

Comparison of Rate of Speech and Diadochokinetic Rate in Nepali and Malayalam Adult Native Speakers

Shanta Dhakal, Keziah Merin Chacko, Vishnu V.K. and Sreelakshmi R.
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Abstract

Fluent speech is the production of speech at a normal level of skill, which is continuous but in addition to flow of sounds and syllables, flow of information should also be continuous. Rate of speech is a dimension of fluency which can be defined as the number of words or syllables uttered per unit of time. Diadochokinetic rate refers to an assessment tool which measures how quickly an individual can accurately produce a series of rapid and alternating sounds. In general, it is the ability to repeat a segment of speech at high speed.

Need: Studies on rate of speech are very few. Recent cross linguistic studies are also very rare. The correlation between rate of speech and Diadochokinetic rate is unclear. Malayalam language was found to have the fastest rate of speech among the southern states of India. Nepali language was chosen to compare with the Malayalam language to check which one has faster rate of speech. There is a need to conduct a study on the Diadochokinetic rate in normal Nepali speaking adults since it has not been investigated yet.

Aim: The purpose of this study was to compare the rate of speech and Diadochokinetic rate of adults between Nepali language and Malayalam language and check the correlation between rate of speech and Diadochokinetic rate within and across language.

Participants: Forty participants i.e. twenty each in both the languages, with equal number of both the genders were included in the study. All the participants were having normal speech, language and hearing skill.

Method: In this study, samples were collected in monologue, oral reading and picture description for attaining the rate of speech in both the languages. It was measured in terms of words per minute. Diadochokinetic rate was measured and both Alternate Motion Rate (AMR)

and Sequential Motion Rate (SMR) were calculated by using count per time method. The samples were recorded using PRAAT software.

Result: The results revealed that there was a highly significant difference ($p < 0.001$) in rate of speech and no significant difference in DDK results between Malayalam and Nepali speakers. Even though, Nepali speakers were found to have faster rate of speech but their Diadochokinetic rates were similar to those of Malayalam speakers. Results showed that DDK results were independent of rate of speech.

The study clearly indicates that there is a significant difference in many parameters of speech across languages. Hence, there is a requirement of separate normative for the speech assessment in different languages.

Key Words: Nepali, Malayalam, Rate of speech, Diadochokinetic rate.

Introduction

Speech is the audible manifestation of language where the motor and neuro-motor behaviors of human sound production are used for the purpose of communication. Fluency is a speech pattern that flows in a smooth and rhythmic manner. Fluent speech is the production of speech at a normal level of skill, which is continuous but in addition to flow of sounds and syllables, flow of information should also be continuous. Rate of speech is an important dimension of fluency which can be defined as the number of words or syllables uttered per unit of time. Speech rate is estimated from samples of connected speech spoken spontaneously or read. A sample of the clients connected speech is necessary to screen for any fluency disorders. Speech rate can be calculated by various methods which are either syllables per minute or words per minute. Factors which can affect the rate of speech are stylistic effects, biological demands on the speech system, cognitive processing, frequency and duration of hesitations and pauses, emotional state of the speaker and type of speaking situation. Rate of speech is slower in shorter utterances than in longer ones. There is more of a rate decrease during short utterances than there is a rate increase during longer ones. This implies that it is the amount of information in the utterances that affects the rate (Malecot, Johnston and Kizziar, 1972; Starkweather, 1981). Abnormal speech rate affects not only articulatory precision, but also speech intelligibility, so either increasing or decreasing the speaking rate is an objective in therapy for various motor speech disorders.

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Rate of speech doesn't have a fixed value, so it is generally expressed in range. The speech rate of English language has a range of 115 to 165 words per minute (Andrews and Ingham, 1971), whereas reading rate has a range of 150 to 190 words per minute (Darley and Spriesterbach, 1978).

Diadochokinetic rate refers to an assessment tool which measures how quickly an individual can accurately produce a series of rapid and alternating syllables. In general, it is the ability to repeat a segment of speech at high speed. Diadochokinetic rates help to determine any problems in the speech mechanism that control motor skills or speech planning functions in the brain. The two ways to obtain these measures are, counting the number of syllable repetitions in a given period of time and counting the number of seconds to repeat a predetermined number of syllables. Alternating Motion Rate (AMR) and Sequential Motion Rate (SMR) are used to assess the Diadochokinetic rate. Syllable repetitions performed as fast as possible gives a valid probe of the maximum speaking rate being an important measure of articulatory performance. West and Ansberry (1968) stated that "the person who can negotiate rapid shifts of inhibition of muscle contraction is, generally speaking, possessed of the high speed of diadochokinesis and, correlatively, of the ability to make rapid articulatory movements."

The correlation between Diadochokinetic rate and ordinary rate of speech is unclear (Lass and Sandusky, 1971). The absence of evidence for a phenomenon does not mean that it is the absence of that phenomenon. So attempts to find such a correlation should be made. Therefore, this present study attempted to compare the rate of speech between Nepali and Malayalam native speakers. And to check whether the Diadochokinetic rate and speech rate correlates with each other.

Review of Literature

“As soon as human beings start to make systematic observations about one another's languages, they were probably impressed by the paradox that all languages are in some fundamental sense one and the same, and yet they are also strikingly different from one another language” (Charles A. Ferguson, 1978).

Rate of speech is influenced by the type of syllable, length of utterances, type of speaking situation and perception of information transmission.

The degree of coarticulatory overlaps and speed of articulation movement determines the rate at which syllables can be continuously produced.(Gay, 1978; Starkweather, 1981). Adult speakers of English speak at an average rate of 5-6 syllables per second (Walker and Black, 1950).

Speech rate can be defined as the speed at which speakers shape and configure their oral cavities to perform articulatory movements necessary for speech production (Crystal & House, 1982; Pellowski, 2010).

Rathna and Bharadwaja (1977) attempted a cross linguistic study for various Indian languages. Their study concluded that the rates of speech in words per minute for languages such as Hindi, Punjabi, Kannada, Tamil and Marathi in reading task were 198, 163, 193, 127 and 131 respectively. Deepti and Anuradha (2011) did a study on the rate of speech in 20 Punjabi speakers aged 18-40 years. Their study revealed that the rate of speech in reading is higher than picture description for both males and females.

Broglio et al (2013) did a study on rate of speech and speech disruptions in individuals who clutter, and to compare with individuals who do not clutter. Their study revealed that persons who clutter present a rapid speech rate.

Emma Rodero (2012) did a study which seeks to compare broadcasters' speech rates and the number of pauses in 40 new bulletins from the BBC (U.K), Radio France (France), RAI (Italy) and RNE (Spain). The findings indicate that the extent to which the individuals surveyed experience subjective assessment varies according to the speech rate.

Need of the Study

The correlation between rate of speech and Diadochokinetic rate is unclear. Malayalam language was found to have the fastest rate of speech among the southern states of India. Nepali language was chosen to compare with the Malayalam language to check which one has a faster rate of speech. Few research works are done in rate of speech as well as cross linguistic studies

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are also very rare. There is a need to conduct a study on the Diadochokinetic rate in normal Nepali speaking adults since it has not been investigated yet.

Aim of the Study

The objective of the study is to compare the rate of speech in Nepali and Malayalam native speakers and check the correlation between rate of speech and Diadochokinetic rate within and across language.

Methodology

Subjects

Participants were selected based on inclusion criteria in which individuals with normal Maximum Phonation Time, no history of any communication disorders, adequate speech intelligibility, medically fit and literate native speakers of each language were chosen for the study. Forty participants were selected which includes 20 Nepali and 20 Malayalam native speakers aged 20-25 years, with equal number of both the genders.

Method

Tasks included were monologue, oral reading, picture description and Diadochokinetic rate. Prior to the actual data collection, a pilot study was done in six subjects from each group for checking the feasibility of the study.

Monologue

Each of the participants was instructed to speak about their 'daily activities' in one minute, as they speak in their daily lives.

Oral Reading

Unfamiliar passages were used from both the languages to elicit reading samples from the subject. Participants were instructed to read the given passage and the sample was recorded for one minute.

Picture Description

Same standardized picture was given to both the groups and they were asked to describe the picture given to them for one minute.

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The entire samples were recorded on the PRAAT software. Prior trials were not given to nullify the effects of familiarity. The total number of words per minute was counted in all the tasks.

Diadochokinetic Rate

Both the Alternating Motion Rate (AMR) and Sequential Motion Rate (SMR) were calculated. In Alternating Motion Rate, subjects were instructed to utter the syllables /p[^]/, /t[^]/ and /k[^]/ separately and repeatedly as fast as possible for 10 seconds, whereas in Sequential Motion Rate, they were instructed to utter the combination of the syllables /p[^]t[^]k[^]/ repeatedly as fast as possible for 10 seconds. The samples were recorded using PRAAT software and the number of syllables produced in one second, were then calculated by dividing total the number of syllables by 10.

Data Analysis

Verbatim transcription was done for all the collected speech samples.. Rate of speech can be assessed mainly at the word level, syllable level and morpheme level. Here, speech rate was measured in terms of words per minute. The data were subjected to statistical analysis to obtain the mean and standard deviation.

Results

The study attempted to compare the rate of speech between Nepali and Malayalam native speakers aged 20-25 years. This study also aimed to find out the correlation between Diadochokinetic rate and speech rate. The graphical representation of speech parameters are as follows:

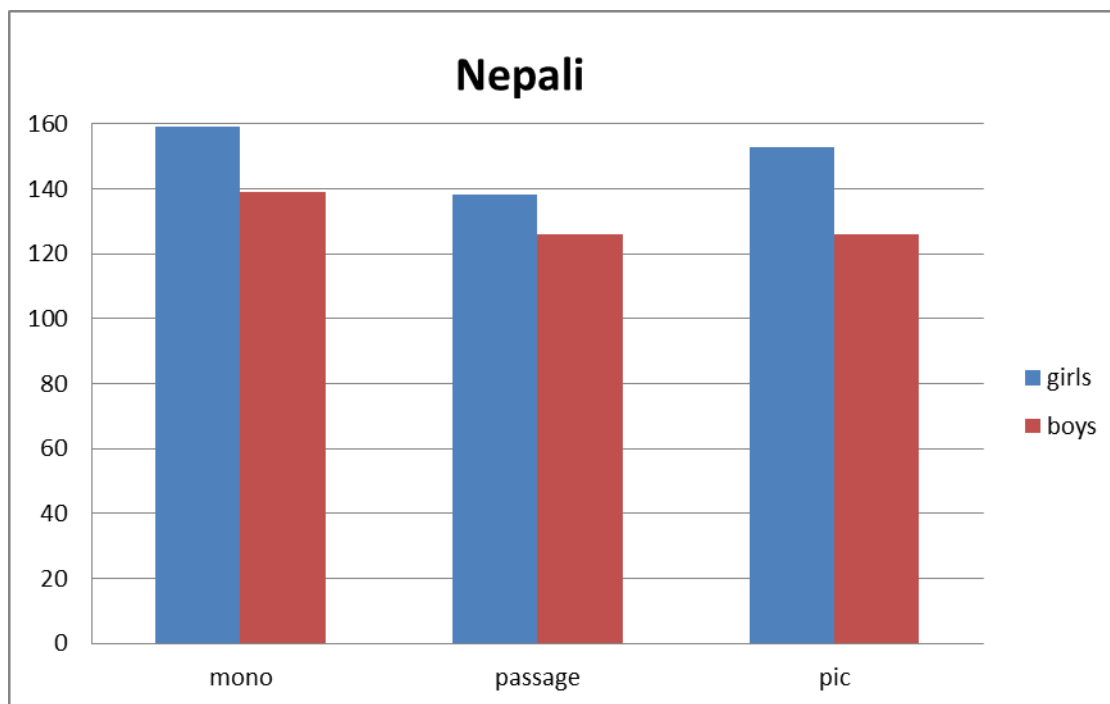


Fig1. Showing the rate of speech in words per minute for monologue, passage reading and picture description.

In the above graph, Nepali girls have maximum words per minute in a monologue (mean: 159.20 WPM), compared to picture description (mean: 152.60 WPM) and the least was in passage reading (mean 138.10). Nepali boys have maximum words per minute in a monologue (mean: 139 WPM), followed by a picture description (mean: 125.80 WPM) and passage reading (mean: 125.80 WPM). From this result Nepali girls were found to have more rate of speech than boys.

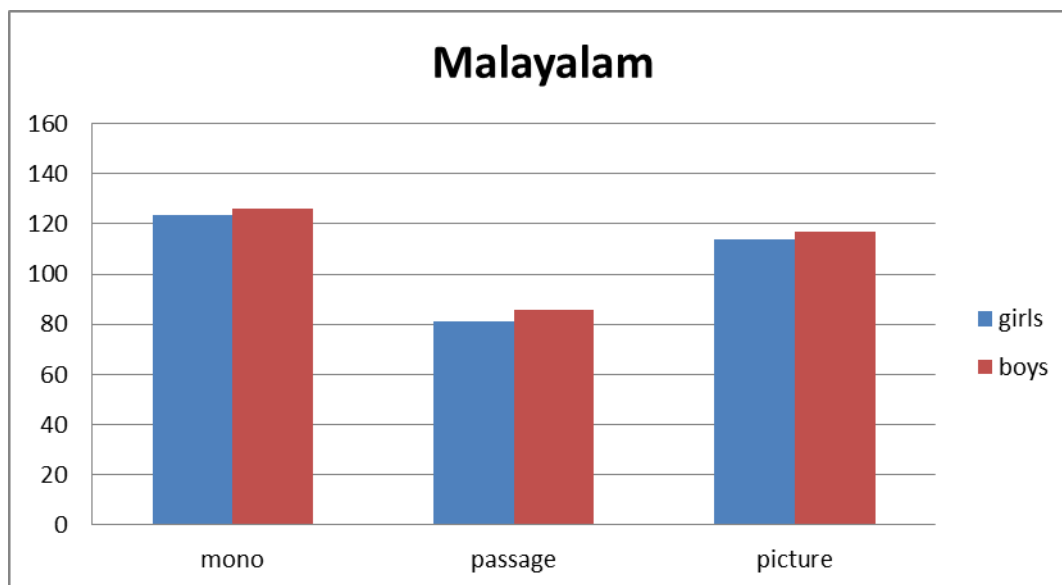
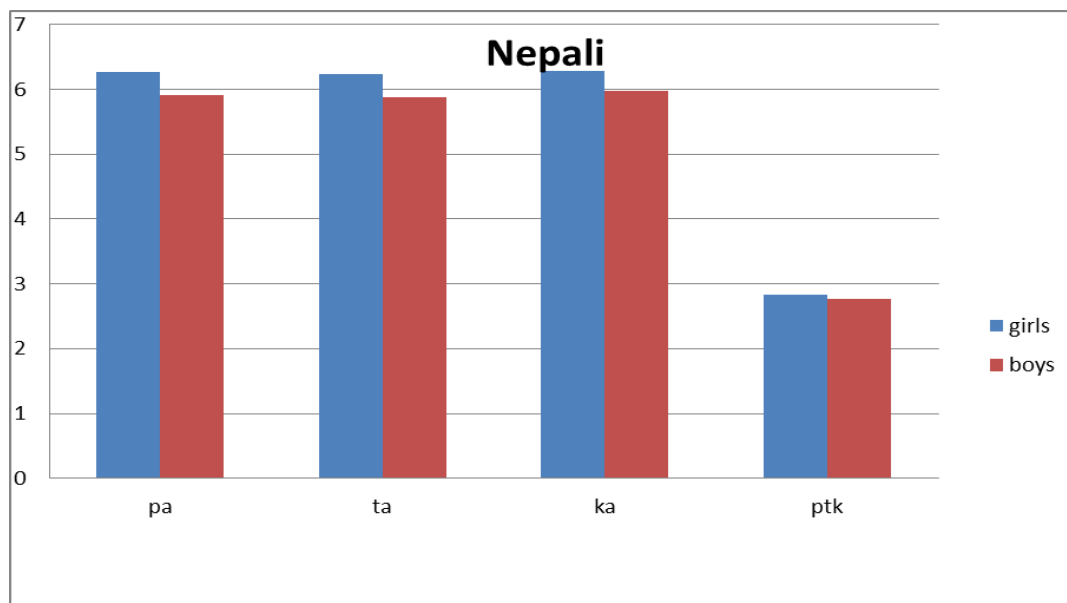


Fig 2. Showing the rate of speech in words per minute for monologue, passage reading and picture description.

In the above graph, Malayalam native girls have maximum words per minute in a monologue (mean: 123.80 WPM), followed by a picture description (mean: 113.80 WPM) and the least was



obtained for passage reading (mean: 81.10). Malayalam native boys have maximum words per minute in a monologue (mean: 126.30 WPM), followed by a picture description (mean: 117

WPM).The least was obtained in passage reading (85.8 WPM). The obtained data reveal that Malayalam native boys have a slightly more speech rate than girls.

Fig. 3: showing the AMR and SMR in Nepali boys and girls.

In the above graph, the Alternating Motion Rate (AMR) for /p^/, /t^/ and /k^/ is 6.27, 6.23 and 6.29 repetitions/Sec respectively and Sequential Motion Rate is 2.83 repetitions/Sec, for Nepali native girls. In boys, AMR for /p^/, /t^/ and /k^/ is 5.91, 5.87 and 5.98 repetitions/Sec respectively and SMR is 2.76 repetitions/Sec.

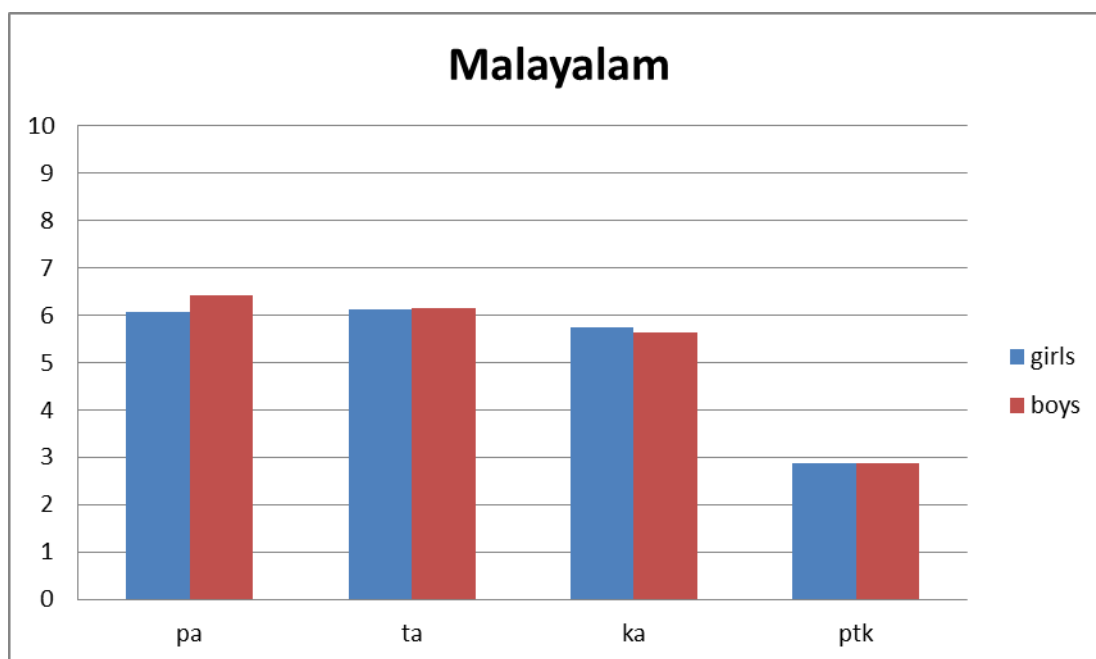


Fig. 3: showing the AMR and SMR in Malayalam boys and girls.

In the above graph, the Alternating Motion Rate (AMR) for /p^/, /t^/ and /k^/ is 6.07, 6.11 and 5.73 repetitions/Sec respectively and Sequential Motion Rate is 2.88 repetitions/Sec, for Malayalam native girls. In boys, AMR for /p^/, /t^/ and /k^/ is 6.41, 6.14 and 5.63 repetitions/Sec respectively and SMR is 2.88 repetitions/Sec.

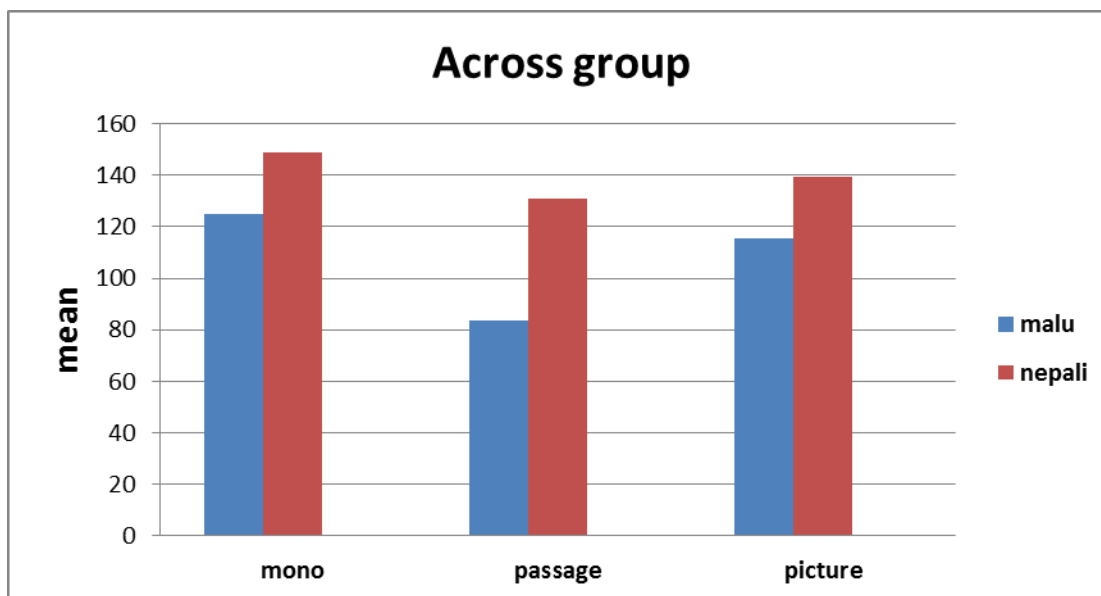


Fig 5. Comparing the rate of speech in monologue, passage and picture description in both the languages.

In the above graph, Nepali speakers have maximum words per minute in a monologue (mean: 149.11 WPM), followed by picture description (mean: 139.20 WPM) and passage (mean: 130.70 WPM), whereas Malayalam speakers have maximum words per minute in a monologue (mean: 125.05 WPM), followed by a picture description (mean: 115.40 WPM) and passage (mean: 83.45 WPM). This data reveals that Nepali native speakers have more rate of speech than Malayalam native speakers.

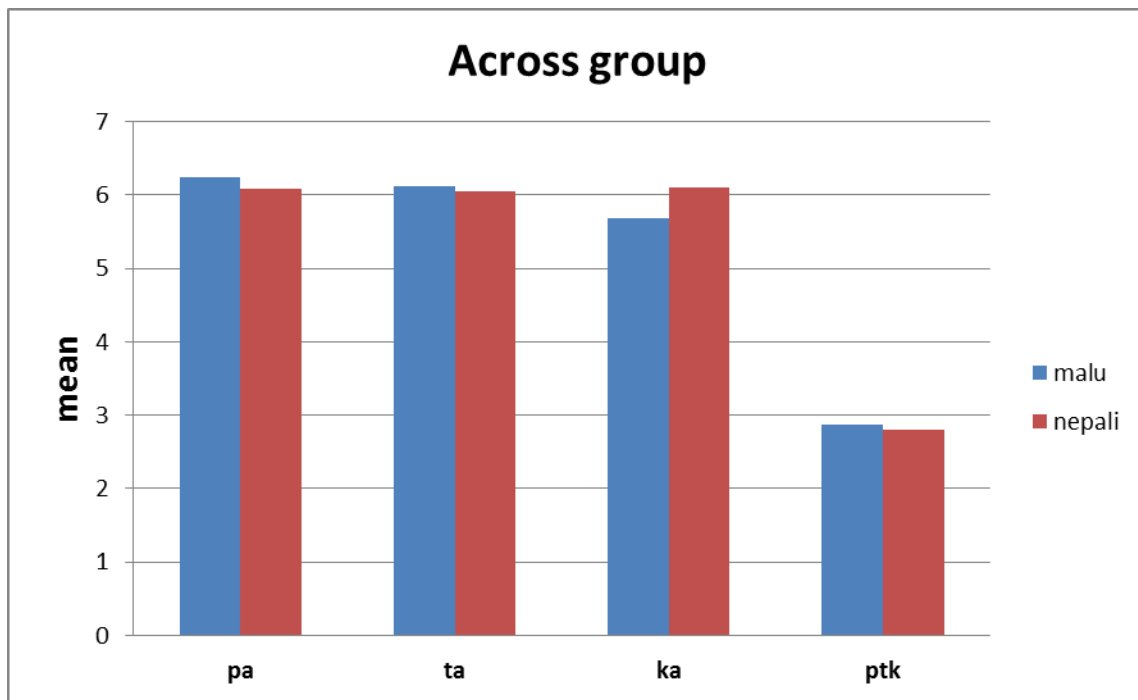


Fig 6: showing the AMR and SMR in both the groups.

In the above graph, the mean AMR of /p[^]/, /t[^]/ and /k[^]/ is 6.24, 6.05 and 6.14 repetitions/Sec respectively in Nepali speakers, whereas 6.09, 6.13 and 5.68 repetitions/Sec respectively in Malayalam speakers. The mean SMR of Nepali speakers is 2.80 repetitions/Sec and in Malayalam speakers is 2.88 repetitions/Sec respectively.

The results revealed that there was a highly significant difference ($p < 0.001$) in rate of speech and no significant difference in DDK results between Malayalam and Nepali speakers. Even though, Nepali speakers were found to have a faster rate of speech, but their Diadochokinetic rates were similar to those of Malayalam speakers. Results showed that DDK results were independent of rate of speech. These results can be used for identification and diagnosis of deviation in rate and for the intervention for speech timing disorders.

Discussion

Speech rate is the term given to the speed at which we speak, i.e., the number of words spoken in a particular time. The rate of speech can depend on the language competence, age of the speaker, complexity of the task, situation, familiarity, gender, education, interest, and cognitive factors. Despite of that fast rate of speech or slow rate of speech can help to draw the conclusion of the various communication disorders. The clinical importance of finding the rate of speech is

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being a focused assessment tool in both the screening and diagnostic assessment protocol. The Diadochokinetic rate is an assessment tool which measures how quickly an individual can accurately produce a series of rapid and alternating syllables. It is the ability to repeat a segment of speech at high speed. The implication of Diadochokinetic rate is, it helps to determine any problems in the speech mechanism that control motor skills or speech planning functions in the brain. The rate of speech and Diadochokinetic rate provides validated information about the person's speaking rate and ability to control the articulators.

There is no evidence based research on the relationship between the rate of speech and the Diadochokinetic rate, hence there is a need to find the dependency of DDK rate in rate of speech i.e., whether the DDK tends to more who speaks faster .

The present study aims to find the rate of speech in two different languages. Nepali and Malayalam languages were selected and the participants were selected from the same native language speakers for both the groups. Nepali girls were found to have more rate of speech than boys. The result reveals that Malayalam native boys have a slightly more speech rate than girls. Nepali speakers have maximum words per minute in a monologue (mean: 149.11 WPM), compared to picture description (mean: 139.20) and passage reading (mean: 130.70 WPM), similarly, Malayalam speakers have maximum words per minute in a monologue (mean: 125.05 WPM), compared to picture description (mean: 115.40 WPM) and passage reading (mean: 83.45 WPM). This data reveals that Nepali native speakers have more rate of speech than Malayalam native speakers. The mean AMR of /p^/, /t^/ and /k^/ is 6.24, 6.05 and 6.14 repetitions/Sec respectively in Nepali speakers, whereas 6.09, 6.13 and 5.68 repetitions/Sec respectively in Malayalam speakers. The mean SMR of Nepali speakers is 2.80 repetitions/ Sec and in Malayalam speakers is 2.88 repetitions/sec respectively. There is not much difference in mean DDK rate across the groups.

There are significance variation in rate of speech in Nepali language and Malayalam language ($P < 0.001$) but the statistical evaluation shows the DDK rate across the groups are not significance. The formulation of language , length of the words, taking style, pronunciation, knowledge of language, styles of talking, grammatical structure, cultural aspects etc. might have different from each language for across the group, because of this factors Nepali speakers might have faster rate of speech compare with Malayalam speakers. There is not much difference in

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Diadochokinetic rate across the groups so from this present study we can conclude that Diadochokinetic rate is independent from rate of speech.

Summary and Conclusion

The speed at which a person speaks is the rate of speech. Usually rate of speech is calculated by two ways, those are words per minute and syllables per minute. DDK rate is the rate at which a person can repeat a syllable rapidly, loudly, clearly, and rhythmically. AMR and SMR will provide information regarding the person ability to control his/her articulators. The study aims to compare the rate of speech between Nepali language and Malayalam language speakers as well as to find the relationship between rate of speech and Diadochokinetic rate. From the result we conclude that Nepali native speakers had faster rate of speech compare to Malayalam native speakers. But there is no co-relation between rate of speech and Diadochokinetic rate. DDK rate is a subsystem of rate of speech where the subject has to move his articulators as much as fast he can and produce the syllables loudly, clearly, rhythmically, and rapidly. Rate of speech depends on language proficiency, familiarity of the task, interest of the speaker, length of the words, cultural aspects, cognitive aspects etc. So from this study we can conclude that Diadochokinetic rate is independent on rate of speech.

Limitation

Only twenty subjects from each of the group were included.
The passage which used for this study was not standardized in both the language.

Further Suggestions

- More number of subjects can be included.
- The rate of speech can be calculated in syllables per minute.

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