EFFECT OF PHONOLOGICAL AND MORPHOLOGICAL FACTORS ON SPEECH DISFLUENCY IN NEPALI SPEAKING ADULTS WHO STUTTER

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CERTIFICATE

This is to certify that this dissertation entitled **"Effect of phonological and morphological factors on speech disfluency in Nepali speaking adults who stutter"** is a bonafide work submitted in part fulfillment for degree of Masters in Science (Speech Language Pathology) of the student Registration Number: 18SLP011. This has been carried out under the guidance of the faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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CERTIFICATE

This is to certify that this dissertation entitled **"Effect of phonological and morphological factors on speech disfluency in Nepali speaking adults who stutter"** has been prepared under my supervision and guidance. It is also certified that this dissertation has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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DECLARATION

This is to certify that this dissertation entitled **"Effect of phonological and morphological factors on speech disfluency in Nepali speaking adults who stutter"** is the result of my own study under the guidance of Dr. Santosh M., Associate Professor, Department of Speech-Language Sciences, All India Institute of Speech and Hearing, Mysuru and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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CHAPTER 1

INRODUCTION

Stuttering refers to "disorder in the rhythm of speech in which individual knows precisely what he wishes to say but at the same time is unable to say because of an involuntary repetition, prolongation, or cessation of a sound (WHO, 1977)". Typically the onset of stuttering begins between 2-5 years of age (Andrew & Harris, 1964; Dworzynski, Remington, Rijksdijk, Howell, & Plomin, 2007; Yairi & Ambrose, 2005). The overall prevalence of the disorder in childhood is 5% but decreases to 1% in adulthood (Bloodstein, 1995).

All speakers produce typical disfluencies like silent pauses, interjections of word and non-word fillers, whole-word repetitions, and phrase repetitions (Ambrose & Yairi, 1999; Tumanova, Conture, Lambert, & Walden, 2014). Unlike typical disfluencies, stuttering-like disfluencies are part-word repetitions, single-syllable word repetition and dysrhythmic phonation (Yairi & Ambrose, 2005). And these SLDs are accompanied usually with more duration, effort, tension, or struggle. Persistent stuttering is also associated with secondary characteristics that define the disorder beyond speech characteristics. These are eye blinking, reduced eye contact, facial grimaces, jaw and neck tension, hand tapping, or other extraneous body movements (Conture & Kelly, 1991). Secondary characteristics are broadly categorized as escape and avoidance behaviors. Escape behaviors occurs when the speaker stutters and strives to get out of stuttering and finish the word. Eye blink, head nods, or interjection of extra sounds are escape behaviors. In contrast, avoidance behavior is seen when a speaker anticipates stuttering and tries to keep from stuttering by changing the word, using pause, or using an eye blink. The PWS's ability to communicate clearly and efficiently with conversation partner is interfered by such secondary behaviors (Bloodstein, 1995; Plexico, Manning, & Levitt, 2009).

1.1. Factors affecting stuttering

Stuttering is considered a multi-factorial disorder where several factors like cognitive, motor, linguistic, and environmental factors are responsible for the development and progression of the disorder (Smith & Kelly, 1997; Smith & Weber, 2017). Among these factors, multiple evidences support strong connection between stuttering and linguistic factors at both the word and sentence level (Anderson & Wagovich, 2010; Coulter, Anderson, & Conture, 2009; Howell & Au-Yeung, 2002; Richels, Buhr, Conture, & Ntourou, 2010; Weber-Fox, Spencer, Spruill, & Smith, 2008). In the earliest investigation, Brown (1945) reported specific linguistic contexts are more prone to cause stuttering in native speaker of English, adults who stutter (AWS), i.e., on utterance initial position, words with initial consonants, longer words and on content words. Further, the succeeding studies performed in English, Spanish, and Kannada language, in AWS, have confirmed the findings provided by Brown (Au-Yeung, Gomez & Howell, 2003; Dayalu, Kalinowski, Stuart, Holbert, & Rastatter, 2002; Dworzynski, Howell, & Natke, 2003; Griggs & Still, 1979; Howell & Au-Yeung, 2007; Jayaram, 1981, 1983; Venkatagiri, Nataraja, & Deepthi, 2016; Wingate, 1967). However, in languages like Germany, Arabic, Persian, these findings were contradicted (Abdalla, Robb & Al-Shatti, 2009; Al-Tamimi, Khamaiseh & Howell, 2013; Dworzynski, Howell & Natke, 2003; Dworzynski & Howell, 2004; Masumi, Kashani, Hassanpour & Kamali, 2015; Phaal & Robb, 2007). Due to this disparity in the findings across different languages present study aims to assess the effect of phonological and morphological factors on the frequency of disfluency in Nepali speaking AWS.

1.1.1. Phonological factors

The variables investigated under phonological factors are phoneme category (words beginning with consonant/vowels), phoneme position (initial position/ final position of utterance), word length (monosyllable, bisyllable, trisyllable or multisyllable words), word shape, and phonological complexity.

Studies have recorded higher stuttering rates in initial position of word, clause, and utterance in AWS in English, Kannada, and Spanish languages (Brown, 1938; Griggs & Still, 1979; Hahn, 1942b; Jayaram, 1984; Johnson & Brown, 1935; Soderberg, 1967; Taylor, 1966; Wingate, 1979). Similarly, the rate of stuttering is also increased on words with initial consonants than vowels in both AWS and CWS (Brown, 1938; Hahn, 1942; Jayaram, 1983; Seth & Maruthy, 2019; Sheehan, 1974; Spencer & Weber-Fox, 2014; Taylor, 1966; Wingate, 1967) because the production of consonant requires more precise movement of articulators making it more complicated. Researches in AWS in different languages that investigated the influence of word length have shown more stuttering on longer words (words with more than two syllables) (Al-Tamimi, Khamaiseh, & Howell, 2013; Brown & Moren 1942; Griggs & Still, 1979; Soderberg, 1966; Taylor, 1966; Venkatagiri, Nataraja, & Deepthi, 2016; Wingate, 1967). Further, Howell, Au- Yeung and Sackin (2000), described that in AWS, phonological complexity was a contributing factor for disfluency in case of content words only. However, for Persian speaking AWS, phonetic complexity and syllable length did not have significant effect on stuttering rate (Masumi, Kashani, Hassanpour, & Kamali, 2015). Similarly, in German-speaking AWS, phoneme category and phonetic complexity were not responsible factor for disfluency (Dworzynski, Howell, & Natke, 2003; Dworzynski & Howell, 2004).

1.1.2. Morphological factors

Word class is one of the majorly studied morphological factors. Grammatically word class can be categorized into content and function words. Content words include nouns, main verbs, adjectives, and adverbs, whereas, pronouns, articles, prepositions, conjunctions, modals, auxiliary verbs, and inflections are function words (Brown & Fraser, 1963). The linguistic organization is found to be different in these word categories. Content words are dynamic and offer expansion, so they are labeled as open linguistic set, while function words are closed linguistic set because the addition of new words is rare in this category (Hartmann & Stork, 1972; Quirk, Greenbaum, Leech, & Svartvik, 1985). In comparison, function words occur more frequently, have simple linguistic elements, and increased predictability with restricted information (Kucera & Francis, 1967; Quirk & Stein, 1990). Also, in terms of prosodic characteristics, function words are less stressed, have more flat contours of fundamental frequency and shorter vowel shifts (Bard & Anderson, 1983; Wingate, 2002). Moreover, the retrieval and encoding are accessed through the different systems as storage of content and function word occurs in different mental lexicons (Bock & Levelt, 1994; Levelt, 1992).

The available evidences are mixed regarding the stuttering rate in content versus function words in AWS. Some studies have reported a high disfluency on content words (Au-Yeung, Howell, & Pilgrim, 1998; Brown, 1937; Dayalu, Kalinowski, Stuart, Holbert, & Rastatter, 2002; Eisenson & Horowitz, 1945; Jayaram, 1981; Wingate, 1979). And few studies have found no significant differences on either type (Abdalla, Robb, & Al-Shatti, 2010; Dworzynski, Howell, & Natke, 2003; Phaal & Robb, 2007).

Mostly English, German and Spanish share many standard features as they belong to the Indo-European language family. Nonetheless, the distribution of stuttering in languages other than Indo-European languages is different. In the grammatical class, apart from content and function words, hybrid content-function words are also present in languages like Arabic, Persian, Kannada, and Nepali. Among these languages as well, variations are observed regarding the rate of stuttering in different grammatical classes. A study by Abdalla, Robb, and Al-Shatti (2010), in Kuwaiti Arabic speaking AWS, reported no significant effect in stuttering rate among content words, function words, and content-function words. Likewise, in Kannada language, there was no variation in disfluency frequencies between content-function words and pure content words in AWS (Venkatagiri, Nataraja, & Deepthi, 2017). Whereas, in native speaker of Jordanian Arabic CWS and AWS, significantly higher stuttering frequency was observed on hybrid function-content words than content and function words (Al-Tamimi, Khamaiseh, & Howell, 2013). Hence, influencing factors of stuttering are highly determined by the linguistic feature of the language, which is varied among the world's languages.

Nepali language belongs to the Indo-Aryan family of language and is spoken as the first language by 16 million (Census 2011) people in Nepal. It consists of six oral vowels and five nasal vowels, including ten diphthongs and twenty-nine phonemic consonants (Pokharel, 1989). Consonants are further categorized as stops, nasals, fricatives, affricates, laterals, tap, and approximants. Stops and affricates have voiced /unvoiced and aspirated /unaspirated versions (Khatiwada, 2009). Nepali and English languages differ from each other in phonological and morphological aspects. English language includes 44 segmental phonemes where 24 are consonant sounds; while Nepali language has 38 segmental phonemes with 29 consonant sounds (Kandel, 2010). Further, in Nepali some sounds are phonemic but are allophonic in English. For example, /pul/– bridge, /phul/– flower (Nepali); /pæn/ and /p^hæn/- pan (English). Vowel nasalization is phonemic and considered as a supra-segmental feature co-occurring with vowels. Nepali is a syllable-timed language and the syllable structure includes V, CV, CVC, CVCV, CCVCV, CCCV, and CVCC, where V represents vowel and C consonant. Similar to Arabic, Persian, and Kannada, there is the presence of hybrid 'content-function' words in the Nepali language. For example, /gadima/ is a C-F word (/gadi/ + /ma/ - /gadima/ i.e., by bus).

Need for the Study

The impact of linguistic factors on rate of stuttering is well-documented for various languages, and variations are observed across the languages. Different languages have different structures. Due to linguistic differences, specific stuttering characteristics might differ during comparison between languages. Moreover, to date, there is no proof about linguistic factors influencing disfluency rate in Nepali language. Therefore, to establish evidence about the association of linguistic factors and stuttering in the Nepali language and appreciate the universal features of stuttering, it is crucial to expand analysis across languages that are linguistically different.

Aim

To assess the influence of phonological and morphological factors on the disfluency rate in adult who stutter, speaking Nepali Language.

Objectives

The objectives were to compare stuttering frequency in terms of percentage of syllable stuttered (%SS) across

- word initial and word medial position
- words with initial consonants and initial vowels
- monosyllable, bisyllable, trisyllable and multisyllable words, where multisyllable word includes four to six syllables
- content words, function words, and content-function words

Hypotheses

- There is no significant difference in the frequency of stuttering across phoneme position, phoneme category, and word length in Nepali speaking AWS
- There is no significant difference in the frequency of stuttering across content words and function words; across content and content-function words; across function and content-function words in Nepali speaking AWS

CHAPTER 2

REVIEW OF LITERATURE

The influence of linguistic factors on disfluency rate has strong evidence and studies have been carried out in multiple languages and mostly in two types of the population that is adult and children (Abdalla et al., 2009; Al-tamimi et al., 2013; Alqhazo & Al-Dennawi, 2018; Au-Yeung et al.,1998; Bloodstein, 1960; Brown, 1945; Dworzynski, 2003; Eisenson & Horowitz, 1945; Griggs& Still, 1979; Howell & Au-yeung, 1995; Jayaram, 1981, 1983; Natke, Sandrieser, VanArk, Pietrowsky, & Kalveram, 2004; Seth & Maruthy, 2019; Soderberg, 1962; Venkatagiri et al., 2016; Wall, Starkweather & Cairns, 1981; Wingate, 1979;). Further, different patterns have been observed on stuttered episodes concerning linguistic elements in different languages within the adult population (Abdalla et al., 2009; Al-tamimi et al., 2013; Au-Yeung et al.,1998; Brown, 1945; Dworzynski, 2003; Eisenson & Horowitz, 1945; Griggs& Still, 1979; Hahn, 1942; Jayaram, 1981, 1983; Mausami et al., 2015; Phaal & Robb, 2007; Soderberg, 1962; Taylor, 1966; Venkatagiri et al., 2016; Wingate, 1979). Therefore, the present study's purpose is to determine the linguistic factors, phonological and morphological, affecting the disfluency rate. And for the same, the review is arranged in the following sections based on the phonological and morphological factors impacting stuttering frequency.

2.1. Phonological Factors

The phonological factors studied are phoneme category (words beginning with consonant/vowels), phoneme/ word/ clause position (initial position/ final position), word length (monosyllabic, bi-syllabic, tri-syllabic or multisyllabic words), word shape and phonological complexity.

Brown and Moren (1942) studied the influence of word length on stuttering frequency in oral reading task. Thirty-two AWS participated (age range- 18 -30 years; mean-22.5) in the study. Each of the participants was given to read five lists of 1000 words twice. The word lists consist of only adjectives and prepositions to make the grammatical factor as constant. The word length was quantified based on number of syllables and letters. Adjectives were one to four-syllable and three to ten letters in length while prepositions were mono and bisyllable with two to five letters. The percentage of stuttering was calculated for each letter and syllable group of adjectives and prepositions in each participant. Results showed that for adjectives, the frequency of stuttering varied in proportion with the word length that is more stuttering for four syllabic words than three syllables than two syllables than one syllable. And this finding was same for number of syllable in preposition. But concerning the number of letters, it was seen that stuttering percentage within any syllable group had an indefinite pattern. For mono and bi-syllable adjectives, the stuttering rate was directly proportional to number of letters but in three-syllable adjectives, the stuttering rate was indirectly proportional(i.e., nine-letter three-syllable adjectives with nine letters had less stuttering than seven-letter three-syllable adjectives). However, for prepositions increase in the number of letters lead to a significantly increased stuttering rate. Hence, it was concluded that there is a direct correlation between word length and amount of stuttering while the phonetic difficulty of the words explained certain irregularities observed.

Soderberg (1962) investigated the relation between stuttering and phonetic categories in reading tasks. Fifteen individuals with mild to severe stuttering and age ranging from 12 to 41 years (mean-30 years) were recruited. The phonetic categories comprised vowels, voiceless, and voiced consonants. To determine the severity of stuttering, both the frequency and duration of stuttering instances were considered. The reading material consists of three lists of 15 five-syllable phrases and 50 words. In list one, all word initial was vowel, in list two, all word-initial was voiced consonants and in list three, voiceless consonants. Semivowels, due to their vowel-like characteristics, and consonant blends, were excluded from the list of consonants beginning words. Other factors like frequency of usage, grammatical function, word length, position in a phrase, and accent of initial syllable of words were controlled among all three lists. Words in each list were selected from thousand most frequent words in the English. They had equal count of one to three-syllable words and accented and unaccented initial syllables of words, and content and function words. Analyses of variance evaluated the difference in the frequency and duration of stuttering moments. The study's outcome revealed that frequency and duration of stuttering among words beginning with vowels, voiced and voiceless consonants were not significantly different. And the author suggested that the disparity in results with earlier studies is due to the variations in lexical and communicative aspects of oral reading tasks.

Soderberg (1966) conducted a study in native English speakers to derive an association between stuttering and word length and word frequency. Twenty individuals with stuttering age ranging from 12 to 44 years participated in the study. Participants were given to read nine lists of 10 words with one to four-syllable words—the frequency of these listed words varied from high, medium, and low frequency. High-frequency words occur at least 100 times or more per million, medium frequency words at least 50 times per million and the low frequency at least once per million. And each level of word length consist high, medium and low frequent words. Also, all the words were predominantly nouns with few verbs, adjectives, and adverbs. Four listeners judged audio-recorded readings of participants with an inter-rater agreement of 75%. Statistical analysis indicated significant independent effect of word length and word frequency on disfluency, but the interaction effect was not significant. Moreover, in word length, a significant difference was observed between all types of word length while for word frequency, between high and low-frequency word was significant. Therefore, the author suggested word length as a potential factor compared to word frequency for considering disfluency rate.

Wingate (1967) did a study in AWS to determine the influence of stuttering frequency on word length presented in isolation. Participants were 14 adults who stutter, in the age range of 16-36 years (mean age of 25.2). For this study, 30 pairs of monosyllabic meaningful words and 30 bi-syllabic meaningful words were used. The bi-syllable words were phonetically correspondent to a respective pair of monosyllable words but had a different meaning and pronunciation. Common and uncommon words were equally comprised in the lists. 30 pairs of monosyllabic words were presented in a sequence so that subjects produced each pair's words in succession but as separate words. Monosyllable and bisyllable words were presented in a gap of one week. Chi-square test showed that participants stuttered more in bi-syllable words and word-initial positions. Moreover, stuttering frequency was identical for both common and uncommon bi-syllable words whereas on monosyllable words, the stuttering frequency was more in uncommon words than in common words. Therefore, author concluded that word length is independent of grammatical factor and responsible variable for disfluency occurrence.

Griggs and Still (1979) analyzed the individual variations in words that are stuttered. A total of six participants were recruited, among whom four were children of age range 11-14 years, and two were adults of 23 and 25 years old. The participants read twenty-five passages with approximately 200 words in a gap of a week. The passages were randomly selected. For the analysis, each word was classified as phoneme, grammatical class, position in a sentence, and word length. 29 English phonemes and 19 grammatical classes were considered. The frequency of stuttering in each category was calculated. Chi-square test revealed increased stuttering moments on the beginning of sentence, longer words, initial consonants, and content words. The author suggested the phonetic complexity as a factor influencing stuttering.

Jayaram (1983) studied the effect of phonetic factors on the disfluency in oral reading versus spontaneous speech, in monolingual and bilingual speakers. Ten monolingual Kannada speakers who stutter and ten bilingual PWS exposed to both English and Kannada were taken for the study. The age range of monolingual participants was 17 to 34 years (mean age 24.8 years) and of bilinguals was 19 to 32 years (mean age of 25.6 years). All the subjects read eight word lists consisting total of 286 Kannada words and 297 English words. Wordlist across the language had the same extend of length and familiarity of words. Each list had different initial sounds in both languages, i.e., one word list with only one initial sound in all the words. Eight initial sound taken includes short vowel, long vowel, voiceless stop, voiceless fricative, voiced stop, voiced fricative, nasal, and semivowel. Consonant clusters were not excluded in the word lists. Also, the spontaneous speech sample was recorded, and words of spontaneous speech were categorized similar to reading material. The outcome of the study displayed higher disfluency in voiceless stops and voiceless fricatives. The significant difference was observed between the different sound categories to total stuttering for all the groups, in both tasks and languages. There were few differences between stuttering frequency concerning tasks. In spontaneous speech, voiceless fricatives stuttered most, whereas voiceless stops in oral reading. Furthermore, stuttering percentage was more considerable in reading tasks than in spontaneous speech due to constraint in spoken words in oral reading. Compared to bilinguals, the monolingual stutterers exhibited more stuttering which was explained as the availability of additional modes to express themselves for bilinguals than monolinguals.

Au-Yeung, Howell, and Pilgrim (1998) investigated the impact of phonological word and position of utterance on disfluency in PWS across age groups. For this study, 51 PWS with age ranging from 2 years 7 months to 40 years were taken. Participants were divided into five age groups: 6 young children (age range: 2years 7 months to 6 years; mean=4years 2 months), 15 middle children (age range: 6 years to 9 years 6 months; mean= 7years 3 months), 10 older children (age range: 9years 6 months to 12 years 7 months; mean=11years 6 months), 8 teenagers (age range: 13 years 11 months to 17 years 1 month; mean=15 years 8 months) and 12 adults (age range: 20 to 40 years; mean=28years 4 months). Spontaneous speech was recorded and transcribed using broad and narrow phonetic transcription. The first analysis compared disfluencies between word classes for each group using Wilcoxon signed rank test. Results revealed significantly high disfluencies on function words in young group. Although a significant difference was not observed, a higher ratio of function words was disfluent compared to content words for middle group. However, the older group, teenagers, and adults showed more disfluency on content words. The second analysis investigated position effect with respect to word classes on stuttering rate. ANOVA and post-hoc-tukey tests revealed higher disfluency on utterance initial (first two utterance positions) function and content words than other positions. In the third analysis, disfluency frequency of function words and content words in different phonological word positions was computed, which showed function words located in phonological word-initial position were more disfluent compared to other positions. Unlike in function words, there was no significant influence of phonological word positions on disfluency frequency for content words. Authors concluded that disfluency on function words is influenced by external factors like position relative to content words within phonological words. Nevertheless, content words are governed by inherent factors like phonetic composition, lexical content, phoneme length and frequency of occurrence.

Howell and Au-Yeung (2007) conducted study in Spanish speaking PWS to determine impact on the frequency of stuttering due to phonetic complexity. Thirty-five monolingual native speakers of Spanish diagnosed with developmental stuttering were recruited. These participants were grouped into: 19 children of age 6 to 11(mean: 8.5 years, SD: 2.0), 7 teenagers between 11 to 17 years (mean: 13.9 years, SD: 2.0) and 9 adults on age range of 18 to 68 years (mean: 39.3 years, SD: 15.4). Authors have analyzed the influence of eight Index of Phonetic complexity factors across age groups and word classes. These eight IPC factors include consonant by place, consonant by manner, singleton consonants by place, vowel by class, word shape, word length, adjacent consonants, and cluster by place. A spontaneous speech sample was taken and each word was classified as content and function word. Related t-tests on each age group revealed significantly increased IPC scores of content words for all age and of stuttered words for adults. And no difference in IPC scores between fluent and disfluent function words for all age group was observed. Thus it was suggested that higher stuttering is associated with high IPC score, i.e., phonetic complexity.

Mausami, Kashani, Hassanpour, and Kamali (2015) conducted study in the native speaker of Persian to evaluate the impact of syllable structure on stuttering. Participants were sixteen AWS in age range of 20 to 39 years (Mean: 24.56 years, SD = 5.26). Reading material taken was 60 words and 60 non-words, with and without consonant clusters. Words and non-words without consonant clusters were considered as simple syllable structures and with the consonant cluster as a complicated syllable structure. All the words selected were content words. Non-word list was designed with a similar consonant and vowel variation as in word list. The length and syllable structure of non-words corresponded to words. Participants were given to read a list of 60 words and 60 non-words, which was audio-video recorded. Statistical analysis was performed using paired t-test and odds ratios. Results showed that the disfluency rate between simple and complicated syllable structures in the word was significantly different but not in non-words. Therefore, the authors attributed consonant clusters to increase the linguistic processing load, leading to more stuttering moments in meaningful situations.

Venkatagiri, Nataraja, and Deepthi (2016) studied the relation of morphophonemic and disfluency in Kannada. 22 AWS, in the age range of 15 to 30 years (Mean=19years 6 months) with mild to severe stuttering, participated in the study. Individuals read short stories consisting of 764 syllables. Results obtained using linear regression analysis manifested that word length and morphophonemic complexity (MPC) significantly affected disfluency in reading task. Despite significant direct relation of MPC and stuttering, the effect size of 7.5% suggested that MPC's impact is negligible in real-world scenarios. Therefore, the authors suggested word length as a potential factor compared to MPC on determining disfluency rate. Further, multiple regression analyses to observe the interaction of these two factors on stuttering frequency displayed a reduction in strength of word length. Moreover, the influence of sandhi and non-sandhi words and content and content-function word on stutter rate, making word length as a constant factor, revealed no significant difference. Authors derived the conclusion that PWS may be inefficient in phonetic planning and execution because of which they stutter more in longer words than shorter words.

Among the phonological factors like the initial position of an utterance, initial consonant in words, longer words, word with consonant clusters, higher IPC scores have been associated with increase in disfluency in reading and spontaneous speech tasks. Also the influence of these factors is observed in grammatical factors like word class for causing disfluency.

2.2. Morphological Factors

Mostly grammatical class investigated consists of content and function words, also some languages include hybrid content-function or function-content words.

Brown (1937) investigated the effect of word class on the locus of stuttering. In the study, thirty-two AWS (age range: 18 -30 years; mean-22.5) were participated. These participants were asked to read five 1000-word lists. For analyzing grammatical factors first, twenty-three classifications were used, out of which rank of difficulty for eighteen speech parts was determined through the percentage of stuttering. Results revealed no difference in stuttering within the same category of grammatical class. Therefore, the data were grouped into conventional eight parts of speech: nouns, adjectives, adverbs, verbs, articles, conjunctions, and prepositions and ranked according to stuttering percentage. The relative difficulty was observed in adjectives and nouns, whereas lesser difficulty in conjunctions, prepositions, and articles. This study reflects that grammatical factors appear more constant than phonetic factors but are related to each other. Hence, it was concluded that words that are easier in speech consist of initial sounds located towards the lower part of the difficulty in phonetic rank and vice versa.

Eisenson and Horowitz (1945) carried a study to determine whether individuals with stuttering have more difficulty in production of words with propositional value, or with little or no propositional value. Eighteen individuals in age range of 17 to 20 years (Mean=18.4 years) with mild to severe developmental stuttering participated in the study. Three types of reading materials with varying propositional value were used: a list of 130 words, a non-sense selection of 130 words, and a meaningful paragraph of 130 words. Each of these materials had 20 same sets of adjectives ranging from one to five syllables. Also, the numbers of other parts of speech like nouns, verbs, etc. was determined in paragraphs, and the same number was used in the list of words. Repetition, prolongation, and (audible and inaudible) block were marked as stuttering moments. The percentage of stuttering across these three types of reading material was calculated, which showed an increase in stuttering frequency from reading word lists to reading meaningful paragraphs on nouns, verbs, and adjectives. Adverbs and prepositions stuttered more in meaningful paragraphs, whereas pronouns and articles stuttered less in meaningful paragraphs than the other two. Authors concluded that the steady increase in stuttering in adjectives, nouns, and verbs indicated that higher propositional value cause an increase in stuttering. However, the less important parts of speech, such as pronouns, prepositions, articles, and conjunctions, have less stuttering frequency. Thus, it is explained that the increase in propositionality affects stuttering that is more important word tends to be stuttered more.

Wingate (1979) conducted a study to observe the relative effects of grammatical class and initial sentence position on disfluency. 33 AWS in age range of 18 to 32 years were taken for the study. They were asked to read a passage of 21 sentences incorporating 163 words. These sentences comprised function words predominantly in the first three positions of the sentence. Results reported increased stuttering rate on content words that do not occur in the first three words of sentence. And, for the first three words in sentence, stuttering frequency was lesser for content words than function words. However, in general, the disfluency ratio for the first three words and other words was not different. From this study, it was found that grammatical categories have a relationship with stuttering occurrence, and a high incidence of stuttering in initial words in a sentence is related to the presence of content words mostly in those positions. Therefore, the authors suggest that initial position and grammatical class are interrelated factors for impacting disfluency frequency.

Jayaram (1981) analyzed the distribution of stuttering on grammatical classes in monolingual and bilingual stutterers. Ten monolingual Kannada speakers who stutter and ten bilingual Kannada and English speakers who stutter were recruited in the study. The age range of monolingual participants was 17 to 34 years (mean age 24.8 years) and of bilinguals was 19 to 32 years (mean age of 25.6 years). Reading material of 149 words English passage and 122 words Kannada passage was used. The words in the passages were classified into content words and function words. A spontaneous speech sample was also taken for the analysis. Repetitions and prolongations of sounds and syllables were considered as stuttering moments for the analysis. Results revealed significantly more disfluency frequency on content words than function words in both the tasks and the monolingual and bilingual groups. And author explained that as content words hold high information, stuttering occurs more in them. Also, additional stuttering moments were observed on words starting with consonants than vowels. Further, many content words started with consonants than vowels. Therefore, author concluded that the phonetic factors interact with grammatical factors in affecting stuttering rate.

Dayalu, Kalinowski, Stuart, Holbert, and Rastatter (2002) investigated the frequency of stuttering across grammatical classes in native English speakers. 10 AWS in age range of 21 to 52 years (Mean age: 32.1 years; SD: 10.7) were taken in this study. A list of 126 words containing same count of content and function words of one grammatical category was given for reading tasks. Stuttering frequency and proportion of stuttering events was calculated for individual data. One way repeated measures of ANOVA revealed more disfluency rate on content words. Further, Kendall rank correlation showed significant positive correlation between word frequency and stuttering. As function word occurs more frequently, so they were less stuttered than content words and more frequent words in both categories were also less stuttered. And the conclusion was made that the difference in disfluency frequency between word classes is due to the generalized adaptation effect on neuro-linguistic processing of these two word categories.

A study by Au-Yeung, Gomez, and Howell (2003) examined the developmental change in loci of stuttering, mainly in word categories for Spanish speakers who stutter. Forty-six native speakers of Peninsular Spanish diagnosed with developmental stuttering were recruited for the study. There were five groups of participants: 7 participants (age: 3 to 5 years), 11 participants (age: 6 to 9 years), 10 participants (age: 10 to 11 years), 9 participants (age: 12 to 16 years) and 9 participants (age: 20 to 68years). Spontaneous speech sample was obtained from each participant. The disfluency rate of function words in pre and post the content word and disfluency across age groups was examined. First analysis performed through two-way ANCOVA revealed that function word before the content word had significantly higher disfluency than content word, in 3 to 5 years and 6 to 9 years old; whereas for 20 to 68 years old group pre-function word had significantly higher rate than post function word. In the second analysis, significantly higher proportion of disfluencies was observed on content word in the adult group than children. It was concluded that young speakers stutter dominantly on function words, and there is swapping of disfluencies from function to content words as speakers get older, which is explained by EXPLAN theory.

Dworzynski, Howell, and Natke (2003) studied across different age groups of German speaking AWS to discover the influence of linguistic factors on disfluency. In this study, two groups were taken one group of 15 AWS (age 16 years 3 months to 47 years; mean=29 years and 8 months) and other groups of 35 CWS (age 2 years 10 months to 11 years 11 months; mean =7 years 10 months). For all age groups, spontaneous speech was used for analysis of stuttering. The stuttering rate was analyzed in these factors: function/content word, a word beginning with vowel/consonant, word shorter/longer than five phonemes and words in first three positions /beyond first three in an utterance. In results children displayed more stuttering on an easier level that is on function and short words than content and long words. And opposite pattern was observed in adults. However, for all other factors, no significant difference was observed in both age groups. Therefore, the conclusion was made that stuttered words were not linked with linguistic and motor difficulty.

Phaal and Robb (2007) studied the influence of grammatical class on stuttering rate and length of utterance concerning the grammatical class. Ten individuals speaking New Zealand English (two females and eight males) with stuttering severity varying from very mild to severe were recruited in this study. The participants' age ranged from 10 to 59 years (mean= 30 years). Participants were given a reading material consisting of 40 stimulus sentences where twenty sentences were four words in length, ten sentences with initial content word, and ten with initial function word. A series of *t*-tests were performed. And the results showed no significant effect on disfluency due to grammatical class when other variables like phonetic composition, word length, sentence position, syllable stress, and utterance length were controlled. Also, the analysis indicated that the utterance length of content and function words did not affect speech disfluency. Thus, authors concluded that word-class should not be viewed as independent dimensions of stuttering occurrence and utterance length is not a variable in the disfluency surrounding content and function words.

Abdalla, Robb, and Al-Shatti (2009) investigated the effect of grammatical class on disfluency in adult native speakers of Kuwaiti Arabic. Ten AWS with age ranging from 17 to 42 years (mean age of 22yrs and 4 months) participated in the study.

Spontaneous speech, reading, and single word naming were the three tasks used in the study. For reading, the passage of 300 words was taken and 50 words including same count of content and function words were used for the naming task. Orthographic transcription was done in each of the three speech samples to mark the moments of disfluency. Disfluent words were classified into content, function, and content-function. A series of t-tests displayed no significant influence of content and function words on disfluency across all three tasks. In spontaneous speech, significant difference wasn't observed in any of the word categories. However, in oral reading, significant differences were found between bare content words and combined content-function words, and between bare function words and combined content-function words. The differences seen in reading tasks were justified by the presence of a grammatically more complex literary variety of Arabic than the local dialect used in spontaneous speech. Also, in spontaneous speech, there is selection of word according to speaker's convenience and speaker might avoid certain word types causing reduction in disfluency. However, it was concluded that the grammatical classes do not hold a strong influence in the Arabic language.

The study by Al- Tamimi, Khameish, and Howell (2013), investigated twenty-one monolingual Arabic speakers diagnosed with mild to moderate developmental stuttering. These participants were grouped into: children (age range: 6 to 11; mean age: 9.62), teenagers (age range: 12 to 17; mean age: 13.94), and adults (age above 18; mean age: 24). Spontaneous speech samples of 3 to 24 minutes were audio-video recorded. In the obtained sample, words were categorized into content, function, and function-content. Statistical analysis revealed that stuttering occurred more in function-content words than content words than function words. Thus, the authors concluded that a higher number of syllable and phonetic complexity increased the likelihood of stuttering across word categories in Arabic.

In AWS, stuttering rate is significantly higher on content words than function words in most of the studies because of high propositional value and greater phonetic complexity. However, few languages did not held influence of content-function word dichotomy. In the languages having hybrid content-function words, the significant difference between C-F words and content words is not well established in both reading and spontaneous speech task.

CHAPTER 3

METHOD

3.1. Participants

The participants in the present study were eighteen Nepali speaking adults who stutter (AWS). The age range of participants ranges from 20 to 41 years (Mean = 30.72, S.D. =6.33). All of the participants were male. The self-reported questionnaire was used to obtain the demographic details like the onset of the problem, family history of stuttering, handedness, age of onset, absence or presence of associated issues. The examiner administered Stuttering Severity Instrument-Fourth Edition (SSI-4; Riley, 2009) before initiating study. Among eighteen individuals, six had a mild degree of stuttering; eight had moderate stuttering, two severe stuttering, and other two very severe stuttering. None of them had associated problems like neurological, intellectual, hearing, vision, or any communication disorders other than developmental stuttering. All the participants were well informed about the study and written consent was taken. Table 1 shows the individual participant information of AWS.

Table 1

Demographic details of individual participants and their overall scores of SSI-4

S.N	Age (in years)	Gender	SSI score	SSI severity	Handedness	Age of onset of Stuttering (years)	Family History of Stuttering	History of treatment
1.	31	M	29	Moderate	Right	4	Positive	Positive
2.	25	M	30	Moderate	Right	3	Negative	Negative
3.	29	M	22	Mild	Right	10	Positive	Negative
4.	38	M	33	Severe	Right	6-7	Positive	Positive

5.	34	M	28	Moderate	Right	9	Positive	Negative
6.	23	M	25	Moderate	Right	4	Positive	Negative
7.	31	M	33	Severe	Right	5	Negative	Negative
8.	40	M	25	Moderate	Right	5-6	Negative	Positive
9.	22	M	21	Mild	Right	5	Negative	Negative
10.	29	M	22	Mild	Right	3-4	Positive	Negative
11.	20	M	37	Very Severe	Right	8-9	Positive	Positive
12.	29	M	38	Very Severe	Right	10	Positive	Negative
13.	32	M	18	Mild	Right	7	Negative	Negative
14.	31	M	31	Moderate	Right	4-5	Negative	Positive
15.	41	M	23	Mild	Right	4	Positive	Positive
16.	35	M	22	Mild	Right	6-7	Positive	Positive
17.	24	M	29	Moderate	Right	4-5	Positive	Negative
18.	39	M	26	Moderate	Right	4	Positive	Negative

3.2. Recording and transcription of speech sample

The effect on the frequency of disfluency due to phonological and morphological factors was assessed through spontaneous speech tasks. Topics for monologue, such as family, friends, places, movies, personal information, interests, and hobbies were suggested. Audio-video recording of the same was done for each participant in a quiet room with appropriate illumination. The duration of sample was for 10 minutes.

Orthographic transcription of fluent and disfluent utterances was done for the recorded sample. A sample of 350 syllables was analyzed after removing the first and last seventy-five syllables. Stuttering like disfluency classified by Yairi and Ambrose (2005) was used to identify and mark stuttering moments in the recorded sample. These are part-word repetition, single syllable word repetition and dysrhythmic phonation (blocks, prolongations, and broken words).

3.3. Data analysis

3.3.1. Phonological factors

Variables investigated under phonological factors were the position of phoneme, phoneme category, and word length. Comparison of stuttering frequency in phoneme position was made between the initial and medial position of the word, and in the phoneme category between initial consonant versus word with initial vowel. In word length, the comparison was made between monosyllable, bi-syllable, tri-syllable, and multi-syllable words, where multi-syllable word includes four or more than four syllables.

3.3.2. Morphological factors

Morphological factors evaluated were types of word-class: content words, function words, and content-function words. Content words include nouns, main verbs, adjectives and adverbs, whereas pronouns, articles, prepositions, conjunctions, modals, auxiliary verbs, and inflections are function words (Brown & Fraser, 1963). While content-function words are the words in which function word is attached to the root content word forming a single word. Stuttering frequency across these variables was compared.

The percentage of stuttering on each of these variables was obtained by calculating the number of stuttering instants with respect to each factor divided by a total number of occurrences of particular linguistic category and multiplied by 100 (Howell et al.,2000; Alqhazo & Al-Dennawi, 2018; Seth & Maruthy, 2019).

Formulae to compute the frequency of stuttering:

Phonological factors

Phoneme position: [(Total number of words stuttered in initial/medial position)/Total number of stuttered words] * 100

Phoneme category: [(Total number of stuttered words beginning with vowel/consonant)/Total number of words beginning with vowel/consonant] * 100

Word length: [(Total number of monosyllable/bisyllable/trisyllable/multisyllable words stuttered)/Total number of monosyllable/bisyllable/trisyllable/multisyllable syllable words]* 100

Morphological factors

Word class: [(Total number of stuttered content/function/content-function words)/Total number of content/function/content-function words] * 100

3.4. Reliability measures

Intra-rater and inter-rater reliability measures were determined for the recorded sample of three participants. Inter-rater reliability was carried out by other Speech-Language Pathologist, a native speaker of the Nepali, by calculating the stuttering rate for each of the factors considered. For intra-rater reliability, the first examiner re-analyzed the data in the interval of a month and computed the frequency of stuttering for each factors.

3.5. Statistical analysis

IBM Statistical Package for the Social Sciences (SPSS; Version 20.0) was used for all the statistical analyses. Normality analysis performed with the Shapiro-Wilks test (Field, 2005) showed that data was normally distributed with $p > 0.05$. Therefore, parametric tests like paired t-test and repeated measures analysis of variance (ANOVA) were carried out. The influence of phoneme position and phoneme category on stuttering frequency was assessed using a Paired t-test. To evaluate the impact of word length and word class, repeated measures ANOVA was performed. The effect size for paired t-test was computed using Cohen's d measure ($d = t/\sqrt{N}$, where N sample size and t is test statistic). The level of significance considered was $p=0.05$.

CHAPTER 4

RESULTS

4.1. Phonological factors

Values of mean, median and standard deviation were obtained through descriptive statistical analysis for each of the phonological factors and morphological factors. These values for phonological factors are provided in Table 2. The higher stuttering rate was noted in the initial word position than word middle position, and the difference was statistically significant with t (17) = 44.11, p=0.000, d=10.39.

Further, main effect of word length was found to be significant [*F* (2.242, 38.116= 10.519, Greenhouse Geisser, *p*=0.000] in one-way measures of analysis of variance. Further, to get the pair wise comparison, Bonferroni correction was applied, which revealed a significant difference between disfluency rate on monosyllable and tri-syllable word (p=0.008), monosyllable and multi-syllable word (p=0.017), bi-syllable and tri-syllable (p=0.01), bi-syllable and multi-syllable word (p=0.007). Furthermore, the stuttering frequency was seen higher in tri-syllabic words compared to other syllable lengths.

However, paired t-test (t (17) = 0.158, p=0.876, d= 0.03) showed no significant effect of phoneme categories on the disfluency frequency that is between words starting with consonant and words starting with vowels.

4.2. Morphological factor

The results of descriptive statistics (mean, median, and standard deviation values) for word classes are provided in Table 3. The frequency of stuttering was higher for content-function words compared to the other two classes. Repeated measures analysis of variance showed significant differences between word class [*F* (1.440, 24.47= 22.946, Greenhouse Geisser, *p*=0.000]. Further, Bonferroni post hoc analysis revealed significant difference between content and function word (p=0.005), content and content-function word (p=0.004) and function and content-function words (p=0.000).

Table 2

Values of mean, median, and standard deviation for stuttering rate (in percentage) concerning phonological factors in Nepali speaking AWS

Factors	Mean	Median	SD
Phoneme position			
Initial position	95.56	96.35	4.37
Medial position	4.44	3.63	4.38
Phoneme Class			
Consonant	16.88	12.67	10.28
Vowel	17.35	17.95	10.85
Word length			
Mono-syllabic	10.99	9.22	13.48
Bi-syllabic	14.81	12.98	9.17
Tri-syllabic	26.79	25.54	18.05
Multi-syllabic	24.79	21.57	14.62

Table 3

Values of mean, median, and standard deviation for stuttering rate (in percentage) concerning morphological factors in Nepali speaking AWS

Factors	Mean	Median	SD
Word class			
Content words	18.67	15.39	11.00
Function words	10.86	9.23	7.83
Content-Function words	33.72	30.95	20.40

4.3. Intra-rater and inter-rater reliability

For reliability judgment, Cronbach's alpha value was computed for three participants in each of the factors considered. The value of Cronbach's alpha obtained was more than 0.9 for all of the phonological and morphological factors, indicating high inter and intra rater reliability. The values are provided in Table no 4.

Table 4

Cronbach's alpha value for Inter-rater and Intra-rater reliability

Phonological factors	Cronbach's alpha for Inter-rater reliability	Cronbach's alpha for Intra-rater reliability
Phoneme position		
Initial	0.90	0.93
Medial	0.91	0.94

Phoneme category		
Consonant	0.96	0.94
Vowel	0.90	0.95
Word length		
Monosyllable word	0.95	0.95
Bisyllable word	0.95	0.95
Trisyllable word	0.99	0.99
Polysyllable word	0.91	0.99
Morphological factors		
Content words	0.94	0.98
Function words	0.96	0.92
Content-function words	0.97	0.99

CHAPTER 5

DISCUSSION

The study's objectives were to compare stuttering frequency across different phonological and morphological factors in Nepali speaking AWS. Phoneme position, phoneme category, and word length were phonological factors, and the grammatical class was the morphological factor, considered in this study.

5.1. Phonological factors

In first analysis, disfluency rate between the initial and medial position of word was compared. As Nepali is a syllable timed language, most of the words end in a vowel, so any stuttering moment occurring in the final syllable would make it the middle position in a word. The comparison of stuttering moments in word-initial and word medial positions revealed a significantly greater stuttering rate on the initial position than medial position of the word. This result is in agreement with earlier investigation done by Brown (1938), Hahn (1942b), Taylor (1966), and Wingate (1967) in AWS. Researchers have suggested higher stuttering on the initial position because the initial position is more prominent and conspicuous. There is an initiation of motor activity and more demand on motor planning for intricate articulation, sound transition, change in stress, pitch, and volume. Therefore, in this study also the increase in demand for speech motor systems for the planning of utterance is attributable to the higher stuttering frequency on the initial word position compared to word medial position.

Second analysis included comparison of stuttering moments between words that begin with consonants and words with vowels. Results revealed no significant difference between these situations and is corroborated with existing literature (Dworzynski, Howell, & Natke, 2003; Soderberg, 1962) and contradicted with other researches (Griggs & Still, 1979, Jayaram, 1983, 1981, Johnson & Brown, 1935). Soderberg (1962) considered no significant difference between phoneme category as a difference in semantic and communication aspects of oral reading compared to spontaneous speech. Moreover, in a study by Dworzynski, Howell, and Natke (2003) suggested no influence of linguistic complexity on the stuttering rate. However, other literature has shown a strong association between the phoneme category and stuttering in AWS. It was justified saying that words beginning with a consonant are challenging to produce as it requires more rapid and precise articulation with active use of speech mechanism. Also, the consonant provides clarity and distinctiveness in speech, while vowel gives volume. In contrast, the current study did not find effect of phoneme category on speech disfluency. It is suggested that the proportion of function and content words beginning with vowels might be different in Nepali than other languages. Also the formula used, in present study, to calculate stuttering percentage concerning respective factors includes denominator as respective factors but not total words which is different from the existing literature studying effect of phoneme type. Therefore, it is concluded that as stuttering occurred more in initial sound and longer words, the effect of phoneme type alone is not a potential factor in Nepali language.

Final phonological factor studied was word length, where the highest stuttering frequency was observed in trisyllable words, followed by multi-syllable words. Moreover, the significant difference was observed between stuttering frequency on monosyllable word with tri-syllable word and multi-syllable word, and bi-syllable word with tri-syllable and multi-syllable word. Therefore, the findings of this study show word length as an important factor causing stuttering which confirms earlier investigations in AWS by other researches (Al-Tamimi, Khamaiseh & Howell, 2013; Brown & Moren, 1942; Griggs & Still, 1979; Soderberg, 1966; Venkatagiri, Nataraja & Deepthi, 2016; Wingate, 1967). The word length used in these studies varies from two syllables longest word to eight syllables and the variability is computed in either reading or spontaneous speech task. Researchers have suggested that an increase in syllable length increases phonetic complexity because of changes in articulatory movement, stress and syllable transition, requiring an intricate pattern of coordination. As the length of syllable increases there are elevated demands on motor planning and its execution. As per the model of spoken word production by Levelt, Roelofs, and Meyer (1999), abstract phonological words are converted into syllable sized motor programs, which are retrieved and assembled during speech motor planning. Further, for the articulation to happen, motor programs are translated to neural signals. Therefore, the increase in the number of syllables increases computational load during planning. People who stutter are likely to be inefficient in planning and execution, which is probably more evident for long words than short (Howell, 2004; Venkatagiri et al., 2016). In the present study, findings extend to words more than four syllables and computed variation in stuttering rate accounted by word length in spontaneous speech. An increase in stuttering frequency with word length was observed and can be explained as increased phonetic complexity leading to increase speech motor planning demands. This factor has shown the dominant effect on speech disfluency in Nepali language.

5.2. Morphological factors

A comparison of the disfluency rate was made across content-function words, content words, and function words in grammatical class. The results manifested that effect of word class on the disfluency is significant. Significantly higher disfluency rate was found on content-function words followed by content words, followed by function words.

Increased disfluency rate on the content word than function word corroborates to the study done by Au-Yeung et al.,(1998); Brown (1937); Dayalu et al. (2002); Eisenson and Horowitz (1945); Jayaram (1981); Soderberg(1967); Wingate,(1979), whereas few other researchers showed no significant effect of word class in AWS (Abdalla, Robb, & Al-Shatti, 2009; Dworzynski et al.,2003; Phaal & Robb,2007). Brown (1937), Dworzynski et al. (2003), Eisenson and Horowitz (1945), Soderberg (1967) and attributed the results to the propositional value and frequency of occurrence in the speech. Function words being the part of speech contributing least to the meaning conveyed, incorporating low information, and frequently occurring are stuttered less than content words. Further, Au-Yeung et al. (1998) suggested that disfluency on function words is influenced by external factors, i.e., position relative to content words within phonological words; nevertheless, content words are governed by inherent factors like phonetic composition, lexical content, phoneme length and frequency of occurrence. Dayalu et al. (2002) found more stuttering on content words occurring in isolated condition and suggested that this difference is attributed to the difference in the neurolinguistic constitution and explained as more frequent occurrence of function word and generalized adaptation effect on neurolinguistic processing of two word categories. Nonetheless, few studies have shown the influence of phonetic factors (phoneme category and word length) for the increased stuttering on content words. The majority of content words begin with consonant than vowels. The initial consonants in words involve greater articulatory complexity than vowels, so are associated with more stuttering. Also, in general function words have shorter word length than content words, therefore less stuttering on function words (Jayaram, 1981; Taylor 1966a; Wingate, 1967).

Al-tamimi et al. (2013) reported that in Arabic speaking AWS, the higher stuttering rate in function-content words followed by content words followed by function words and suggested phonetic complexity as a factor. It was observed that the majority of content-function and content words were multisyllabic, and function words were monosyllabic with an increase in the number of syllable from content to content-function words. Therefore, due to increase in the number of syllable number of stuttering also increased. However, in a Kuwaiti-Arabic speaking AWS study, by Abdalla, Robb, & Al-Shatti (2009), no significant difference was seen between word classes in all reading, spontaneous speech and naming tasks, indicating that these grammatical categories do not influence disfluency on Kuwaiti-Arabic speaker. Nonetheless, in oral reading tasks, stuttering moment in content-function was significantly greater than content and function words. Authors considered that combined forms require greater linguistic and motor processing, placing more demands on the resources required for planning or executing speech. Similarly, in Kannada speaking AWS, the stuttering rate on content words and content-function words were not significantly different in their spontaneous speech. Thus, Venkatagiri et al. (2016) recommended that effect of word class is independent of word length in Kannada.

The present study holds content-function dichotomy. The significant impact of word class on stuttering frequency can be seen due to the phonetically complex nature of content-function and content words than function words. Also, mostly function words are mono or bisyllabic, but most of the content-function and content words are tri or multi-syllabic. Thus, the interaction of word length and word class can be considered as a factor for influencing disfluency in Nepali speaking AWS.

CHAPTER 6

SUMMARY AND CONCLUSION

The purpose of this study is to determine the impact of phonological and morphological factors on the disfluency of Nepali speaking AWS. 18 adult speakers of Nepali with mild to very severe developmental stuttering were taken in this study. Spontaneous speech sample was audio-video recorded and transcribed through orthographic transcription. A total of 350 syllables were analyzed to calculate stuttering frequency. Phoneme position, phoneme category, and word length was considered in phonological factor and word class in morphological factor. The percentage of stuttering for each of these variables was computed. The study's outcome displayed a significant effect of phoneme position and word length but no effect of phoneme category. The increase in the stuttering rate in initial word position and longer words is explained as the increase in phonetic complexity causes higher speech motor planning demands. Moreover, in morphological factors, a significant difference between content-function word, content word and function word was observed. The higher disfluency rate on a content-function word followed by content word is suggested due to the phonetically complex nature of content-function and content words compared to function words.

To conclude, this study shows a significant effect of phoneme position, word length, and grammatical class on the frequency of disfluency in Nepali speakers but no impact of phoneme category. And the findings are attributed to the phonetically complex nature of these variables, leading to an increase in motor planning demand, making them more prone to stuttering. These findings support and contradict to the previous investigations, which are ascribed to linguistic differences between Nepali and other languages like English, German, Kannada, Arabic, and Persian. Also, this study highlights the view that differences in linguistic structure affect the pattern of stuttering.

Future indications

- Future research should be carried in pre-school and school-age children, so that comparison among these can provide better perspective in nature of stuttering in the Nepali language
- Further studies can be done, including other factors like different types of consonants, consonant clusters.
- Studies can be done across other tasks, like reading.
- Studies can also investigate the effect of linguistic factors in bilingual population.

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