Original Article

The Percentage of Vowel correct Scale in Persian Speaking Children

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Objectives: The Percentage of vowel correct (PVC) is one of the indices in the development of articulation and phonological skills in children that can be measured with speech samples that could be extracted from the single word or connected speech tests. The aim of this study is to introduce the PVC scale in Persian speaking children and investigate its validity and reliability.

Methods: This validation study was conducted on 387 monolingual Persian speaking children aged between 3-6, that were selected from 12 nurseries and kindergartens in north-western of Tehran. The instrument for measuring PVC was Phonological Picture naming Test which its Content Validity Ratio (CVR) was assessed by Speech Language Pathologists and linguists. The comparison PVC scores in with and without phonological disorders (using Independent t-tests) and the relationship of PVC scores with age (using Kruskal Wallis test) was used for determining construct validity of the scale. Test-retest and scoring-rescoring were assessed, using Spearman's correlation coefficients, intra-class correlation coefficients (ICCs), standard errors of measurement (SEMs) and coefficients of variations (CVs).

Results: Construct validity was confirmed with a significant difference between PVC scores of Children with and without phonological disorders (respectively: P<.001 and P<.05) and different age groups. Spearman's correlation coefficients, intra-class correlation coefficients (ICCs), standard errors of measurement (SEMs) and coefficients of variations (CVs) for test– retest respectively were (.65,.65,.48,.08) and for scoring-rescoring respectively were (.71,.69,.33,.08).

Discussion: Results show that the PVC Scale is probably to be a reliable and valid instrument for evaluating articulation competence of Persian speaking children in clinical settings and research projects.

Key words: phonology, articulation and phonological disorder, Percentage of vowel correct

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Introduction

A glance on Speech Sound Disorders(SSD) literature shows that there is a small group of children with vowel production difficulties (1). Nonetheless, this group of children should be diagnosed early because any delay or deviant in vowel development is considered as a sign for developmental apraxia (2-4). Shriberg & Kwiatkowski introduced the Percentage of Vowel Correct (PVC) as one of the components in Articulation Competence Indices (ACI) (3, 5). Based on their method, the PVC is calculated through dividing the number of pronounced correct vowels by the total number of pronounced correct and incorrect vowels multiplied by 100. The PVC index values have been investigated and reported in a number of English and non - English speaking children populations (4, 6-10).

According to the importance of preparing Persian normative data (11, 12) as a basis for drawing the natural articulation and phonological developmental curves, and the lack of a reliable and valid instrument for gathering these data in Persian language, the Diagnostic Evaluation Articulation and Phonology (DEAP) is adapted and validated to Persian for 3-6 year old children in Tehran as a

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study for the first author's PhD dissertation. The DEAP test is one of the most useful and popular instruments is designed to evaluate articulation and phonological ability and to provide a differential diagnosis of speech disorders for children aged 3;0- 6;11 years. The DEAP test includes a series of assessments. The Phonological Picture naming Test (PPT), one of the assessments in DEAP test, examines phonological abilities (i.e. the ability to use sounds in context) by identifying and classifying error patterns and calculating the Percentage of Consonant Correct (PCC), the PVC and the Percentage of Phoneme Correct (PPC).

This study aimed to introduce the PVC index in Persian speaking children and to report its psychometric properties in 3-6 Persian speaking children in Tehran.

Methods

A total number of 387 boys and girls aged between 35-72 months, from 12 nurseries and kindergartens in Tehran participated in the study. This age range was chosen according to the most frequent reported speech disorders (13). The sample contained 191 boys (49.36%) and 196 girls (50.64%).12 groups was designed by age and gender. All children were given an information letter and a consent form to take home to be signed by their parents or guardians. Only monolingual Persian speaking children, not currently attending speech therapy, were included in the study. Parents were invited to attend the assessment. In order to reach quotas in terms of age and gender, participants were randomly selected among children whose parents or guardians had signed consent form. Subjects had no orofacial structural deficit (e.g., cleft palate), hearing loss, Persian as a second language, autism spectrum disorder, or dysarthria. These were determined by their medical records, history, and clinical examination. No specific cutoff for cognitive skill was determined for inclusion in the study. Participants needed to attend clinics for the duration of the Phonological Picture naming Test (PPT) (14), attempt the imitation, and tolerate cuing. Participants were tested individually in a quiet room in the nurseries and kindergartens. Table (1) presents the descriptive data of age groups for all participants.

Table1. Demographic characteristics of participants by age

Age group (month)	N	Mean age (month/day)	SD	percent
35-42	60	39.3	1.89	15.50
43-48	82	45.6	1.51	21.18
49-54	60	51.3	1.64	15.50
55-60	68	57.3	1.67	17.57
61-66	61	63.5	1.73	15.76
67-72	56	69.3	2.18	14.47
total	387	53.7	10.09	100

2 graduate and 1postgraduate students tested children. The examiners were trained to ensure consistency. Precise instructions were given on sampling, phonetic transcription, elicitation techniques, and scoring. PPT was administered to all participants. Responses to the speech tasks in the PPT were recorded on a COBY MP3 (MPC-7405) digital audio recorder. The PVC was calculated based on the procedure mentioned in attachment (1).

Attachment 1. Procedure of calculating PVC

(PVC)

Target Vowels (V.) = 84

1- Count the number of Vowels in words not elicited (a);
2- Calculate the total number of Vowel elicited (b) using the formula:
84- (a)= (b)
3- Count the number of Vowels in error (c);
4- Calculate the total number of correct Vowels (d)
using the formula (b)- (c)= (d)
5- Calculate PVC using the formula (d)÷ (b)× 100

Audio-Video recordings were also made to allow the revision of transcription difficulties and transcription reliability measurement. The open access Gold Wave software (Digital Audio Editor-5.67) was used for detailed analysis and refining the audio recorded sounds. The examiners (SLP)

reviewed each transcription with reference to the audio-video recorded samples to ensure the accuracy of online transcriptions.

Content validity Ratio (CVR) of the PVC scale was evaluated by expert's opinion (4 Speech Language Pathologist (SLP) and 7 linguists). Evidence for construct validity was based on two priori assumptions. Firstly, it was assumed that PVC as a developmental scale would have a significance relationship with age in a positive direction. The Kruskal- Wallis test was conducted to examine the relationship of the PVC and 6 age groups. Secondly, it was assumed that, PVC would have a significant difference between individuals with and without SSD. Procedure of diagnosing children with and without SSD was conducted by 3experienced SLPs. Independent t-test was used to analyze the difference of PVC between the two groups. Alpha level was set at 0.05 for all statistical procedures.

For reliability, temporal consistency was evaluated through test–retest procedure (intra-judge) and content consistency was evaluated through rescoring (inter-judge) data from the first administration of the PPT. Among the total number of studied children, 52 participants (12.9%) were randomly selected for test- retest reliability assessment. The time-interval between the two test sessions was from 1 to 2 weeks. For scoring-rescoring reliability, audio recordings of 70 children (18.6%) were analyzed and scored by two raters independently. Spearman coefficients, Intra Class Correlation coefficients (ICCs), Standard Errors of Measurement (SEM) and Coefficients of Variations (CV) were estimated as measures of reliability between repeated assessments of the same variable.

Results

Validity The CVR of the PVC scale was more than 99.7 (based on expert's opinion invalidation P-DEAP).In order to evaluate construct validity the relationship between age and the PVC was measured. The relationship between age and the PVC. The results of Kruskal- Wallis tests for comparing PVC values among age groups showed that the PVC values were significantly increased in higher age groups. It could be concluded that with increasing age, the rate of PVC was increased as well ($p < 0.05$). Additionally, the result of independent t-test for comparing the PVC values between children with and without SSD showed significantly difference ($t = 2.140$, $p < 0.04$, $df = 29$).

Reliability The reliability was assessed through test–retest and scoring- rescoring. Calculating the PVC twice showed an acceptable correlation between the two administrations (table 2).

Table 2. The result of studying correlation between the test - retest and scoring-rescoring

statistics Measure	Spearman's rho (P-value)	ICC (P-value)	SEM	CV
Test-Retest	0.65 (0.001)	0.65 (0.001)	0.48	0.08
Scoring- Rescoring	0.71 (0.001)	0.69 (0.001)	0.33	0.08

Discussion

The results of the present study provided evidence for psychometric properties (content validity, construct validity, test- retest and scoring- rescoring reliability) of a Persian version of the PVC scale. In general, the obtained results for the psychometric performance of the PVC in the present study are similar to those of original, English, version (10). In an attempt to develop and validate an outcome instrument for measuring PVC, Dodd et al. studied the DEAP in 684 English speaking children.

Their results showed that the content validity of the scale vowel sound in terms of content validity is acceptable. The construct validity seems adequate in terms of significance relationship between age and the PVC values. In this study PVC was positively related with age, a finding consistent with those of Stoel-Gammon (8), Pollock (15), James, Van Doorn & McLeod (16), Pollock (9), Dodd et al., (10), Grech (2008), Potter et al (6). Additionally the significant difference of PVC between children with and without SSD is another evidence for construct validity. The result of this study agreed with those of Dodd et al. (10) with regarding to reliability, the results of the present study showed acceptable test–retest and scoring-rescoring reliability for PVC index. Statistical analysis of the two experiments indicated an acceptable correlation coefficient based on Spearman correlation coefficients, ICCs, SEMs

and CVs in test- retest and scoring- rescoring reliability. The responsiveness of the PVC scale was not investigated in the present study, Future research should assess the sensitivity of these instruments to detect changes in activity levels over time following speech therapy interventions. Furthermore, the results of the present study provided a measure for evaluating children's vowel production ability. Based on the results of this study, PVC seems to be a valid and reliable measure that could be used as an indicator of the articulation competence in Persian speaking children. Currently results in children from the age of 3 to 6 year old language are extensible. The results of the present study should not be generalized to the children in other age groups. So, it is suggested to evaluate the reliability and validity of our Persian version of DEAP in children with ages lower than 3 and higher than 6 years. Also, provincial and national-level studies in a larger size for various Persian dialects and standardized data acquisition are suggested for future studies.

References

1. Watts N. Assessment of vowels summary. ACQuiring Knowledge in Speech, Language and Hearing. 2004;6:22-5.
2. Ball MJ, Duckworth M. Advances in clinical phonetics. Amsterdam ; Philadelphia: John Benjamins Pub. Co.; 1996. xiv, 258 p. p.
3. Shriberg LD, Fourakis M, Hall SD, Karlsson HB, Lohmeier HL, McSweeny JL, et al. Extensions to the Speech Disorders Classification System (SDCS). Clinical linguistics & phonetics. 2010;24(10):795-824.
4. Pollock KE. The identification of vowel errors using traditional articulation or phonological process test stimuli. Language, Speech, and Hearing Services in Schools. 1991;22(2):39.
5. Shriberg LD, Kwiatkowski J. Phonological disorders I: a diagnostic classification system. The Journal of speech and hearing disorders. 1982;47(3):41-226.
6. Potter NL, Nievergelt Y, Shriberg LD. Motor and Speech Disorders in Classic Galactosemia. JIMD reports. 2013.
7. Grech H, Dodd B. Phonological acquisition in Malta: A bilingual language learning context. International Journal of Bilingualism. 2008;12(3):155-71.
8. Stoel-Gammon C. Phonological Skills of 2-Year-Olds. Language, Speech, and Hearing Services in Schools. 1987;18(4):323-29.
9. Pollock KE. Identification of vowel errors: Methodological issues and preliminary data from the Memphis Vowel Project. Vowel disorders. 2002:83-113.
10. Dodd B, Hua Z, Crosbie S, Holm A, Ozanne A. Diagnostic evaluation of articulation and phonology (DEAP): Psychology Corporation; 2002.
11. Afshordi N, Kauschke C. Object and Action Naming: A Study on Persian-Speaking Children. Iranian Rehabilitation Journal. 2013;11(17).
12. Nilipour R, Sima Shirazi T, Afshordi N, Kauschke C. Processing of Object and Action Naming: A Study on Persian-Speaking Children. Iranian Rehabilitation Journal. 2013;11(17):31-40.
13. Holm A, Crosbie S, Dodd B. Differentiating normal variability from inconsistency in children's speech: normative data. International Journal of Language & Communication Disorders. 2007;42(4):467-86.
14. arifian T, Modarresi Y, Gholami-Tehrani L, Dastjerdi Kazemi M, Salavati M. The Persian version of Phonological Test of Diagnostic Evaluation Articulation and Phonology for Persian Speaking Children and investigating its validity and reliability. J Audio. 2013.(im press)
15. Pollock KE, Schwartz RG. Structural aspects of phonological development: Case study of a disordered child. Language, Speech, and Hearing Services in Schools. 1988;19(1):5. (impress)
16. James D, Van Doorn J, McLeod S, editors. Vowel production in mono-, di-and polysyllabic words in children aged 3; 0 to 7; 11 years. Proceedings of Speech Pathology, Australia Conference; 2001.