Original Article

The Study of Psychometric Properties of the Persian Version of Communication and Symbolic Behavior Scale Developmental Profile /Infant Toddler Checklist: An Application of Confirmatory Factor Analysis with Skew Distribution

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ARTICLE INFO

ABSTRACT

Introduction: The importance of early detection and intervention of communication and language problems has increased the need for appropriate tools in this area.
This study with aim to evaluating the psychometric properties of Persian version of the Communication and Symbolic Behavior Scales Developmental Profile (CSBS DP) infant/ toddler questionnaire has been done.
Methods: In a cross-sectional study the Persian version of the CSBS DP was submitted to 157 participants randomly drawn from 8 kindergartens of Tehran city (Iran) in year 2020. Internal consistency, reliability, concurrent validity, and construct validity were evaluated. Concurrent validity was explored with total score of two questionnaires (Ages and Stages Questionnaire (ASQ) and MacArthur-Bates Communicative Development Inventory (CDI)).
Results: The correlation between CSBS DP questionnaire with ASQ-3 and CDI were 0.88 and 0.64 respectively. The test-re-test reliability and internal consistency were 0.78 and 0.77 respectively. The confirmatory factor analysis showed adequate construct validity of the Persian version of the CSBS DP questionnaire. RMSEA, GFI and AGFI were <0.000, >0.9 and >0.9 respectively; moreover, other indexes were satisfactory.
Conclusion: The results of this study showed that the validity and reliability of Persian version of CSBS DP questioner is approved and these tools can be used for early detection of evaluating language problems in in infant toddler.

Introduction

Delay in communication skills is one of the most common developmental disabilities seen in 5 to 10% of children fewer than three years of age.[1] Speech and language delay in children is associated with increased difficulty with reading, writing, attention, and socialization.[2] Numerous studies support the role of prevention, early detection and intervention

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of communication and language problems.[3,4] Assessment and treatment of children's communication problems involve cooperative efforts with others such as psychologists, parents, social workers, audiologists, social workers, special education teachers, classroom teachers, physicians, guidance counselors, dentists, physicians and nurses.[5] Prior to language and speech acquisition, children communicate with others through Pre-lingual skills such as crying, laughing, eye contact, snoring, and joint attention. Pre-lingual skills form the basis of communication and enhance a person's language and social skills throughout life.[6] Using symbols in the form of words, gestures and gestures makes it possible to transfer from pre-verbal skills to linguistic communication.[7]

Skills such as the use of gestures,[8] joint attention,[9] vocalization,[10] and symbolic games[11] before 12 months provides the ground for the development of spoken and received language. Individual differences in pre-lingual skills seem to predict future language development.[12] The importance of early detection and intervention of communication and language problems has been confirmed in several studies.[13] In most cases, children who are referred to intervention and treatment centers because of parental concerns about speech and language development are older than two years and show no sign of major developmental disability in infancy. However, paying attention to pre-lingual skills before children say the first words is important in early detection of developmental delays and communication problems.

In Iran, there are few tools for screening and early detection of communication skills for children under the age of two, including the Communicative Development Inventory (CDI)[14] and the Early Social Communication Scale (ESCS).[15, 16] Other available tools are designed for older children to assess children's language and social skills, so it seems necessary to have a standard tool that matches the linguistic and cultural characteristics.

One of the appropriate tools in this field is the Communication and Symbolic Behavior Scales Developmental Profile (CSBSDP).[17] This tool is designed to assess the predictors of the development of speech, language and basic communication skills in children aged 6-24 months.

Because CSBS DP assesses the communication skills of young children, and given the predictive role of early communication problems in developmental delays and the relatively quick and easy implementation of this scale by parents, as well as the early detection of children with Special needs addressed by specialists and therapists. The need to achieve a standard scale that has the ability to quickly and timely detect delays in communication skills.[17] Therefore, the present study was conducted with the aim of study the psychometric properties of the Persian version of CSBSDP has been done.

Material and Methods

This cross- sectional study has been done in year 2020 on children under the age of two years old. The samples have been selected using cluster random sampling method.

At first, a list of kindergartens in Tehran city was prepared from the Welfare Organization, then in first stage, 8 kindergartens were randomly selected from sampling list, and in second stage, 20 samples from each kindergarten were randomly selected. In this study, parent's literacy, willingness to cooperate and lack of physical and mental illness in parents and their children were considered as inclusion criteria.

In the present study, participants responded to the 3 questioner (1-Communication and Symbolic Behavior Scales Developmental Profile (CSBSDP), 2-Ages and Stages Questionnaire (ASQ) and 3- MacArthur-Bates Communicative Development Inventory (CDI)).

Approval to conduct the study was obtained from the Tehran University of Medical Sciences Ethics Committee. The Participants were briefed about the aim of the study. They were assured of their privacy and also informed that they could withdraw from the study without any problem.

Statistical Analysis and Sample size

Data were analyzed in IBM SPSS Software Version 21 and Open BUGS version 3.2.3. Descriptive and analytic statistics was used. In this study, normality of the quantitative variables was evaluated by the Kolmogorov–Smirnov (K-S) test. A P-value less than 0.05 have been considered as significant different. The Spearman correlation has been used for concurrent validity and test-re-test reliability.

In this study, confirmatory factor analysis (CFA) was performed by considering the multivariate skew normal distribution (due to data asymmetry). In this prospective study, instead of multivariate normal, the multivariate skew normal distribution which was defined by Azzalini et al[18] has been used. Considering a CFA with one latent variable (F) and 3 indicator variables (y_1, y_2, y_3), where $\epsilon=(\epsilon_1,\epsilon_2,\epsilon_3$), ϵ~Skew Normal $(0,\Sigma,\lambda)$, where $\lambda=[\lambda_1,\lambda_2,\lambda_3]$ is parameter of skewness:

$$y_1=\beta_1\times F+\epsilon_1$$
$$y_2=\beta_2\times F+\epsilon_2$$
$$y_3=\beta_3\times F+\epsilon_3$$

To fit the hierarchical Bayesian model in Open BUGS software according to the Azzalini et al[18] lemma, first generate F~N$(0, \sigma_F^2$) and X~N$(0,1)$. Then the vector μ is calculated as follows

$$\mu=[\mu_1,\mu_2,\mu_3]=[\beta_1\times F+\lambda_1 X,\beta_2\times F+\lambda_2 X,\beta_3\times F+\lambda_3 X]$$

Then the y distribution considered as multivariate normal distribution with mean μ and covariance matrix Σ. In this study, the Nikpour et al study[19] prior distribution for $\beta=[\beta_1,\beta_2,\beta_3],\lambda=[\lambda_1,\lambda_2,\lambda_3]$, σ_F^2 and Σ considered as study prior distribution.

In this study factor analysis evaluated by Goodness of Fit Index (GFI>0.9), Adjusted Goodness of Fit Index (AGFI>0.9) and the Root Mean Square Error of Approximation (RMSEA<0.05).[20] In CFA analysis the rule of thumb for sample size is the 5 sample for each question. Considering these rules, 24×5=120 sample size is needed. Considering 30% drop up sample, we add 40 samples in optimal sample size, so we totally considered 160 samples.

The Tools Communication and Symbolic Behavior Scales Developmental Profile (CSBS DP)

This scale is used to assess predictors of speech, language and basic communication skills development in children aged 6-24 months.[21] The tool is to be completed by a caregiver, who may be either a parent or other person who nurtures the child on a daily basis. The Checklist takes about 5 to 10 minutes to complete. For caregivers who cannot answer the questions by reading them or writing the responses, the questions may be presented in an interview format with adequate explanations to clarify what is being asked. The CSBSDP Checklist is designed to measure the following 7 language predictors have been identified:

1- Emotion and Use of Eye Gaze, 2-Use of Communication, 3- use of gestures, 4- use of sounds, 5-use of words, 6- understanding of words and 7- use of objects.[17]

In the present study, an Infant toddler CSBSDP checklist of scales translated by Hassanzadeh et al[22] was used. This questionnaire contains 24 questions (often=2, sometimes=1, never=0), and in each question parents must answer. The questions are arranged according to the cultural characteristics of the Persian language and we try to use familiar and widely used words for Persian-speaking children in the examples. If parents have not observed the desired skill in their child at the time of the questionnaire, they should never choose the option, and if they repeatedly observe the desired behavior, the option is often assigned to the relevant question.   Scores are calculated in three subscales of communication, expressive speech and symbolic.[17, 22]

Ages and Stages Questionnaire (ASQ)

The ASQ is a parent reported initial level developmental screening instrument consisting of 20 intervals, each with 30 items in five areas (personal social, gross motor, fine motor, problem solving and communication) for children from 2-60 months, designed and developed in response to a growing need for early and accurate identification of children who have developmental delays or disorders. The ASQ has been translated into several languages.[23, 24] It has excellent psychometric properties, test-retest reliability of 92%, sensitivity of 87.4%, and specificity of 95.7%. Its validity has been examined across different cultures and communities across the world. ASQ is an easy test that can be completed by parents in 12-18 minutes.[23, 25] The Persian

version was translated by Sajedi et al study[26]. In 2006 and its reliability, determined by Cronbach's alpha, ranged from 0.76 to 0.86 and the inter-rater reliability was 0.93. The validity determined by factor analysis was satisfactory. In Ghazi et al study,[27] the Cronbach's alpha coefficients has been reported in the range of 77% to 93%.

MacArthur-Bates Communicative Development Inventory (CDI)

This scale provides information about the language, expression, and symbolic moods and behaviors of young children (children aged 8-16 months).[28] This tool was also used to evaluate the simultaneous validity of the Persian version of the CSBSDP baby-infant questionnaire. This scale includes sub-scales of phrases, vocabulary comprehension, vocabulary expression, general gestures, basic gestures, and advanced gestures completed by parents. In Kazemi et al study,[14] the reliability coefficients for different sections of CDI-infant form were computed respectively from the lowest (α=0.43) to the highest (α=0.98) in regard of general gestures and vocabulary comprehension.[14]

Demographic Checklist

This checklist was prepared by researchers and includes demographic information such as parents' education, number and children order and basic communication language. The demographical distribution of parents and children

Results
Descriptive analysis

This study was performed on 157 children. In

this study, children were classified into three age groups: 12-16 months (22 girls and 25 boys), 21-17 months (26 girls and 31 boys), and 24-22 months (28 girls and 25 boys)., the demographical distribution of parents and children has been presented in Table1. According to this table, the highest percentage for parent's education (mother: 41%, father: 47%) belonged to associate degree or bachelor's degree. 71% of the children were the first child and 89% of the parents used only Persian language to communicate with their child.

Table1. The demographical distribution of parents and children

Variables	N	%
Mother education		
Diploma or under diploma	44	28%
Associate Degree or bachelor's degree	64	41%
Bachelor's or Master's degree	36	23%
PhD or upper	13	8%
Father education		
Diploma or under diploma	33	21%
Associate Degree or bachelor's degree	72	46%
Bachelor's or Master's degree	42	27%
PhD or upper	9	6%
Children order		
First	111	71%
Second	36	23%
Third or higher	9	6%
Basic communication language		
Persian	140	89%
Non Persian	17	11%

Validity
Concurrent validity

The Concurrent validity of the Persian version of CSBS DP was examined based on the relationship with age and stage scales - Third

Edition (ASQ-3) as well as the Communication Evolution (CDI) questionnaire to determine concurrent validity. In this stage, at first the total scores of ASQ-3 and CDI were calculated then the Spearman correlation of these two scores was calculated with different domain of Persian Edition of the CSBS (social, speech, symbolic and total). In this study, the Spearman correlation coefficient was obtained from 0.52 to 0.88 (see Table 2). The strongest association was observed between ASQ-3 and speech as well as between CDI and speech. The correlations in these criteria also show large impact sizes.

Table 2. The correlations among the total score of ASQ-3 and CDI with different domain of Persian Edition of the CSBS (social, speech, symbolic and total)

Domain	ASQ-3	CDI
Social	0.82**	0.52**
Speech	0.87**	0.61**
Symbolic	0.87**	0.66**
Total	0.88**	0.64**

**P-value<0.01

Construct validity

The CFA was also conducted to assess the factorial structure of CSBSDP questionnaire and the results were shown in Figure 1. This was done by the hypothesized model and comparing it to the covariance matrix based on the empirical data. Regarding these findings, the finding CFA indicated excellent goodness of fit results for this data.

Reliability
Test–retest reliability

The number of 30 parents were asked to complete the CSBS DP questionnaire twice

(at two weeks intervals). The result is shown in Table 3, as it is seen for total score, r=0.78 (P<0.001) which is good reliability index.
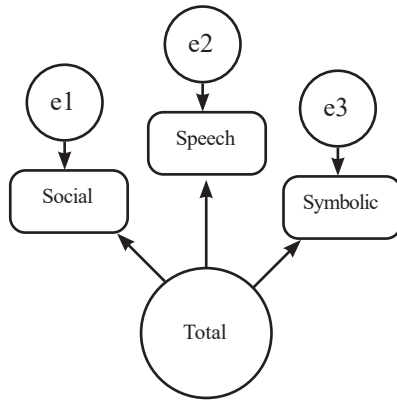
RMSEA<0.000, GFI, AGFI>0.999 Chi-square=0.000

Figure 1. Standard Path way estimation of CFA Reliability

Internal consistency

The internal consistency indices for the domains of the CSBSDP questionnaire were presented in Table 4. Based on our findings, the calculated internal consistency for all domains met or exceeded the minimum level of acceptable value.

Discussion

Due to the lack of Persian version of diagnostic tools and screening of preverbal skills in children under two years of age,[21] the aim of this study was to investigate the psychometric properties of the Persian version of Communication and

Table 3. Test–retest reliability of the Persian Edition of the CSBS DP

Domain	Follow-up test		Initial test		Correlation
	SD	Mean	SD	Mean	
Social	3.10	21.48	3.71	18.97	0.64**
Speech	2.52	10.81	2.89	7.73	0.72**
Symbolic	2.49	12.66	3.12	9.43	0.75**
Total	7.19	44.95	8.45	36.13	0.78**

**P-value<0.01

Table 4. Generalizability (g) coefficients for the behavior samples on the Persian Edition of the CSBS DP.

Variables	g-coefficient
Social	0.78
Emotion and eye gaze	0.82
communication	0.71
Gestures	0.78
Speech	0.74
Sounds	0.83
Words	0.84
Symbolic play	0.74
Object use	0.74
Comprehension	0.74
total	0.77

Symbolic Behavior Scale Developmental Profile Infant/ toddler Checklist. The results indicate the appropriate test-retest capability of this tool. Also, the high correlation between the three subscales and the total score indicates the appropriate content validity of this tool. Social subscales, speech, symbolic behavior, and total score are strong predictors of ASQ-3 and CDI instrument scores, which is a good predictor of CSBS DP predictive validity. The present findings are consistent with the Wetherby et al,[17, 29] Chambers et al study[30] and Lin et al studies.[31]

The findings of the present study show that the three subscales of social, symbolic behavior and speech predict developmental skills for 5 months after assessment and the subscale of speech has a higher validity and reliability to predict expressive, receptive and communication language skills, scored by ASQ-3 and CDI tools.

One of the main reasons is the way Iranian parents interact with the child. Most Persian parents use speech to communicate with the child and use less non-verbal cues such as eye contact and gestures, which explains the lower score of the social subscale in content validity.[32] Parents' fear of the toy being put in the mouth by the infant leads to the fact that playing with objects is less important in Persian infants, which confirms the lower score of validity between the subscales of the symbolic behavior.[33]

One of the strengths of this study was the performance of various validity and reliability methods as well as the use of CFA with multivariate skew normal distribution.

One of the limitations of the present study was the use of small sample size (less than 200 samples) and also most of the participating parents had higher education and higher economic status than the average population. These challenge the generalization of the results to other people. Therefore, more studies are needed to evaluate the validity and reliability of the Persian version of the CSBS DP scale on a heterogeneous group that is a more accurate representative of the Persian community and both parents participate in the study.

Conclusion

The results of this study showed that the validity and reliability of Persian version of CSBS DP questioner is approved and these tools can be used for early detection of evaluating language problems in infant toddler.

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