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Original Research Article

Comparison of Diadochokinetic Rate between Malayalam and Tamil Native Speakers

S. Jothi[1], Amritha M L[2]

[1]MASLP, Clinical Supervisor, Department of Audiology and Speech Language Pathology, Holy Cross College (Autonomous), Trichy, Tamil Nadu.
[2]MASLP, Assistant Professor, Department of Audiology and Speech Language Pathology, Holy Cross College (Autonomous), Trichy, Tamil Nadu.

Corresponding Author: S. Jothi

ABSTRACT

Diadochokinetic (DDK) rate represents an index for assessing oro-motor skills. It is commonly used in routine clinical evaluation of diseases of the central nervous system, disturbances of the peripheral sensory motor formations and immaturity of the speech mechanism. Oral DDK rates are a popular guideline for the assessment, diagnosis and treatment of patients with neurological deficit of the speech mechanism. But there is no culture and language specific (Indian Language) normative range for the application of oral DDK task. So the study aims to compare the diadochokinetic rate between Tamil and Malayalam speakers. Hundred healthy adults were recruited for the study within the age range of 20 to 25 years. Participants were grouped based on their native language (G1 & G2) and gender (F & M). The participants were asked to perform both AMR and SMR. The rate was accounted by Time-By-Count method. The result shows there is a significant difference ($p<0.001$) between the groups. DDK score was found to be higher in Malayalam speakers than Tamil speakers which reflect the faster rate of speech in Malayalam. So the study reflects the need for establishing language specific normative for accurate assessment and diagnosis.

Keywords: DDK, Tamil, Malayalam, rate of speech, AMR, SMR.

INTRODUCTION

Speech is a very complex motor skill that requires high neuromuscular control and coordination of several systems respiration, phonation and articulation. Speech motor control refers to the systems and strategies that regulate the production of speech, including the planning and preparation of movements (sometimes called motor programming) and the execution of movement plans to result in muscle contractions and structural displacements [1] (Kent, 2000).

Small alterations in speech production (e.g., rate, fluency and accuracy) may be an early sign for the presence of diseases of the nervous system and motor-speech disorders [2] (Icht, M., & Ben-David, B. 2014). Deviated velum movement compared to normal pattern during the production of nasal and non-nasal consonants [3] (Itho et al., 2004) and abnormal oropharyngeal movement patterns and timing during the volitional oral as well as the pharyngeal stage of swallowing in Parkinson's disease [4] (Robbins, 1986) are some of the early signs reported.

One of the most common tools for the detection the changes of speech motor functioning is the Diadochokinesis performance task (DDK). It is commonly used in routine clinical evaluation of diseases of the central nervous system, disturbances of the peripheral sensory motor

formations and immaturity of the speech mechanism. Diadochokinetic (DDK) rate represents an index for assessing oro-motor skills. It assesses the ability to perform rapid repetitions of relatively simple patterns of opposite muscular contractions [5] (Baken & Orlikoff, 2000). DDK provides a convincing analysis of the maximum speaking rate which is an important measure of articulatory performance. Dysdiadocho-kinesis was correlated with the degree of speech impairment. In individual with cerebellar pathology DDK will be affected mostly when compared to sentence production whereas individuals with apraxia has impaired ability to repeat the syllables at maximum speed [6] (Ziegler, 2002). DDK rate was lower in person with Parkinson's disorder and this could be due to limited muscle control and movements of lips and tongue [7] (Kumar S, et al, 2018).

Oral DDK rates are a popular guideline for the assessment, diagnosis and treatment of patients with a neurological deficit of the speech mechanism. There are two forms of DDK one is Alternating motion rates (AMR) involves the individual to produce repetitions of the same syllable (/p/ or /k/ or /t/) and another is Sequential motion rates (SMR) involves the individual to produce repetitions of a sequence of syllables (/pataka/) [8] (Berry J, 2014).

Factors affecting DDK were gender, age, socio-demographic factors: culture and cross-language differences [9-17] (Lass & Sandusky, 1971; Ptacek, Sander, Maloney, & Jackson, 1966; Robb, Hughes, & Frese, 1985; Topbas, 2010; Kent & Former, 1987; Ben-David & Schneider, 2009, 2010; Finkelstein & Amir, 2013; Castro, Serridge, Moraes, & Freitas, 2010).

Cross linguistic comparisons of rate of speech were carried out in different Indian languages and it has been found that rate of speech differs among different languages. Most of the existing studies in Indian scenario were focused on North Indian languages. Rathna and Bharadwaja (1977) [18] compared rate of speech of Hindi, Punjabi, Kannada, Tamil and Marathi languages and concluded that the rates of speech of these languages as in reading task were 198, 163, 193, 127 and 131 words per minute respectively. There are very few studies conducted on south Indian languages. Sreelekshmi and Murali [19] (2016) compared the rate of speech and DDK among Tamil and Malayalam native speakers and results shows that there is a significant difference in rate of speech. No significant difference was observed in DDK. Hence it is not necessary that DDK should vary as rate of speech varies between languages.

These variations are due to the variations in frequency of phonemes between languages [20] (Maddieson, 2013). Different frequency within the specific language can also impact the ease and accuracy of rapid articulation. Common phonemes may be produced faster and more accurately than less common phonemes. Language differences in these segmental structures might have a direct impact on DDK production. There are certain non segmental features like syllable and word structure which influence the rapidity and accuracy of DDK [21] (Laver, 1994). Different languages use different syllable and word combinations. The frequency of trisyllabic combinations varies among languages and hence there can be difference in SMR across such languages. Limited researches are available specifically on DDK among South Indian languages like Malayalam and Tamil. Even though both the languages share a common origin of Dravidian form they differ in terms of segmental aspects like phoneme aspirations and voicing. To bridge this gap in the literature the current study was carried out which aims to compare the diadochokinetic rate between Tamil and Malayalam native speakers.

MATERIALS AND METHODS

Participants: 100 healthy adults within the age range of 20 to 25 years were selected for the study. The participants were native speakers of either Tamil or Malayalam.

Participants with any known neurological problems, lisping, oro-motor deficits and speech sound disorders were excluded from the study. The participants were divided into two groups based on their native language. Group 1(n=50) consisted of native Tamil speakers and group 2 (n=50) consisted of native Malayalam speakers.

Procedure: The participants were made to sit straight on a chair in a comfortable manner. They were instructed to take a deep breath and phonate the phoneme /p/ or /t/ or /k/ in a single breath accurately as fast as possible (Alternative motion rate) and was recorded using PRAAT software. The sequence of these three phoneme /pataka/ (sequencing motion rate) was also recorded using PRAAT software in the same manner. The participants were asked to perform three trials of each task independently with the time break on 1 minute.

Statistical Method:

The rate was accounted by Count- by - time method and results were compared between groups using T-Test in SPSS Software. The level of Significance is ($p<0.05$).

RESULTS AND DISCUSSION

The current study attempted to compare the DDK between Tamil and Malayalam native speakers. The mean scores obtained for AMR of Tamil speakers for /p^/, /t^/ and /k^/ were 4.082, 3.895 and 3.91 Syllables per seconds respectively. The AMR mean scores for /p^/, /t^/ and /k^/ were 4.838, 4.982 and 4.722 Syllables per seconds for Malayalam speakers. 2.897 and 3.468 Syllables per seconds was the mean SMR scores obtained for Tamil and Malayalam native speakers respectively. Table 1 and graph 1 shows the mean AMR and SMR scores of Tamil and Malayalam native speakers.

The result shows there is a statistically significant difference ($p<0.05$) between the groups in DDK. Malayalam speakers were found to be have better DDK scores than Tamil speakers. On separate comparison of AMR and SMR Malayalam speakers outscores with Tamil speakers. The results of the current study were in contradictory with the findings of Sreelekshmi and Murali (2016). They found no significant difference in DDK between Tamil and Malayalam native speakers. Even though there was no significant difference Malayalam speakers had faster SMR when compared to Tamil speakers which supports the current study findings.

To identify the effect of gender on DDK the AMR and SMR scores were compared between males and females within groups. The mean AMR scores obtained for /p^/, /t^/ and /k^/ for Tamil speaking females and males are 4.714, 4.424, 4.52 and 3.45, 3.366 and 3.3 respectively. 3.308 and 2.486 were the mean SMR scores obtained by Tamil speaking females and males. Table 2 shows the mean value of AMR and SMR of Tamil native speakers across gender.

Similarly the DDK scores were compared between Malayalam speaking females and males. The mean AMR scores obtained for female Malayalam native speakers for /p^/, /t^/ and /k^/ were 5.192, 5.44 and 5.024 respectively. Males obtained 4.484, 4.524 and 4.42 for /p^/, /t^/ and /k^/ respectively in AMR. Mean SMR score for Malayalam speaking males were 3.116 and females were 3.82.

The results shows that there is a significant difference ($p<0.05$) in DDK across gender. It can be inferred from the results that females were having faster AMR and SMR when compared to males. Thus the current study findings show a significant gender effect on DDK.

Table 1 Mean value of Tamil and Malayalam native speakers

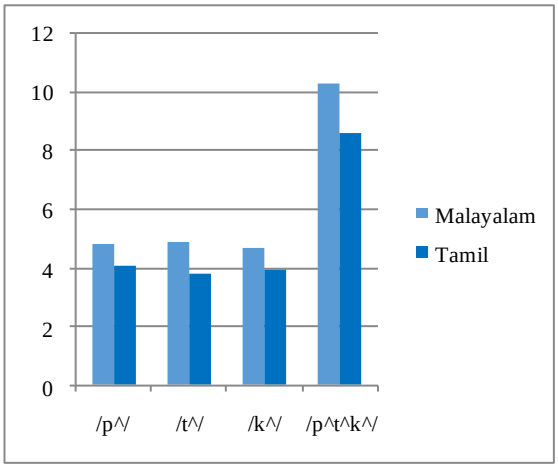
	Mean	Statistical inference
AMR- /p^/		
Tamil (n=50)	4.082	.000<0.05
Malayalam (n=50)	4.838	Significant
AMR - /t^/		
Tamil (n=50)	3.895	.000<0.05
Malayalam (n=50)	4.982	Significant
AMR - /k^/		
Tamil (n=50)	3.91	.000<0.05
Malayalam (n=50)	4.722	Significant
Q5.pataka/SMR		
Tamil (n=50)	2.897	.000<0.05
Malayalam (n=50)	3.468	Significant

Table 2 Mean value of Tamil native speakers across gender

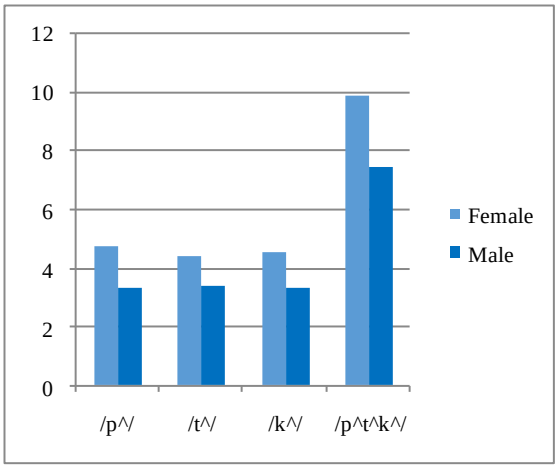
Tamil - Gender	Mean	Statistical inference
AMR- /p^/		
Female (n=25)	4.714	.000<0.05
Male (n=25)	3.45	Significant
AMR - /t^/		
Female (n=25)	4.424	.000<0.05
Male (n=25)	3.366	Significant
AMR - /k^/		
Female (n=25)	4.52	.000<0.05
Male (n=25)	3.3	Significant
SMR - /p^t^k^/		
Female (n=25)	3.308	.000<0.05
Male (n=25)	2.486	Significant

Table 3 Mean value of Malayalam native speakers across gender

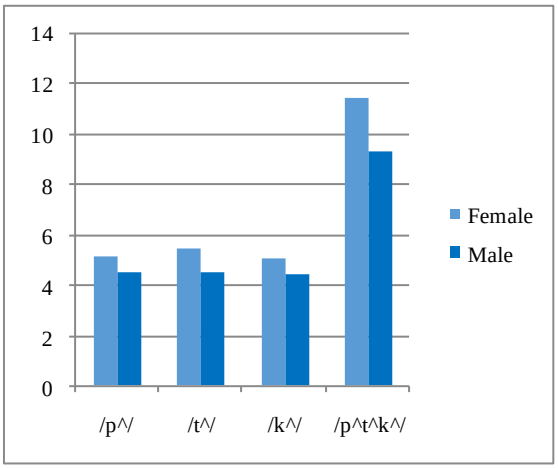
Malayalam - Gender	Mean	Statistical inference
AMR- /p^/		
Female (n=25)	5.192	.000<0.05
Male (n=25)	4.484	Significant
AMR - /t^/		
Female (n=25)	5.44	.000<0.05
Male (n=25)	4.524	Significant
AMR - /k^/		
Female (n=25)	5.024	.000<0.05
Male (n=25)	4.42	Significant
SMR - /p^t^k^/		
Female (n=25)	3.82	.000<0.05
Male (n=25)	3.116	Significant



Graph 1 **Mean value of Tamil and Malayalam native speakers**



Graph 2 **Mean value of Tamil native speakers across gender**



Graph 3 **Mean value of Malayalam native speakers across gender**

CONCLUSION

DDK scores differ among languages as a result of intra language differences in rate of speech. In the present study DDK score was found to be higher in Malayalam speakers than in Tamil speakers which reflect the fast rate of speech in Malayalam. Gender differences were also noted in DDK wherein females were having faster DDK scores compared to males. Hence gender and linguistic specific norms should be established for more accurate assessment and diagnosis. These findings also alert the importance of considering linguistic differences and gender of the speaker during DDK assessment.

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