-C section and total scores (intra-class correlation coefficients = 0.91–0.99). Internal consistency was good to excellent for the maternal section and total score ($\alpha = 0.71$ –0.86) and was fair to good for the infant and dyadic section score ($\alpha = 0.44$ –0.75).

Conclusions: The modified AMIS-C scale is a clinically feasible and reliable instrument for assessing mother–infant interaction of preterm and term dyads during early infancy.

Key Words: assessment, feeding, mother–infant interaction, reliability

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RÉSUMÉ

Objectifs : Les objectifs de cette étude étaient de modifier et de traduire l'évaluation de l'échelle de sensibilité maternelle en langue chinoise (échelle AMIS-C modifiée) et d'analyser sa fiabilité auprès de dyades mère-bébé taiwanaises, avant terme et à terme.

Méthode : Au total, 241 paires mère-bébé (179 dyades avant terme et 62 dyades à terme) ont été inscrites prospectivement et leur comportement au cours de l'allaitement a été évalué à l'aide de l'échelle de sensibilité maternelle (échelle AMIS-C modifiée) chez les enfants à quatre mois et à six mois d'âge corrigé. Un sous-ensemble de l'échantillon a été utilisé pour des tests de fiabilité inter-échelle et l'ensemble de l'échantillon a été utilisé pour l'évaluation de la cohérence interne.

Résultats : La fiabilité inter-échelle était élevée pour la section modifiée d'AMIS-C et pour les pointages totaux (coefficients de corrélation intraclasse = de 0,91 à 0,99). La cohérence interne variait de bonne à excellente pour la portion maternelle et pour les pointages totaux (coefficients alpha = de 0,71 à 0,86). Elle variait d'acceptable à bonne pour les bébés et pour les pointages de la portion dyadique (coefficients alpha = de 0,44 à 0,75).

Conclusions : L'échelle AMIS-C modifiée de sensibilité maternelle est un instrument utilisable et fiable sur le plan clinique pour l'évaluation des interactions mère-bébé des dyades avant terme et à terme chez les très jeunes enfants.

Mots clés : allaitement, évaluation, fiabilité, interaction mère-bébé

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The authors have no conflicts of interest to declare.

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INTRODUCTION

Infants born prematurely with very low birth weight (VLBW, birth weight < 1,500 g) are at risk of developing cognitive, motor, and behavioural problems.^{1–7} Prior studies revealed that several biological (e.g., extreme prematurity, neurological insults, bronchopulmonary dysplasia)^{8–10} and environmental factors (e.g., social class, parental education, parental mental status, family function, home environment) may relate to developmental outcomes for preterm infants.¹¹ Furthermore, parent–child interaction in the family context may also influence preterm infants' later development.^{12–14}

Several studies have documented differences between preterm and term infants in terms of parent–child interaction during infancy. Preterm infants were found to be more easily distressed than term infants and to show less positive affect with their mothers or fathers during social interaction.^{15–17} Meanwhile, mothers and fathers of preterm infants were less sensitive and responsive to their infants' cues and exhibited more interfering and higher controlling than parents of term infants.^{15,16,18,19} While parent–child interaction behaviours have been found to predict subsequent cognitive and behavioural outcome in preterm infants,^{14,20,21} assessment of the quality of parent–infant interaction in preterm infants and their parents is crucial to help clinicians design interventions to enhance parental sensitivity and responsiveness.

Feeding is a frequent activity involving an early stage of interaction between an infant and his/her parent. An effective feeding relationship, characterized by sensitive and responsive behaviour, has been found to support homeostasis and attachment of parent–child dyads.^{22,23} However, there are few studies examining the interaction between preterm infants and their parents during feeding. One study reported that preterm mothers were more likely than term mothers to use verbal and physical behaviours prompting their infants to feed.²⁴ Another found that preterm infants with young gestational ages showed less positive interaction during feeding than those with older gestational ages.²⁵

The Assessment of Mother–Infant Sensitivity (AMIS) scale, consisting of maternal, infant, and dyadic sections, is an observational scale that examines the quality of early mother–infant interaction in a feeding context.²⁶ The scale was found to have acceptable levels of interrater reliability for use with American, Italian, and Swedish term dyads (item agreement > 85%)²⁷ but varying internal consistency ($\alpha = 0.70–0.87$ for the maternal section; $\alpha = 0.29–0.74$ for the infant section; $\alpha = 0.82–0.84$ for the dyadic section).²⁷ The AMIS has several clinical applications, including assessment of feeding behaviour in breastfeeding and bottle-feeding mother–infant pairs,²⁸ evaluation of interactive behaviour of preterm dyads in feeding during hospital stay,²⁵ and identification of feeding difficulty in infants of high-risk parents.²⁹

Although the AMIS has been found to be feasible and reliable for use with Western populations, the question of whether the psychometric properties are applicable to mother–infant dyads of different cultural backgrounds requires investigation. The objectives of the present study, therefore, were to translate and modify the AMIS scale into a Chinese version (modified AMIS-C) and to examine its interrater reliability and internal consistency for assessment of mother–infant interaction in preterm and term Taiwanese dyads during feeding.

METHODS

Participants

The study sample was selected randomly from our longitudinal prospective follow-up study of a cohort of term and VLBW preterm dyads from birth to 2 years of (corrected) age. These dyads were enrolled from the National Taiwan University Hospital, Mackay Memorial Hospital, and Taipei City Hospital, Branch for Women and Children, in Taipei, Taiwan, during the years 2006–2008. The inclusion criteria for VLBW preterm infants were as follows: birth weight < 1,500 g; gestational age < 37 weeks; admission to the study hospital within the first 7 days of life; singleton or firstborn of a twin or higher-order multiple birth; physiologically stable at post-conceptual age (PCA) 36 weeks, as determined by attending physician; hospital discharge prior to PCA 44 weeks; absence of congenital anomalies and/or severe neonatal diseases (including seizures, hydrocephalus, ventriculoperitoneal shunt, meningitis, periventricular leukomalacia, grade III–IV intraventricular haemorrhage, stage IV retinopathy of prematurity, necrotizing enterocolitis with colonostomy, and severe cardiopulmonary disease requiring ventilator use at PCA 40 weeks); and family residence in the greater Taipei area. Inclusion criteria for term infants were birth weight > 2,500 g; gestational age 38–42 weeks; absence of serious prenatal or perinatal complications; and family residence in the greater Taipei area. Additional selection criteria for study families of all infants were as follows: mother > 18 years of age; absence of history of maternal substance abuse at any time (e.g., alcohol and drug abuse); and parents married at the time of delivery. The study was approved by the Ethics Committees of the participating hospitals, and informed consent was obtained from each infant's parent at study enrolment.

Testing Procedure and Instrument

All mother–infant dyads were asked to come to our laboratory for observation of their interactive behaviour during feeding when infants approached corrected age 4 and 6 months. Mothers were instructed to bottle- or breastfeed their child as they normally would at home. Each mother sat in the same chair while feeding her baby. Mother–infant interaction during feeding was

recorded by means of a video camera positioned 2 m from the dyad to capture the mother's upper body and the infant's whole body. Videotaping began when the infant first latched onto the breast or bottle (initiation) and was terminated after completion of feeding or when the mother burped the infant (termination).

The AMIS assessment has three sections—maternal (15 items), infant (7 items), and dyadic (3 items)—each using a five-point rating scale; higher scores indicate more responsive and reciprocal interactions between mother and infant.²⁶ The maternal items include spatial distance of the contact position (e.g., ventral/ventral contact or side/ventral contact between mother and infant); predominant mood/affect; verbalization; visual interaction behaviour; modulation of infant distress; holding, caregiving, and burping style; and frequency and manner of stimulation to feed. The infant items are predominant state, mood/affect, vocalization, visual interaction behaviour, distress, posture, and response to stimulation to feed. The dyadic items are synchrony in response to pleasure affect, regulation of feeding at initiation, and regulation of feeding at termination (i.e., how mother and infant initiate or terminate the feeding session and how they respond to each other).²⁶

Translation and modification of the AMIS to produce the modified AMIS-C took place in two stages. First, three research assistants with a background in physical therapy or psychology assisted in translating the AMIS and applying it to five mother–infant dyads. This work was guided by one of the investigators who is a child development expert (HCH) to verify the removal or addition of items. First, one maternal item—"maternal visual interaction behaviour"—was modified to "maternal visual contact," because our mothers frequently used visual contact in interaction. We then moved the original item into the dyadic section to measure the visual interaction behaviour between mother and infant. Second, two maternal items—"manner of stimulation to feed" and "frequency of stimulation to feed"—were modified to "manner of stimulation during pre-feeding and feeding" and "timing of stimulation to feed," because our mothers seldom used stimulation during feeding. Subsequent application of the modified AMIS-C scale in another 18 feeding trials showed good agreement (80–100%) on 18 items but low agreement (60–80%) on 5 items. Further modification was performed, including deletion of two maternal items and one infant item and modification of rating criteria for three maternal items. Application of the second version to another six feeding trials revealed high interrater reliability, with agreement of each item ranging from 83% to 100%. In its final form, the modified AMIS-C consisted of 13 maternal items (spatial distance; holding style; predominant maternal mood; maternal verbalization—tone; maternal verbalization—content; maternal eye contact; maternal modulation of distress episodes; caregiving style; stimu-

lation to feed—initiation; stimulation to feed—during feeding; maternal response to changing activity levels of infant; burping style; and timing of stimulation to feed); 6 infant items (infant state, predominant infant mood, infant vocalization, infant distress, infant visual behaviour, and infant posture); and four dyadic items (synchrony in response to pleasure affect; regulation of feeding—initiation; regulation of feeding—termination; and dyadic visual interaction).

Two research assistants (A and B) served as the raters in the interrater reliability study. Rater A has a background in physical therapy, while rater B has a background in psychology. Rater B had participated in the translation and revision work; rater A, who did not participate in these stages of the project, was trained by rater B on the use of the modified AMIS-C, including an introduction to the coding procedure and rating criteria for each item.

Two aspects of reliability were investigated for the modified AMIS-C: interrater reliability and internal consistency. The interrater reliability investigation required that rater A and B independently score the feeding video records of 10 preterm dyads (five at 4 months' corrected age and another five at 6 months' corrected age) and 10 term dyads (five at 4 months' corrected age and another five at 6 months' corrected age). These 20 dyads were selected randomly from the whole sample. For assessment of internal consistency of the modified AMIS-C, rater A scored the feeding video records of the whole sample at 4 and 6 months' corrected age.

Statistical Analysis

Perinatal and demographic variables were compared between preterm and term groups using *t*-tests for continuous variables and chi-square tests for categorical variables. The interrater reliability of the modified AMIS-C was examined using intraclass correlation coefficient (ICC) and standard error of measurement (SEM) with a 95% confidence interval (CI). The ICC (2,1) was chosen for the interrater reliability analyses, in which both subjects and raters were treated as independent factors.³⁰ A correlation coefficient greater than 0.75 was taken to indicate excellent reliability; values between 0.40 and 0.75 to indicate fair to good reliability; and values below 0.40 to indicate poor reliability.³¹

The modified AMIS-C scores obtained by rater A from the whole sample at 4 and 6 months' corrected age were examined using Cronbach's alpha coefficient to establish internal consistency of section and total scores. Values of alpha greater than 0.8 were taken to indicate excellent internal consistency; values between 0.60 and 0.80 to indicate good internal consistency; values between 0.40 and 0.60 to indicate fair internal consistency; and values below 0.40 to indicate poor internal consistency.³² The Statistical Analysis System for Windows, version 9.1 (SAS

Table 1 Modified AMIS-C Section and Total Scores for Term and Preterm Dyads

	<i>Term</i>		<i>Preterm</i>	
	<i>4 Months</i>	<i>6 Months</i>	<i>4 Months</i>	<i>6 Months</i>
Maternal	50.07 ± 3.33	52.02 ± 4.90	51.29 ± 3.27	51.80 ± 5.80
Infant	18.73 ± 2.58	21.05 ± 3.78	19.63 ± 2.62	20.04 ± 4.12
Dyadic	11.30 ± 7.32	12.52 ± 3.26	11.98 ± 8.56	12.04 ± 2.62
Total	80.09 ± 4.45	85.89 ± 9.93	82.89 ± 5.30	83.88 ± 9.74

Modified AMIS-C = Modified Assessment of Mother–Infant Sensitivity—Chinese version

Institute, Cary, NC) was used for statistical analysis in this study.

RESULTS

Participant Characteristics

A total of 241 mother–infant dyads (179 VLBW preterm infants and 62 term infants) were included in this study. Infants in the preterm VLBW group were born at an average of 30 ± 3 weeks' gestation and weighed on average $1,151 \pm 256$ g at birth; term infants were born at an average of 39 ± 1 weeks' gestation and weighed on average $3,222 \pm 344$ g at birth. Preterm VLBW infants had lower 1-minute (6.0 vs. 9.3) and 5-minute (8.0 vs. 9.5) Apgar scores than term infants (all $p < 0.05$). Preterm infants were comparable to term infants with respect to maternal age (32.4 vs. 31.8 years) and paternal age (34.8 vs. 34.3 years); proportion of male gender (48% vs. 59%); and first birth order (52% vs. 60%) (all $p < 0.05$). Both mothers (85% vs. 70%) and fathers (89% vs. 64%) of term infants were more likely to have post-secondary education than those of preterm infants (both $p < 0.05$).

Means and standard deviations for the modified AMIS-C section and total scores for term and preterm dyads at 4 and 6 months' corrected age are given in Table 1.

Table 2 Interrater Reliability for Modified AMIS-C Section and Total Scores

	<i>ICC (95% CI)</i>	<i>SEM (95% CI)</i>
Section score		
Maternal	0.97 (0.87–0.99)*	1.5 (0.9–3.0)
Infant	0.91 (0.69–0.98)*	1.7 (0.8–3.0)
Dyadic	0.91 (0.67–0.98)*	1.7 (0.8–3.0)
Total score	0.99 (0.96–1.00)*	1.7 (0.0–3.5)

Modified AMIS-C = Modified Assessment of Mother–Infant Sensitivity—Chinese version; ICC = intraclass correlation coefficient; CI = confidence interval; SEM = standard error of measurement

* $p < 0.05$ for all ICCs

Interrater Reliability

Interrater reliabilities for the modified AMIS-C section and total scores are presented in Table 2. The ICCs were above 0.90 for the section and total scores, and SEMs were below 1.7 for the section and total scores.

Internal Consistency

Internal consistency values for the modified AMIS-C section and total scores are presented for term and preterm dyads at 4 and 6 months of corrected age in Table 3. Among term dyads, Cronbach's alpha coefficients were 0.71–0.86 for the total score, 0.72–0.80 for the maternal section, 0.54–0.71 for the infant section, and 0.46–0.55 for the dyadic section. Among preterm dyads, alpha coefficients were 0.81–0.84 for the total score, 0.81–0.82 for the maternal section, 0.58–0.75 for the infant section, and 0.44–0.47 for the dyadic section.

DISCUSSION

The modified AMIS-C showed a high degree of interrater reliability when used with Taiwanese preterm and term mother–infant dyads (ICC > 0.90; SEM < 1.7). Our results are consistent with previous findings on the use of the original or modified AMIS with infants in Western countries. For example, acceptable interrater reliabilities have been reported for use of the scale with American infants (92–94% agreement)¹⁸ and Italian infants (88%–

Table 3 Internal Consistency of the Modified AMIS-C Section and Total Scores for Term and Preterm Dyads*

	<i>No. of Items</i>	<i>Term</i>		<i>Preterm</i>		<i>Total</i>	
		<i>4 Months</i>	<i>6 Months</i>	<i>4 Months</i>	<i>6 Months</i>	<i>4 Months</i>	<i>6 Months</i>
Maternal	13	0.72	0.80	0.81	0.82	0.79	0.81
Infant	6	0.54	0.71	0.58	0.75	0.57	0.74
Dyadic	4	0.46	0.55	0.44	0.47	0.45	0.50
Total	23	0.71	0.86	0.81	0.84	0.79	0.84

Modified AMIS-C = Modified Assessment of Mother–Infant Sensitivity—Chinese version

* Data are presented as Cronbach's alpha coefficients.

93% agreement).²⁰ Furthermore, the scale has been modified for assessment of Swedish preterm mother–infant dyads, achieving an average interrater agreement of 91%.¹⁹ In our study, raters with a background in physical therapy or psychology were trained for a total of 20 hours. The high interrater reliability of the modified AMIS-C indicates that through a short training course, professionals with knowledge of paediatric development can achieve a high degree of consistency in using the modified AMIS-C with Taiwanese term and preterm dyads. The modified AMIS-C has the advantage of easy administration, which may make it feasible for use in follow-up clinics.

Internal consistency was good to excellent for the maternal section and for the entire modified AMIS-C, and fair for the infant and dyadic sections, with term and preterm dyads at 4 and 6 months' corrected age. Price reported good to excellent internal consistency for the maternal and dyadic sections of the AMIS and varying degrees of internal consistency for the infant section.¹⁸ Because approximately one-fourth of the original items were revised and two items were added to the modified AMIS-C, we attribute this discrepancy to changes in the structure of test items in the three AMIS sections. Our results indicate that the maternal section and the overall modified AMIS-C are both satisfactory for assessing the quality of mother–infant interaction during feeding of preterm and term Taiwanese infants. The infant and dyadic sections, however, cannot be used independently of the overall score.

Because internal consistency may be related to the average correlation among items and to the number of items, the low alpha coefficient values obtained for the infant and dyadic sections may be due to low correlations among items or to an inadequate number of items. The maternal section generally showed higher internal consistency values than either the infant section or the dyadic section, which may be due in part to the larger number of items in the maternal section. Furthermore, the performance of infants and mother–infant interaction may relate to the status of infants. During the observed feedings, many infants were sleepy and showed minimal vocalizations, movement, and visual interaction behaviour. Scores on some items (infant state, infant vocalization, infant visual behaviour, dyadic synchrony in response to pleasure affect, dyadic visual interaction) were lower for these infants than for those who were alert.

Internal consistency values for section and total scores increased for all mother–infant dyads from 4 months to 6 months; the infant section showed the greatest increase (from 0.57 to 0.74). Infants were more alert during feeding at 6 months of age and demonstrated more and better behaviour performance, including more vocalization, more movement of extremities,

and more eye contact with their mothers. At 4 months' corrected age, variation was smaller for infant scores (2.58 for term infants, 2.62 for preterm infants) than for scores in other sections (3.27–8.56). At 6 months' corrected age, variation was smaller for dyadic scores (3.26 for term infants, 2.62 for preterm infants) than for scores in other sections (3.78–5.80). The limited variation in both infant and dyadic scores may also explain the lower correlations among items.

The small number of test items may also contribute to the lower internal consistency of the infant and dyadic sections. Nunnally's³³ formula provides a means of estimating the number of items required to achieve greater reliability. The formula is given as $k = [r_{kk}(1 - r_{ll})] / [r_{ll}(1 - r_{kk})]$, where r_{kk} is the desired reliability, r_{ll} is the reliability of the existing test, and k is the number by which of the original number of items would have to be multiplied in order for the test to achieve reliability of r_{kk} . The assumption is that the average correlation among the original items in the existing test is the same as the average correlation among the items of the revised test. For the modified AMIS-C, the infant section consists of six items ($\alpha = 0.57$ for all dyads at 4 months) and the dyadic section consists of four items ($\alpha = 0.45$ for all dyads at 4 months). To achieve good reliability ($\alpha = 0.60$), the number of items in the infant section would need to be multiplied by 1.1, to include at least seven items, and the number of items in the dyadic section multiplied by 1.8 times, to include at least eight items. Adding one item to the infant section and four items to the dyadic section would likely increase the time needed for scoring.

LIMITATIONS

The observational data in the current study consisted of videotaped feeding interactions. One potential limitation of the study may arise from the reactions of mothers, infants, or both to the observation context; mothers and infants in the study may have interacted differently because they were aware of being observed or because of the novelty of the observational setting. In addition, one rater had participated in the translation work and modification work before administering the modified AMIS-C in the context of the study, which may have introduced bias into the evaluation process.

CONCLUSIONS

The results of this study demonstrate high levels of interrater reliability and acceptable levels of internal consistency for the modified AMIS-C scale when used with term and preterm Taiwanese mother–infant dyads. A training course and scoring criteria have been established to provide a basis for training potential users of

the scale. Future research should examine the validity of the modified AMIS-C in infants who are at risk of feeding problems.

KEY MESSAGES

What Is Already Known on This Topic

Previous studies have shown differences between preterm and term infants in terms of their social interaction. However, there has been limited investigation of preterm infants' interaction with their mothers during feeding. The Assessment of Mother–Infant Sensitivity (AMIS) is an observational scale that examines the quality of mother–infant interaction in a feeding context. Clinical feasibility and reliability have been demonstrated for its use with several Western populations.

What This Study Adds

The results of this study demonstrate high degrees of interrater reliability and acceptable levels of internal consistency for the modified Assessment of Mother–Infant Sensitivity—Chinese version when used with term and preterm Taiwanese mother–infant dyads.

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