EFFECT OF PHONOLOGICAL AND MORPHOLOGICAL FACTORS ON SPEECH DISFLUENCIES OF KANNADA-SPEAKING SCHOOL-AGED CHILDREN WHO STUTTER

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CERTIFICATE

This is to certify that this dissertation entitled **"Effect of Phonological and Morphological Factors on Speech Disfluencies of Kannada-Speaking School-aged Children Who Stutter"** is a bonafide work submitted as part of fulfilment of the degree of Master of Science (Speech-Language Pathology) of the student with Registration Number P01II24S123023. This has been carried out under the guidance of a 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 Disfluencies of Kannada-Speaking School-aged Children Who Stutter " has been prepared under my supervision and guidance. It is also being 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 Disfluencies of Kannada-Speaking School-aged Children Who Stutter " is the result of my own study under the guidance of Dr. Santosh M, Professor of Speech 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

INTRODUCTION

Stuttering is "speech disorder characterised by repetition of sounds, syllables, or words; prolongation of sounds; and interruptions in speech known as blocks" (NIDCD, 2017). Typically, the onset of stuttering is between 2 and 6 years of age (mean ≃ 33 months) and is the most common during a period of rapid language development, which coincides with emerging cognitive and social skills (Yairi & Ambrose, 2005).

Hence, many researchers over the years, studied the occurrence of stuttering across linguistic dimensions and tried investigating whether there is any effect of various linguistic factors on the stuttering moments. Pioneer research was done by Brown (1937, 1938a) on the effect of linguistic factors on the stuttering frequency in English-speaking adult speakers and established that speech disfluencies were systematically related to language properties. The author studied grammatical function, word stress and word position with their effect on stuttering moments. Results showed that all the three factors have a predominant effect on the occurrence of stuttering. Later, with this line of thinking, on the stuttering moments and its association with linguistic domains such as phonological, lexical, morphological, and syntactic factors and stuttering have been researched extensively (Anderson & Wagovich, 2010; Howell & Au-Yeung, 2002; Seth & Maruthy, 2019). Studies are done in the Adults Who Stutter (AWS) (Brown, 1945; Dworynksi, Howell & Natke, 2003; Venkatagiri, Nataraja & Deepthi, 2017), school-aged Children Who Stutter (CWS) (Howell and Au-Yeung, 2006; Al-Tamimi, Khamaiseh, & Howell, 2013; Alqhazo & Al-Dennawi, 2018) and preschool CWS (Williams, Silverman, & Kools, 1969a; Throneburg, Yairi, & Paden, 1994).

Subsequent evidence highlights the relationship between linguistic factors like phonological and morphological factors on the stuttering moments.

1.1 Phonological factors

In recent years, phonological factors associated with stuttering moments have been receiving significant attention. Increase in linguistic and speech motor planning demand, has been hypothesized to increase the stuttering moments (Howell, 2004). Past evidence suggests that stuttering is governed by phonological factors such as: phoneme position, phoneme type, word length and phonological complexity (Brown & Moren, 1942; William et al., 1969a; Throneburg et al., 1994).

Phoneme Position

Variables assessed under phoneme position are initial, medial, and final position. Studies have recorded that initial sounds in the word are most likely to cause stuttering, which may be because of higher demands on motor planning (Natke et al., 2004; Alqhazo & Al-Dennawi, 2018). Brown (1945) revealed that in AWS, occurrence of stuttering was higher for initial sound position and similar results were seen for preschool CWS (Seth & Maruthy, 2019). While, Eichorn and Donnan (2021) through a case study of school-aged CWS revealed the predominance of disfluencies in word-final position, contradicting the typical loci pattern (word-initial) of phoneme position. On the other hand, Bircan et al., (2023) analysed both the syllable and word levels in Turkish-speaking school-aged CWS and confirmed that initial positions were most vulnerable, reinforcing the universality of onset difficulty across languages. Different studies have found dominance of different phoneme positions, while linguistic form of the language being held on. Since phoneme position clearly influences the likelihood of stuttering, the type of phoneme also plays a significant role in speech disfluencies.

Phoneme Type

Variables considered in the studies are words commencing with consonants and compared with words commencing with vowels. Since consonant articulation demands greater articulatory precision and motor coordination than vowel articulation, words that begin with consonants have higher stuttering rate than those words that begins with vowels, as seen in preschool CWS (Seth & Maruthy, 2019), similar results were seen for Jordanian-Arabic speaking school-aged CWS (Alqhazo & Al-Dennawi, 2018) and Kannada-speaking AWS (Jayaram, 1981). On the contrary, a study conducted in Japanese-speaking preschool CWS (Iimura et al., 2021) found no significant differences between the words having consonants and vowels in the initial position. These findings highlight that higher disfluencies are observed on consonants than on vowels; however, the influence of language is also attributed.

Word Length

According to the literature, stuttering is more frequent on longer words than on shorter ones, as it could be due to the increase in linguistic and motor demand for longer words. Typically, word length is compared among monosyllable, bisyllable, trisyllable and multisyllable words. In AWS, studies have found that stuttering rate was higher on longer words (Brown, 1945; Venkatagiri et al., 2017; Aryal & Maruthy, 2023). While in school-aged CWS, researchers report that they demonstrate more disfluencies on multisyllabic words, especially those with more than two syllables (Griggs & Still, 1979b; Al-Tamimi et al., 2013). On the contrary, Seth and Maruthy (2019) found no significant effect of word length on stuttering frequency in Kannada-speaking preschool CWS. While in Japanese school-aged CWS, the strength and mix of linguistic predictors (e.g., word length, lexical frequency, phonological load) shift with age from preschool to early school years,

supporting a developmental trend on phonological constraints (Takahashi et al., 2024). Through this evidence it highlights that word length is an important determinant of stuttering frequency; however, the size of the effect can vary by language and age.

Phonological Complexity

Consonant clusters, syllable structure, and phoneme class are among the elements that make up phonological complexity, which is measured by indices such as the Index of Phonetic Complexity (IPC), which was developed by Jakielski (1998). Throneburg (1994) stated that complex syllable shapes and words do not influence the occurrence of stuttering in preschoolers, but somewhat influenced the adults who stutter (AWS). Keeping this in inquiry, studies have also linked phonological complexity to higher disfluency rates in children, especially when clustered consonants or complex syllable shapes are involved (Howell, Au-Yeung & Sackin, 2000). Hence, phonological complexity is one of the linguistic factors related with the occurrence of stuttering in children, carrying mixed results. The above section described the phonological factors in terms of phoneme position, phoneme type, word length and phonological complexity. The subsequent section will emphasise the morphological factors.

1.2 Morphological Factors

Word Class

Word class is one of the most widely studied morphological factors. Grammatically, word class is classified into content and function words. Content words consist of nouns, verbs, adjectives and adverbs, while function words consist of pronouns, articles, prepositions, auxiliary verbs, conjunctions, inflections and modals. Brown (1945), with

English-speaking adults, revealed that higher disfluencies are seen for content words than compared to function words, but studies show mixed results regarding stuttering frequency in content compared to function words in CWS. In Jordanian Arabic school-aged CWS, function words show a higher stuttering percentage than content words in the mild level of stuttering, and as severity increases, stuttering loci was seen on both content and function words (Alqhazo & Alfwaress, 2022), while study by Choi et al. (2020) in English-speaking preschool CWS revealed that children stuttered more on function words. Seth and Maruthy (2019) revealed no significant differences in the frequency of stuttering on both content and function words in preschool CWS. Hence, disfluencies associated with word class may be influenced by the language and age of the individual.

Word Inflections

Inflectional morphology is another factor studied under morphology, which is less explored and limited evidence is available. A study by Alqhazo and Al-Dennawi (2018) indicated the presence of bound morphemes (e.g., -s, -ed, -ing), which may increase stuttering in Jordanian-Arabic speaking school-aged CWS. In contrast, a study by Seth and Maruthy (2019) in Kannada has found no consistent effect in preschoolers. Since the impact of phonological and morphological factors varies across languages, examining them within the specific linguistic framework of the Kannada language becomes essential. Further sections highlight the linguistic makeup of the Kannada language.

1.3 Linguistic properties of the Kannada language

Kannada is considered one of the four major Dravidian languages, predominantly spoken in the southern part of India i.e., Karnataka, which is the fourth largest in the world and with more than 175 million speakers (Steever, 2019). According to Upadhyaya (1972),

there are 43 phonemes in Kannada, including 33 consonants in its consonant system and the vowel system consists of five long and five short vowels. These consonants are divided into seven groups: nasals, laterals, flaps, fricatives, stops, affricates, and continuants. Notably, in addition to voiced and voiceless cognates, there are aspirated forms of the stop consonants and affricates. Kannada when compared to English is phonologically contrastive in nature, differing in syllable shape, consonant clusters, word length and word neighbourhood effects. In Kannada, the following syllable structures are acceptable: V, CV, CCV, and CCCV (the last being mostly limited to borrowed words). According to Nag-Arulmani, Reddy, and Buckley (2003), one of Kannada's distinctive phonotactic characteristics is the "open-endedness" of its words; unlike English, where consonant-final words are prevalent, all Kannada words end in a vowel. As for word length, most of the words in Kannada are bisyllabic, trisyllabic, or polysyllabic words, and monosyllabic words are rare. Prosodically, Kannada is considered as an alpha-syllabary with a simple syllabic structure, a mora-timed rhythm, and emphatic stress patterned language. However, English is considered an alphabetic language with stress-timed rhythm and lexical stress (Savithri, Jayaram, Kedarnath, & Sanjay, 2005).

Morphologically, Kannada is an agglutinative language, characterised by the extensive use of suffixation. According to Venkatagiri, Nataraja, and Deepthi (2017), complements are often added to nouns and verbs to lengthen the words. This results in phonological words that might not be lexically listed, such as /uddeʃawalla/ = /uddeʃa/ "intention" + /alla/ "not" = "not [the] intention". The key factor in word development is the sandhi process, which involves phonemic modifications at morpheme borders. Additionally, Kannada contains hybrid "content-function" (C–F) words, like /u:ruge/ ("to the native"), which combine grammatical and content information into a single phonological unit.

Need for the study

Phonological and morphological factors have been proposed in existing literature to influence stuttering across different age groups. Existing literature findings reveal that children show a word-initial effect (Natke et al., 2004), higher stuttering frequency on consonants (Alqhazo & Al-Dennawi, 2018), longer words (Takahashi et al., 2024) and function words (Choi et al., 2020) while morphological endings are minimally explored. Subsequent studies mainly focus on preschool-aged children, hence, developmental changes and linguistic variations are not emphasised. Although preschool is typically where stuttering first appears, as children's linguistic and academic demands rise during school-age, stuttering's persistence or recovery becomes more apparent. Rapid vocabulary growth, intricate morpho-syntactic development, and developing literacy abilities are characteristics of this stage, which can converse with phonological and morphological factors and thus, affecting the frequency and loci of disfluencies. That said, the majority of this information is collected from English-language studies. The findings from English cannot be directly extended to Kannada because of the massive contrasts the two languages bear in phonological and morphological processes. Languages with extensive agglutinative morphology, like Kannada, may exhibit stuttering differently than morphologically simpler languages, like English. In view of the literature gap, it is theorised that the pattern and degree of phonological and morphological factors in Kannada-speaking school-aged CWS may differ from those seen in similar age groups or other age groups in English. Hence, looking into the linguistic diversity and investigating the linguistic factors on school-aged children comes as an important note. The current study, hence, will contribute to a better understanding of the relationship between phonological and morphological factors with speech disfluencies in CWS who are school-aged and speak Kannada.

Aim of the study

To investigate the relationship between phonological and morphological factors and speech disfluencies of Kannada-speaking school-aged CWS.

CHAPTER 2

REVIEW OF LITERATURE

According to Brown (1937, 1938a), it was stated that grammatical function (nouns, verbs, adjectives, adverbs, etc.), word stress (word accent), and word position all had a significant impact on the occurrence of stuttering. Following this line of thinking, Brown and Moren (1942) demonstrated that word length also influenced the stuttering frequency; longer words might be more vulnerable to stuttering than shorter words. Further, Brown (1945) found that the onset of utterance (more disfluency at the beginning), consonant-initial words (versus vowel-initial words) or longer words (multisyllabic words are more challenging), and content words (nouns and verbs) are more frequently associated with an increase in stuttering in adult English speakers. These results have been demonstrated in Spanish and Kannada (Au-Yeung et al., 2003; Jayaram, 1984). At the same time, Dworzynski et al. (2003) found no significant difference in disfluency between content words and function words among German-speaking children. Hence, it indicates that linguistic contexts associated with the likelihood of stuttering in English-speaking stutterers can differ from those in other languages and age groups.

These inconsistencies provide a way to examine linguistic factors within specific languages and populations. Consequently, further investigation into phonological and morphological influences on stuttering in understudied languages is necessary. Subsequent sections are provided to review based on the phonological and morphological factors and their effects on the stuttering frequency in different languages. However, the findings have been inconsistent and therefore warrant further investigation.

2. 1. Phonological Factors

The phonological factors investigated are phoneme position within words (initial position/ medial position/ final position), phoneme type (words commencing with consonants/ words commencing with vowels), word length (monosyllabic/ bisyllabic/ trisyllabic/ multisyllabic words) and phonological complexity.

Brown (1945) attempted to study certain characteristics of words in relation to stuttering in the oral reading task. Thirty-one AWS participated in the study (age range- 18-30 years; mean- 22.5). Each of the participants was made to read the selected material of 1000 words twice. Each word in the reading material was analysed based on the presence or absence of the characteristics- initial sound, grammatical function, sentence position and word length. This study has used a different approach than the previous study, by using a two-valued system, where each of the 1000 words was assigned a plus or minus rating with regard to each of the four characteristics. Each word starting with a sound carrying a mean percentage of stuttering greater than 9.7 percent was given a plus rating. With regard to grammatical function, adjectives, nouns, adverbs, and verbs, words occurring as the first, second, or third word of a sentence were given a plus rating. Word length was measured in letters, phonemes or syllables and words with five or more letters were given a plus rating. Thirty-one participants were divided into severe stutterers (11), moderate stutterers (12) and mild stutterers (8). Results showed that, irrespective of the approach used, four factors are considered necessary for the loci of stuttering. The adults who stutter classified as a mild group almost had no stuttering on words which do possess at least one of the factors, implying that presence of one or more factors have greater possibility in increasing the percentage of stuttering. An almost perfect correlation between the plus-value and the stuttering percentage was observed. This study highlights that these factors, initial sound,

grammatical function, sentence position and word length are the characteristics of words to which stutterers react as they speak. In relation to previous studies by the author using the percentage of stuttering, a two-valued system was set up to emphasise the relationship of each of four factors with the words stuttered. Hence, it was concluded that these factors are the most important determinants of loci of stuttering.

Williams, Silverman, and Kools (1969a) compared loci of stuttering disfluency in English-speaking Kindergarten stutterers and nonstutterers. One hundred and fifty-two Kindergarten through sixth-grade children consisting of 76 Children who stutter (CWS) and 76 CWNS. The age of CWS ranged from 5 to 12 years, 10 months (median age- 8years, 11 months), while the age of CWNS ranged from 5 years, 4 months, to 13 years, 1 month (median age- 9 years, 2 months) were considered for this study. Each participant performed a speaking task, where, kindergarten and first-grade children repeated 10 sentences (length of five to eight words) after the examiner, while second- through sixth-grade children read passages from first- and third-grade books. Each passage read by CWS was 100 words in length, whereas CWNS read 200 passages of 200 words in length. Each word in the reading passage and sentence list was assessed in terms of four word attributes: initial phoneme, grammatical function, sentence position and word length. Scoring was done as a weight of one was given to each of the four attributes present in the word, hence, maximum weight on each word was four and minimum weight on each word was zero. Each child was examined for percentage of total number of words spoken which carried the attribute and the percentage of disfluent words that carried the attribute. Results revealed that the majority of kindergarten CWS classified as being disfluent on words possessing each of the four attributes, among which, grammatical function, sentence position, and word length were statistically significant. CWNS tends to be disfluent on words possessing the four linguistic attributes, among which, grammatical function and word length was statistically significant,

while sentence position being the least influence on the loci of disfluencies. However, comparing the chronological age with the word attributes, except for the sentence position, the relationship between word attributes and age seems to be the same for CWS and CWNS. Hence, this study concluded that the sentence position attribute appears to exert a greater influence on the loci of disfluency in the speech of CWS than of CWNS, while the other three attributes influence the loci of disfluency in both the groups in similar fashion. Further, this study supported the view of Brown, along with explaining the fact that normal speaker's disfluencies also tend to occur on words carrying these attributes.

Griggs and Still (1979b) studied the individual variations in words stuttered. The study included six participants, out of which four were children aged 11-14 years, and two were adults aged 23 and 25 years. The participants were asked to read twenty-five passages consisting of about 200 words in a gap of a week. The passages were randomly chosen. For analysis, each word was classified by initial phoneme, grammatical class, position in a sentence, and word length. 29 English phonemes and 19 grammatical classes were taken into account. The stuttering frequency in each category was calculated. Chi-square test showed higher stuttering disfluencies in the beginning of a sentence, longer words, initial consonants, and content words. The author proposed that phonetic complexity has an influence on stuttering.

Throneburg, Yairi, and Paden (1994) conducted a study investigating the relation between phonological difficulty of words and point at which stuttering-like disfluencies occurred in the speech of preschool children who stutter. The study included 24 preschool children with an age range between 29 months and 59 months (mean age- 40.5 months, SD = 9.1 months). 9 participants were girls and 15 were boys. A spontaneous speech sample of 1000 words was obtained during two 20-minute audio-video recordings. Five experienced examiners listened to the tape and orthographically transcribed the children's utterances.

Children were subgrouped into (a) severe stuttering/poor phonological ability; (b) severe stuttering/ good phonological ability; (c) mild stuttering/poor phonological ability; (d) mild stuttering/good phonological ability. Phonological analysis was carried out using eight categories of phonological difficulty: complex shape, not difficult, multisyllable, late-emerging consonants, complex shapes and late-emerging consonants, complex shapes and multisyllables, late-emerging sounds and multisyllables, multisyllables and late-emerging consonants and complex shapes. Each Stuttering-like disfluency (SLD) word was categorised into one of the eight phonological difficulty types. Results revealed that words containing SLD were not phonologically difficult or had only a single element of phonological difficulty. Word-bound factors like the presence of late-developing sounds, complex syllable shape, and/or multisyllables do not have any influence on the occurrence of disfluencies. Presence of each type of phonologic difficulty of the next words closely resembles the proportional occurrence of that type of phonologic difficulty in the entire speech sample, hence, phonological difficulty of the upcoming word was not a factor to influence the occurrence of SLD. This study clearly states that phonological difficulty does not have any influence on the occurrence of early stuttering in preschool children. Hence, the author(s) conclude that CWS are not influenced by the words that are phonologically more difficult and emphasize that phonological influences could be more characteristic of advanced than early stuttering.

Dworynksi, Howell, and Natke (2003) investigated the influence of loci of disfluency in German-speaking children and adults who stutter. Total of 15 German adults (5 females, 10 males) age ranging from 16 years 3 months to 47 years 1 month (mean age: 29 years 8 months) and 17 school-aged children (6 girls, 11 boys) age ranging from 7 years 4 months to 11 years 11months (mean age: 10 years 1 month). Spontaneous speech sample of a minimum 2 minutes were analysed and orthographically transcribed. All words were

coded according to Brown's factors and were given a score of 0 or 1 for each factor. A score of 0 was given when the word started with a vowel, was a function word, containing less than five phonemes and occupied one of the first three positions in the sentence. Results showed that children had a higher disfluency rate on function words, and with increasing age, content words were highly stuttered, while function word disfluencies decreased. Adults showed a higher disfluency rate with increasing level of word difficulty (longer words), while the opposite trend was seen for children, easier words (function and short words) were highly stuttered. Similar to the English trend, words beginning with vowels and positioned earlier in the sentence had a higher disfluency rate. However, the study concluded that both linguistic and motor complexity are not as strong determinants in childhood, as in adult stuttering, as linguistic factors do not influence their disfluencies in the same way as adults, that is, linguistically simpler words were stuttered at a higher rate.

Howell and Au-Yeung (2006) conducted a study in Spanish-speaking PWS to determine the impact of phonetic complexity on stuttering frequency. Participants recruited were thirty-five monolingual native speakers of Spanish diagnosed with developmental stuttering. Participants were grouped into: 19 children of age 6 to 11 years (mean: 8.5years, SD: 2.0), 7 teenagers between 12 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 examined the influence of eight Index of Phonetic complexity factors using Jakielski's Index of Phonetic Complexity (IPC) across age groups and word classes. These eight IPC factors include consonant by manner, consonant by place, singleton consonants by place, word shape, vowel by class, word length, adjacent consonants, and cluster by place. A spontaneous speech sample was obtained and each word was classified as content and function word. Related t-tests on each age group, revealed significantly higher IPC scores of content words than those of function words for all age groups and of stuttered words than nonstuttered words for adults in

Spanish. And no difference in IPC scores between fluent and disfluent function words for all age groups was observed. Further, study compared the English and Spanish language and found that stuttered content words had similar IPC scores between them, non-stuttered content words showed no significant differences and IPC scores of stuttered and nonstuttered function words were greater in English than in Spanish. Thus it was suggested that higher stuttering is associated with high IPC score.

Al-Tamimi, Khamaiseh, and Howell (2013) conducted a study investigating the influence of phonetic complexity on stuttering rate in Jordanian Arabic speakers. The study included 21 participants grouped in three age groups (6-11 years, 12-17 years and 18+ years). A spontaneous speech sample was recorded. The sample was analysed using the Arabic Index of Phonetic Complexity (AIPC) to examine correlation between AIPC and word category across the three age groups and examine AIPC factors that increase stuttering on words. Results highlighted that phonetic complexity increases the occurrence of stuttering in the speech of children and stuttered word categories are phonetically complex than nonstuttered words across all age groups. Authors concluded that with increasing age, the number of syllables per utterance increases as a child moves from content to the function-content words in Arabic language, thus, increase in syllable manner increases stuttering.

Alqhazo and Al-Dennawi (2018) assessed the effect of linguistic factors on the speech of Jordanian children who stutter. A total of forty-one Jordanian school-aged children with an age range of 6-13 years were recruited for this study. Sample of spontaneous speech task and sentence completion task (20 sentences) was recorded. The study investigated occurrence of stuttering in relation to phoneme position within words, word length and syllable stress and also in relation to grammatical class in free or bound forms. Results showed that stuttering rate was higher for content words than function words, inflected

words than non-inflected words, words beginning with consonants than vowels, stressed syllable than non-stressed syllables, initial position than medial/final position of the word and increases as length of the word increases. Hence, this study supports the association between linguistic factors and disfluent speech.

Seth and Maruthy (2019) investigated the relation between linguistic factors and stuttering in Kannada speakers. Spontaneous speech sample was recorded from twenty (15 males & 5 females) age range of 3 to 6 years (mean age- 4.2, SD- 1.04) Kannada speaking preschool children who stutter. Data was analyzed for frequency of stuttering in relation to phoneme position within words (initial/medial), phoneme type (words begining with consonant/vowel) and word length (monosyllabic/ bi-syllabic/tri-syllabic/multisyllabic) and also word class (content/function words) and inflectional morphology (without/with inflection). Results indicated that higher stuttering frequency was seen for word-initial position than word-medial position, words beginning with consonants than vowels, while no significant effect for word length was observed. Similarly, Wilcoxon's Signed Ranks Test revealed no significant difference between stuttering frequency on content and function words, and words with and without inflection. Authors concluded through the investigation that stuttering may manifest differently in languages with different linguistic features.

Bircan, Kara, and Kayikci (2023) conducted a study in native Turkish speakers to investigate the influence of linguistic factors on occurrence of stuttering. The study recruited sixty-one Turkish-speaking school-aged children who stuttered with an age range of 6 and 16 years. Spontaneous speech sample of 15-minutes were obtained from each of the participants and syllable-based and word-based measures were carried out. Findings indicated that stuttering frequency was slightly higher in words at utterance- and word-initial position than in other positions. Content words are more likely to stutter than function words and average length of utterances containing at least one Stuttering-like disfluencies (SLD)

are longer than the fluent ones. Study also highlighted that content words with suffixes are highly likely to be stuttered than unbound content words. Hence, study concluded that as Turkish being an agglutinative language, word-based measures are better measures for stuttering frequency and utterance- and word-initial position of SLD is a global feature.

Among the phonological feature, evidences demonstrated that SLDs in preschool children most often occurred on words that were phonologically simple which are short and function words (Throneburg et al., 1994; Dworynksi et al., 2003), while in school-aged CWS SLDs were predominately occurred on consonant-initial words and word-initial position, while the role of word length remains variable (Alqhazo & Al-Dennawi, 2018; Seth & Maruthy, 2019). Highlighting on AWS, higher disfluency observed on initial consonants, initial sounds, longer words and content words (Brown, 1945; Griggs & Still, 1979b) and higher phonetic complexity scores (IPC scores) are associated with increased stuttering frequency, particularly in content words in Spanish and Arabic languages (Howell & Au-Yeung, 2006; Al-Tamimi et al., 2013). Hence, phoneme position (initial position), phoneme type (words beginning with consonants), longer word length and higher IPC scores have been associated with higher occurrence of stuttering moments. Also, the influence of morphological factors on stuttering disfluencies is also appreciated.

2.2. Morphological factors

Morphological factors are classified into: word class- content words or function words and inflectional morphology- free morphemes (without inflection) or bound morphemes (with inflection). Most of the studies have investigated content and function words, while some languages have hybrid content-function or function-content words.

Brown (1937) studied the influence of word class on the incidence of stuttering. Study included thirty-two AWS (age range: 18-30 years; mean-22.5). Each participant was

asked to read five 1000-word lists. Grammatical analysis was carried out using twenty-three classifications, out of which rank of difficulty for eighteen speech parts was determined through the percentage of stuttering and median percentage of difficulty for thirty-two participants was taken forward. Results revealed no significant difference in stuttering within the same category of grammatical class. Hence, the data were re-arranged into conventional eight parts of speech: adjectives, nouns, adverbs, pronouns, verbs, articles, conjunctions, and prepositions and rank of difficulty was analysed for each participant based on percentage of stuttering. The relative difficulty was observed for adjectives and nouns, while contrasting lack of difficulty for conjunctions, prepositions, and articles. This study concluded that the difficulty of grammatical factors is related to phonetic rank of difficulty and stutterers are consistent with difficulty of parts of speech rather than with difficulty of sounds. Hence, words which are less important to convey the meaning of a sentence are stuttered less.

Bloodstein and Gantwerk (1967) investigated the influence of grammatical parts of speech on stuttering in young English-speaking stutterers. Participants included thirteen stutterers (nine boys, four girls) ranging in age from 2 years 11 months to 6 years 6 months. Spontaneous speech sample were obtained from each of the participants. Data was analyzed based on the percentage of stuttering on each of nine parts of speech: adjectives, adverbs, articles, conjunctions, nouns, interjections, pronouns, prepositions and verbs. Results revealed that a larger amount of stuttering was observed for pronouns and conjunctions, while the least amount of stuttering was observed on nouns and interjections. Authors highlighted that as the chances of the word or sentences beginning with the pronouns and conjunctions are higher, hence disfluencies are higher on them. Therefore, frequently, function words are stuttered more than content words as children begin their sentences using these parts of speech. The study concluded that, during the earliest phase of stuttering, no

grammatical factor influences the stuttering moments, just the effect of a strong positional factor on the parts of speech. Apart from this, stuttering disfluencies with a given part of speech depends on the individual's speech.

Jayaram (1981) studied the distribution of stuttering in grammatical classes in monolingual and bilingual stutterers. Study included ten monolingual Kannada speakers who stutter and ten bilingual Kannada and English speakers who stutter with the age range of monolingual participants being 17 to 34 years (mean- 24.8 years) and of bilinguals was 19 to 32 years (mean- 25.6 years). Stimuli used reading material of 149 words English passage and 122 words Kannada passage. The words in the passages were categorised into content words and function words. A spontaneous speech sample was recorded. Results revealed the order of difficulty on grammatical parts of speech in Kannada was verbs, nouns, adjectives, prepositions and pronouns, while in English nouns, adjectives, verbs, pronouns and prepositions in decreasing fashion. Significantly higher disfluency rate on content words than function words in both the tasks in the monolingual and bilingual groups were observed. Comparing Kannada and English stutterers, grammatical class difference with respect to stuttering moments is significant for words in initial position alone, while English stutterers grammatical class difference with respect to stuttering moments is significant for words in initial and medial position. The author explained that as content words hold high information, stuttering occurs more in them along with that, additional stuttering moments were observed on words starting with consonants than vowels. Hence, content words starting with consonants have a higher disfluency rate than vowels, as phonetic factors influence the stuttering moments. Hence, concluding that the phonetic factors interact with grammatical factors in affecting stuttering moments.

Au-Yeung, Howell, and Pligrim (1998) examined the effect of phonological word and utterance position on stuttering rate of function words. Fifty-one participants were

recruited from the age range of 2 years 7 months to 40 years and were classified into five different age groups: young, middle, older children, teenagers and adults. Young age group consisted 6 members age ranging from 2 years 7 months to 6 years; middle age group had 15 children with age ranging from 6 years to 9 years 6 months; older children group had 10 children age ranging from 9 years 6 months to 12 years 7 months; 8 teenagers whose age ranging from 13 years 11 months to 17 years 1 month and 12 adults aged between 20 and 40 years. Spontaneous speech sample were recorded. Stuttering rate for content words and function words were analyzed in all the age groups, effect of utterance position on stuttering rate in content and function words. Results indicated that stuttering rate flipped from function to content words between middle and older children groups. Also, stuttering rate was not affected by the position of content word in an utterance, but was higher for function words in early position for all the age groups. Study also revealed that stuttering rate was higher for function words with early phonological-word position and when function words occurred prior to content words than following it. The study concluded that stuttering on function words depends on word-external factors (position relative to content words), while content words depend on word-internal factors (phonetic composition).

Natke, Sandrieser, Ark, Pietrowsky, and Kalveram (2004) investigated the relation between stuttering and linguistic stress, word position and grammatical class in native German speakers. Twenty-two children who stutter (14 boys, 8 girls) with an age range of 2.1 to 5 years were recruited for the study. Video recording of two play sessions was obtained from each participant. Data was analyzed for disfluent within-word and grammatical class of the affected word. In addition to this, stress rating was done and divided into stressed, unstressed and intermediate stressed syllables and short and long stressed syllables. Results revealed that preschool children just like adults stutter more on short stressed syllables than unstressed syllables. Also, this study confirmed the word-initial

effect, where stuttering was frequent on initial sound and at early childhood disfluency was higher for function words than content words. The study concluded by saying that different causal mechanisms could lead to differentiation of stress effects.

Abdalla, Robb, and Al-Shatti (2009) conducted a study to examine the influence of grammatical class on disfluency in adult native speakers of Kuwaiti Arabic. Study included ten AWS with age ranging from 17 to 42 years (mean age- 22 years 4 months). Data was obtained by spontaneous speech, reading and single word naming tasks. Reading included a passage of 300 words and for the naming task, 50 words including the same count of content and function words were taken for the study. Orthographic transcription for each of the three samples was done. Data containing disfluent words was classified into content, function and content-function words. Results revealed that for spontaneous speech, no significant differences were reported for the word categories, while for reading significant differences were observed between content words and content-function words, and between function words and content-function words. Authors stated that differences seen for oral reading tasks are due to complex grammatical forms of literary variety in Arabic language. Therefore, it was concluded that the grammatical classes do not insert strong influence on the Arabic language.

Juste, Sassi, and Andrade (2012) investigated the exchange of disfluencies from function words to content words in the native speakers of Brazilian Portuguese. Ninety participants recruited in this study with age range of 4 years to 40 years 11 months and divided into three age groups: children who stutter (CWS) had 30 participants (4 years to 11 years 11 months), teenagers who stutter (TWS) had 30 participants (12 years to 17 years 11 months) and adults who stutter (AWS) had 30 participants (18 years to 40 years 11 months). Spontaneous speech sample were obtained from each of the participants. Orthographic transcriptions were carried out to determine stuttering rate. Results indicated that CWS and

CWNS are highly disfluent on function words than on content words. TWS did not show any differences between content and function words, while TWNS showed higher disfluency rate on function words. AWS shows higher disfluency rate on content words, while AWNS continue to stutter on function words. Enlightening further on grammatical class, in the content words category, verbs were highly stuttered in all the age groups, in the function word category, articles were highly stuttered in both children groups, while prepositions were highly stuttered in TWS and AWS. Therefore, study concluded that as an individual grows older, a gradual decrease is seen for stuttering on function words and increase in stuttering for content words and this transition takes place during adolescence for individuals who stutter. In addition to this, authors also concluded that, as an individual grows older, the disfluency pattern differs for PWS and PWNS.

Venkatagiri, Nataraja, and Deepthi (2017) investigated the relation between morphophonemic and stuttering in native speakers of Kannada. The study included twenty-two AWS with age range of 15 to 30 years (mean age- 19 years 6 months) and classified into mild, moderate and severe stuttering. Participants were asked to read four short stories with a total of 192 words. Results revealed that word length is an important factor for stuttering moments and confirmed that longer the words increase the demands for motor planning and execution. However, morphophonemic complexity (MPC) index used in the study was not highly effective in predicting stuttering in reading passages and author(s) stated that in combination of word length and MPC, later had negligible effect on disfluencies. Further, content-function words did not differ in stuttering compared to content words. Authors concluded the study by stating that due to inefficient planning and execution, stuttering is high for longer words than shorter words for PWS.

Choi, Sim, Park, Clark, and Kim (2020) investigated the variation in the loci of stuttering between English- and Korean-speaking CWS. Ten Korean-speaking CWS (mean

age- 56.6 months) and eleven English-speaking CWS (mean age- 59.6 months) in the age range of 3 to 7 years were recruited for the study. Five narratives from the twenty-one participants were audio-video recorded. Samples were transcribed using SALT conventions. Data was analyzed for type of word class stuttered and location of words within utterances. Results indicated content words having higher stuttering rate than function words in Korean-speaking CWS, while function words were highly stuttered in English-speaking CWS. Both Korean-speaking and English-speaking CWS tend to stutter more on the first word of the utterance. However, Korean-speaking CWS produced content words more on utterance-initial position, whereas, opposite trend is seen for English-speaking CWS. Authors concluded that higher stuttering on function words is language-specific characteristic, while stuttering on utterance-initial position is language-nonspecific characteristics.

Alqhazo and Alfwaress (2022) examined the influence of grammatical class on stuttering in Arabic speakers. 85 CWS (24 preschool, 61 school-aged) were recruited for the study. 24 preschool children with an age range of 4 to 5 years and 61 school-aged children with an age range of 6 to 16 years. Speech sample of narrating their choice cartoon story was audio-video recorded. Data was analyzed for stuttering rate on content words and function words. Results highlighted that stuttering frequency between preschool and school-aged children on content and function words were not significantly different. Negative correlation was seen between age and loci of stuttering in the category of function words. Hence, this study concludes by enlightening the distribution of classical loci variables of stuttering in Arabic language.

Rahmalina, Sudana, Arianingsih, and Sunendar (2023) examined the influence of linguistic factors in Indonesian children. Participants included five CWS in the age range of 3 years to 6 years (mean age- 4.2 years). Spontaneous speech sample were obtained by the

participants. Data was analyzed for phonetic factors included phoneme type (words beginning with consonant/vowel), word length (one-syllable, two-syllable, three-syllable and many-syllables) and word frequency, whereas, morphological factors included lexical type (content/function words) and inflectional morphology (free/bound form). Results revealed higher frequency of stuttering on word-initial position, words starting with consonants than vowels, while no significant effect of word length on stuttering. However, higher stuttering rate is observed for content words, although not statistically significant, no significant effect of inflectional morphology is seen. Authors concluded by stating stuttering can occur in different languages with distinct linguistic characteristics.

Most of the studies highlighted that AWS have a higher disfluency rate on content words than function words, while CWS showed the opposite trend. Research on stuttering in preschool children consistently suggests that linguistic complexity plays a limited role during the early stages of development. Instead, disfluencies occurred on words that were least complex, indicating that early stuttering is not strongly driven by phonological demands. Higher disfluency on function words largely because these words frequently occur at the beginning of utterances. In the consonant-initial position being highly stuttered than vowel-initial position. Overall, preschool stuttering appears to be more related to speech planning and sentence initiation than to portray the influence of linguistic difficulty.

School-aged children show developmental shifts towards the influence of linguistic factors on stuttering moments. CWS are more disfluent on words influenced by attributes like grammatical function, sentence position, and word length, with sentence-initial position exerting a particularly strong influence. Additionally, younger children tend to have a higher stuttering rate on function and shorter words, whereas with increasing age, disfluency shifts toward content words and more complex linguistic structures. Moreover, phonological and morphological factors such as word length, phonetic complexity, syllable stress, and

inflection morphology begin to show stronger relation with stuttering frequency in school-age children. Research suggests that as children's language systems mature, stuttering strongly binds with linguistic demands.

Few languages opposed the idea of the influence of word class on stuttering moments. Research carried out in English has similar or different findings compared to studies carried out in other languages. Choi et al. (2020) found that English-speaking children stutter highly on function words, while Korean-speaking children show higher disfluency on content words, indicating language-specific grammatical influences. Bircan et al. (2023) found that Turkish school-aged children are more likely to stutter on content words than function words and inflected words than non-inflected words, supporting the study done by Alqhazo and Al-Dennawi (2018) on Arabic CWS which has similar result, while Seth and Maruthy (2019) indicated no significant differences in the frequency of stuttering on content and function words in Kannada-speaking preschoolers, which contradicts English findings. However, despite these variations, there seems to be a universality with regard to certain attributes such as a stuttering at initial- position and words beginning with consonants.

Overall, the literature indicates a clear developmental trend in stuttering moments from preschool to school-aged and to adulthood. As the age increases, linguistic factors are highly reflective of the stuttering frequency. Most of the available literature has been carried out in English-speaking populations, beginning with pioneering work by Brown (1945) and followed by other investigations that highlights the role of factors such as word position, phoneme type, word length and word class. While few studies have been conducted in this line of research to other languages—such as Spanish (Howell & Au-Yeung, 2006), Arabic (Al-Tamimi et al., 2013; Alqhazo & Al-Dennawi, 2018), Kannada (Seth & Maruthy, 2019), and Turkish (Bircan et al., 2023) which are relatively few and often limited in scope.

Notably, there is a paucity of research focusing specifically on school-aged children across diverse languages.

In view of the literature gap, it is theorised that the pattern and degree of phonological and morphological factors in Kannada-speaking school-aged CWS may differ from those seen in similar age groups or other age groups in English, as the massive contrasts the two languages bear in phonological and morphological processes. Hence, looking into the linguistic diversity and investigating the linguistic factors on school-aged children comes as an important note, proposing the need for language-specific investigation in stuttering research.

CHAPTER 3

METHOD

3.1. Participants

A priori power analysis was conducted using G*Power software (Faul et al., 2009) which indicated a minimum of 27 participants required for the study. To ensure adequate statistical power, a total of 30 Kannada-speaking school-aged children who stutter (CWS) were included in the study. Prior to participation, written consent was taken from all the parents/caregivers of the participants and examiner informed regarding the audio-video recording and assured that the recording would be used only for the research purpose. Verbal assent was obtained from the participants. The study was approved by the AIISH Institutional Review Board (Ref:SH/IRB/M.5/SLP.22/2025-26).

The age range of participants ranged from 6 to 11 years (Mean = 8.98, S.D. = 1.83). A Self-reported questionnaire about demographic information, such as native language, exposure to other languages, age at which stuttering began, handedness, family history of stuttering, birth and developmental history, history of speech therapy and the presence or absence of related communication disorders, was given to each participant's parents/caregiver. The examiner instructed the parent/caregiver to fill out the questionnaire carefully by reading each question and marking their responses appropriately based on their understanding. Any doubts regarding the procedure were clarified before they began filling out the questionnaire. The inclusionary criteria for selecting the participants are detailed in Table 3.1. All the children were taken from the out-patient cases in All India Institute of Speech and Hearing. The examiner confirmed the diagnosis of stuttering using Stuttering Severity Instrument–Fourth Edition (SSI-4; Riley, 2009). Additionally, language and articulation screening was done. Among thirty participants, ten had a mild degree of stuttering; thirteen had a moderate degree of stuttering; six had a severe degree of stuttering

and one had a very severe degree of stuttering and four had attended speech therapy 6 months prior to the study. None of them had associated problems like neurological, intellectual, hearing, vision or any communication disorders other than developmental stuttering. Table 3.2 shows the individual participant information of CWS.

Table 3.1

Inclusionary criteria

Group	Inclusionary criteria
CWS	● All children were native speakers of Kannada diagnosed using the **Stuttering Severity Instrument–Fourth Edition (SSI-4)** (Riley, 2009) ● Children with age-adequate receptive & expressive skills screened using the **Assessment of Language Development (ALD)** (Lakkanna et al., 2021) and articulation skills by **Kannada Diagnostic Photo Articulation Test (KDPAT)** (Deepa & Savithri, 2010) ● At the time of recruitment, the children were not undergoing any speech-language therapy. Children undergone speech therapy 6 months prior to the study were included.

Table 3.2

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	History of treatment
1.	7	M	38	Severe	Right	6	Positive	Negative
2.	9	M	24	Moderate	Right	5	Negative	Negative
3.	10	M	24	Moderate	Right	4	Negative	Negative
4.	7	M	29	Severe	Right	6-7	Positive	Negative
5.	6	M	16	Mild	Right	6	Negative	Negative
6.	7	M	14	Mild	Right	6	Negative	Negative
7.	9	M	23	Moderate	Right	4	Positive	Negative
8.	11	M	25	Moderate	Right	3	Negative	Positive*
9.	7	F	26	Moderate	Right	3	Positive	Negative
10.	6	M	24	Moderate	Right	6	Positive	Negative
11.	9	M	24	Moderate	Right	4	Negative	Positive*
12.	11	M	11	Mild	Right	10	Negative	Negative
13.	10	M	26	Moderate	Right	9	Positive	Negative
14.	10	M	28	Severe	Right	9	Negative	Negative
15.	10	F	22	Moderate	Right	8	Positive	Negative
16.	8	M	17	Mild	Right	6	Positive	Negative
17.	9	M	17	Mild	Right	8	Positive	Negative
18.	11	M	15	Mild	Right	7	Positive	Negative
19.	11	M	19	Mild	Right	9	Negative	Negative
20.	10	M	28	Severe	Right	3	Negative	Positive*

21.	10	M	28	Severe	Right	5	Negative	Negative
22.	6	M	24	Moderate	Right	5	Negative	Negative
23.	7	M	27	Moderate	Right	2	Negative	Negative
24.	11	M	25	Moderate	Right	10	Positive	Negative
25.	10	M	28	Severe	Right	3	Negative	Positive*
26.	10	M	16	Mild	Right	9	Negative	Negative
27.	10	M	45	Very Severe	Right	10	Negative	Negative
28.	6	M	14	Mild	Right	4	Negative	Negative
29.	10	M	23	Moderate	Right	3	Negative	Negative
30.	6	M	12	Mild	Right	5	Negative	Negative

Note. *Participants with a positive history of treatment were included as that the therapy had been received at least six months before the study.

3.2. Speech sample recording and transcription

The impact of phonological and morphological parameters on the frequency of stuttering was evaluated by a 15-minute spontaneous speech task in which each child was asked to converse on well-known subjects like play, school, family, and interests. Audio-video recording was carried out in a quiet and well-lit room. The examiner transcribed the first 10 minutes of the sample, applying narrow transcription to disfluencies and broad IPA to fluent speech. Each participant's 300-syllable sample was examined after the first and last 50 syllables were eliminated. Yairi's (2007) classification of SLDs, which includes single syllable word repetition, part-word repetitions and dysrhythmic phonations (blocks, prolongations and broken words) were used to identify and mark stuttering occasions in the recorded sample. Examiner assessed each transcribed data for phonological factors and morphological factors.

3.3. Data analysis

3.3.1. Phonological factors

The phonological factors that were assessed include the stuttering frequency in relation to the phoneme position within words, phoneme type, word length, and phonological complexity. The phoneme position within the word included comparison between initial and medial position. Final position was not included, as words in Kannada generally ends with a vowel and never with a consonant, in addition to this, the words stuttered in final position found in the speech sample were usually borrowed words. Hence, the examiner looked for the words stuttered in initial position and words stuttered in medial position and compared the frequency of stuttering among them. Similarly, frequency of stuttering was compared between stuttered words beginning with consonants and stuttered words beginning with vowels in phoneme type. In word length, subgrouping of words based on monosyllabic, bi-syllabic, tri-syllabic and multisyllabic words was carried out and frequency of stuttering for each of the word groups were compared, where multi-syllable word includes four or more than four syllables. In Phonological complexity, Index of Phonological Complexity (IPC) given by Jakielski (1998) was used. IPC is based on a points system that focuses on phonetic and phonological features of the words.

Jakielski's IPC scale is weighed on the eight factors: (a) Consonants by place of articulation (words with each dorsal sound assigned with one point) (b) Consonants by manner class (words with fricative, affricate, liquid sounds assigned with one point) (c) Vowels by class (words with rhotic sound assigned with one point) (d) Word shape (Words that end with a consonant assigned with one point) (e) Word length in syllables (Words with three of more syllables assigned with one point) (f) Singleton consonants by place variegation (Word with place variegated singletons assigned with one point) (g) Contiguous consonants (Consonant cluster assigned with one point) and (h) Cluster by type

(Heterorganic cluster assigned with one point). This scale is developed with the English-speaking population in view, hence cannot be used for Kannada directly without modification. Kannada and English are phonologically contrastive in nature, differing in syllable shape, consonant clusters, word length and word neighbourhood effects. One of Kannada's distinctive phonotactic characteristics is the "open-endedness" of its words; unlike English, where consonant-final words are prevalent, all Kannada words end in a vowel unless there is dialectal variation and the words end with consonant, only such words were assigned with the point using Jakielski's scheme like /ɪ:ll/ [here], /ka:n/ [see]. Similarly, Kannada has no rhotic vowels, and in Jakielski's IPC, each occurrence of a rhotic vowel in a word was assigned with a point. Clusters are relatively less common in Kannada and homorganic clusters, which, in Jakielski's scheme, are simple and receive no points, which are rare in Kannada, (Venkatagiri et al., 2017) but still this has been included in the point system. Overall, Jakielski's IPC scale included in this study were: (a) Consonants by place of articulation, (b) Consonants by manner class, (c) Word shape (d) Word length in syllables (e) Singleton consonants by place variegation (f) Contiguous consonants and (g) Cluster by type. Smith and Howell (2013) and Al-Tamimi et al. (2013) have also used phonetic complexity indexes modified to Japanese and Arabic, respectively.

3.3.2. Morphological factors

Morphological factors evaluated were: word class and types of morphemes. Under the word class, frequency of stuttering was assessed on content words, function words and content-function words. Content words consist of nouns, verbs, adjectives and adverbs, while function words consist of pronouns, articles, prepositions, auxiliary verbs, conjunctions and modals. While content-function words are the words in which function words are attached to the root content word forming a single word. According to Venkatagiri, Nataraja, and Deepthi (2017), in Kannada language, complements are often

added to nouns and verbs to lengthen the words. This results in content-function words that might not be lexically listed, such as /uddeʃawalla/ = /uddeʃa/ "intention" + /alla/ "not" = "not [the] intention". Stuttering frequency across these variables was compared. In word inflections - stuttering frequency for words with free forms (without inflection) or bound (with inflection) forms were compared. In Kannada language, words like /u:ruge/ ("to the native"), which combine grammatical and content information into a single phonological unit and forms an inflected form of words. Table 3.3 consists of formulae used for each of the factors considered in the study.

Table 3.3: *Formulae used to calculate frequency of stuttering for the phonological and morphological factors*

Linguistic factors	**Formula for frequency of stuttering**
Phonological factors	
Phoneme Position	[(Total number of words with stuttering in initial/medial position)/Total number of words on which stuttering occurred] * 100
Phoneme Class	[(Total number of words beginning with vowel/consonant on which stuttering occurred)/Total number of words on beginning with vowel/consonant] * 100
Word Length	[(Total number of *n* syllable words on which stuttering occurred)/ Total number of *n* syllable words] * 100
Phonological Complexity	Index of Phonetic Complexity (IPC)
Morphological factors	
Word Class	[(Total number of content/function words on which stuttering

Word Inflections	occurred)/Total number of content/function words] * 100 [(Total number of words with/without inflection on which stuttering occurred)/Total number of words with/without inflection] * 100

3.4. Reliability measures

Intra-judge and inter-judge reliability measures were carried out for 10% of the total recorded sample (3 participants' recorded samples). For the intra-judge reliability measure, the first examiner re-analysed the data and calculated the frequency of stuttering for each factor after a gap of one week. Further, inter-judge reliability was carried out by another Speech-Language Pathologist who is a native speaker of the Kannada language, holding a minimum of five years of experience in analysis of disfluency, carried out the analysis of the frequency of stuttering for each of the factors considered.

3.5. Statistical analysis

IBM Statistical Package for the Social Sciences (SPSS; Version 26.0) was used for all the statistical analyses. Prior to analysis, the data was tested for normality using the Shapiro–Wilk test (Field, 2005) which revealed non- normal distribution of data ($p < 0.05$). Therefore, non- parametric tests like Wilcoxon Signed-rank test and Friedman test were carried out. Wilcoxon Signed-rank test was used to assess the influence of phoneme position, phoneme type, phonological complexity and word inflections. To assess the influence of word length and word class, Friedman test was performed. The effect size for significant factors were determined using the formula $r = Z/\sqrt{N}$ (Rosenthal, 1991), where *'r'* denotes the effect size, *'Z'* denotes the test statistic computed using SPSS, and *'N'* is the no.

of observations or sample size. Intraclass Correlation Coefficient was used for intra- and inter-judge reliability measures.

CHAPTER 4

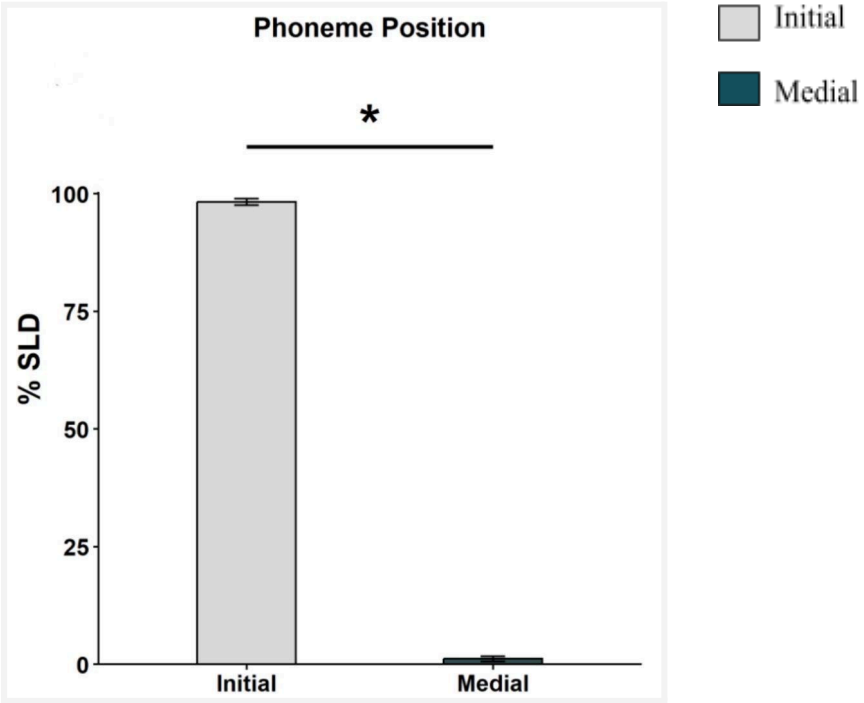
RESULTS

4.1. Phonological factors

The mean, median and standard deviation values were obtained from the descriptive statistical analysis for the phonological and morphological factors included in the study. The values for the phonological factors are provided in Table 4.1. Comparison of the frequency of stuttering corresponding to phoneme position revealed a statistically significant difference ($|Z| = 4.99$, $p < 0.05$, $r = 0.91$) between two word positions. Higher stuttering frequency was observed in word-initial position when compared to the word-medial position as shown in Figure 4.1. Comparing phoneme type, a statistically significant difference ($|Z| = 3.64$, $p < 0.05$, $r = 0.66$) was observed in the stuttering frequency. As illustrated in Figure 4.2, stuttering frequency was higher for words beginning with consonants than vowels.

Figure 4.1

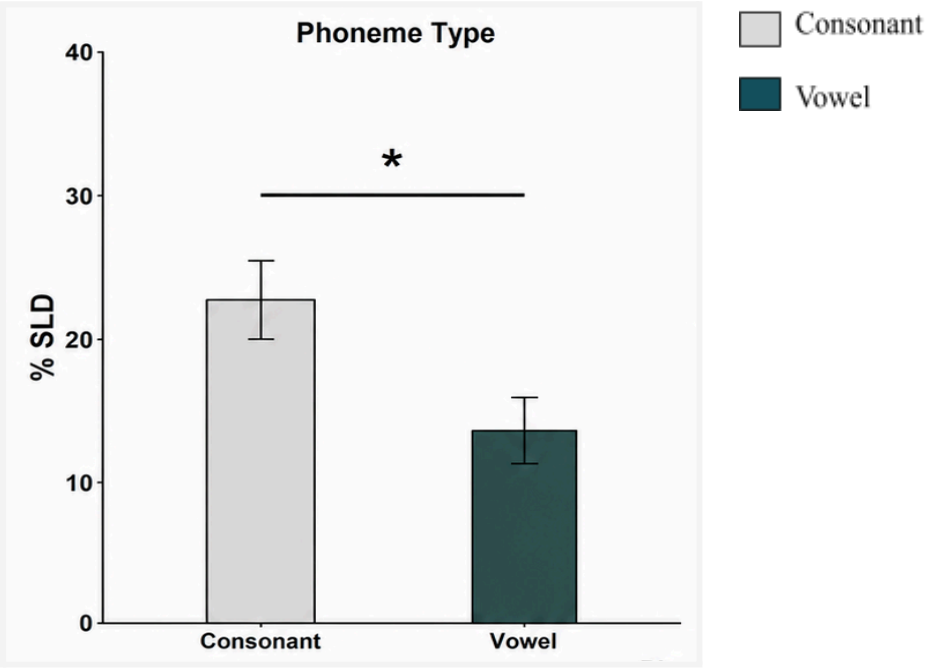
Comparison of stuttering frequency across phoneme position



Note. * indicates a statistically significant difference at <0.05.

Figure 4.2

Comparison of stuttering frequency across phoneme type



Further, the main effect of word length was found significant ($\chi 2$ (3) = 10.29, $p < 0.05$) through the Friedman test. Additionally, pairwise comparison was analysed using post hoc Bonferroni correction, which revealed a significant difference only between trisyllables and monosyllables ($p= 0.02$). Furthermore, higher stuttering frequency was observed in monosyllabic words compared to bisyllabic, trisyllabic and multisyllabic words as shown in Figure 4.3. Furthermore, the Wilcoxon Signed-rank test for IPC showed a significant difference between non-stuttering and stuttering words ($|Z| = 2.99$, $p < 0.05$, $r = 0.55$). Higher scores observed for the stuttering words compared to nonstuttering words as depicted in Figure 4.4.

Figure 4.3

Comparison of stuttering frequency across word length

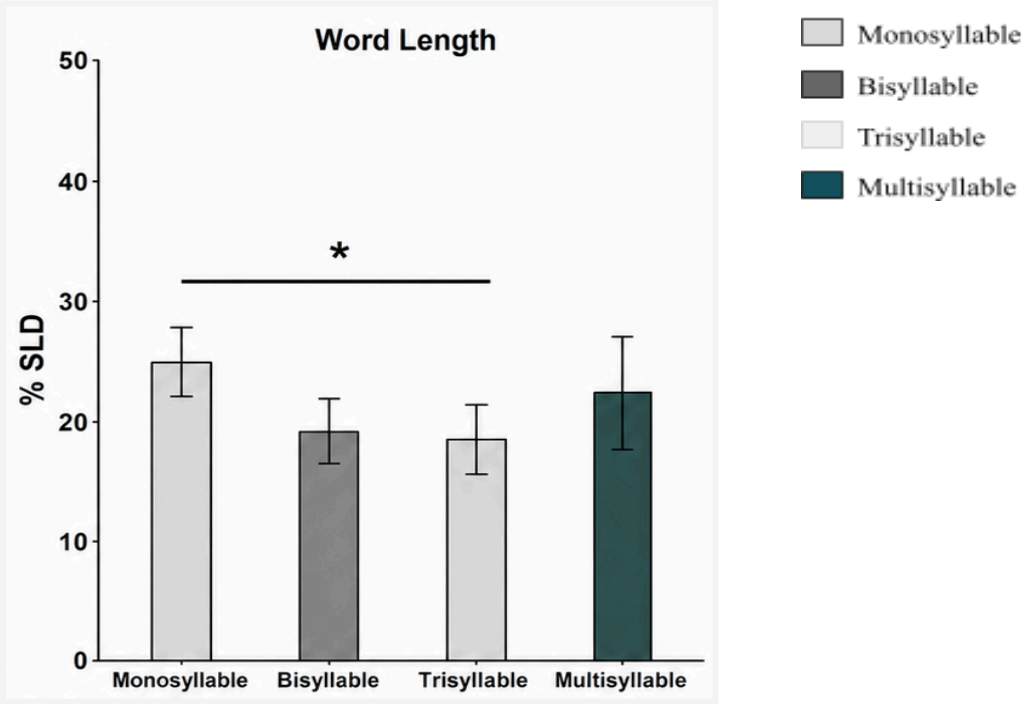


Figure 4.4

Comparison of IPC scores between nonstuttering and stuttering words

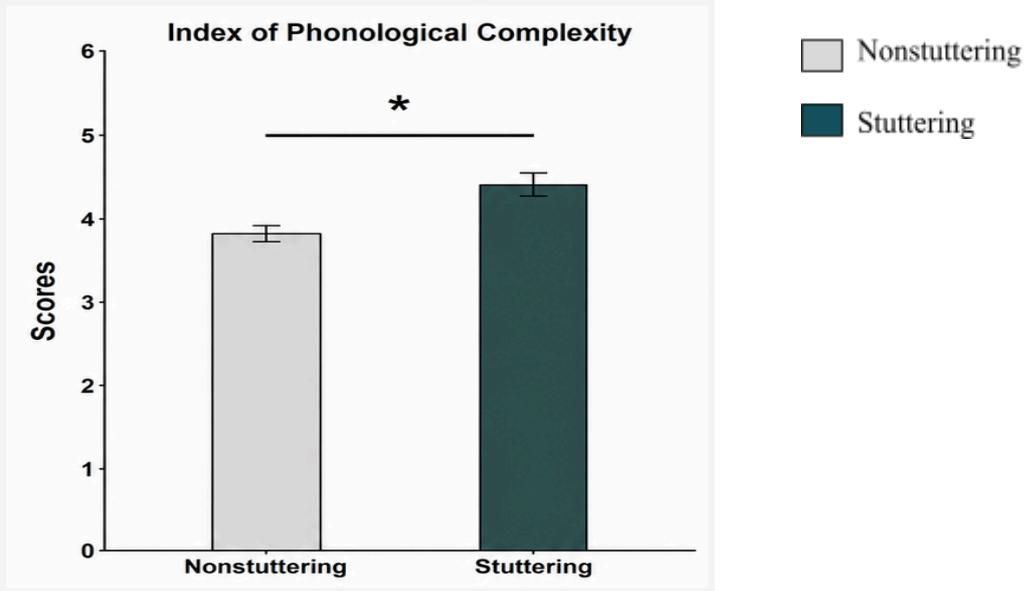


Table 4.1

Values of mean, median and standard deviation for frequency (in percentage) of stuttering in relation to three phonological factors (phoneme position, phoneme type & word length) and for overall scores (IPC) in Kannada speaking school-aged CWS

Factors	Mean	Median	SD
Phoneme Position			
Initial position	98.28	100.00	3.84
Medial position	1.19	0.00	2.97
Phoneme Type			
Consonant	22.68	19.25	15.18
Vowel	13.53	9.25	12.57
Word length			
Monosyllable	24.92	25.00	15.07
Bisyllable	19.19	16.45	13.64
Trisyllable	18.51	14.50	15.13
Multisyllable	22.39	11.10	26.38
Index of Phonological Complexity			
Nonstuttering	3.81	3.77	0.52
Stuttering	4.40	4.45	0.74

4.2. Morphological factors

The descriptive statistics (mean, median and standard deviation) values for each of the morphological factors are provided in Table 4.2. Results of the Friedman test showed significant differences ($\chi 2$ (2) = 7.32, $p < 0.05$) between word classes. Further, post hoc Bonferroni correction analysis revealed significant differences only between

content-function words and content words (p= 0.02) as shown in Figure 4.5. Higher frequency of stuttering was observed for content words compared to the other word class. Similarly, Wilcoxon Signed-rank test revealed significant difference (|Z| = 3.27, $p < 0.05$, r = 0.60) on frequency of stuttering on words with and without inflection. Furthermore, Figure 4.6 illustrates higher stuttering frequency on words without inflections than on the words with inflections.

Figure 4.5

Comparison of stuttering frequency across word class

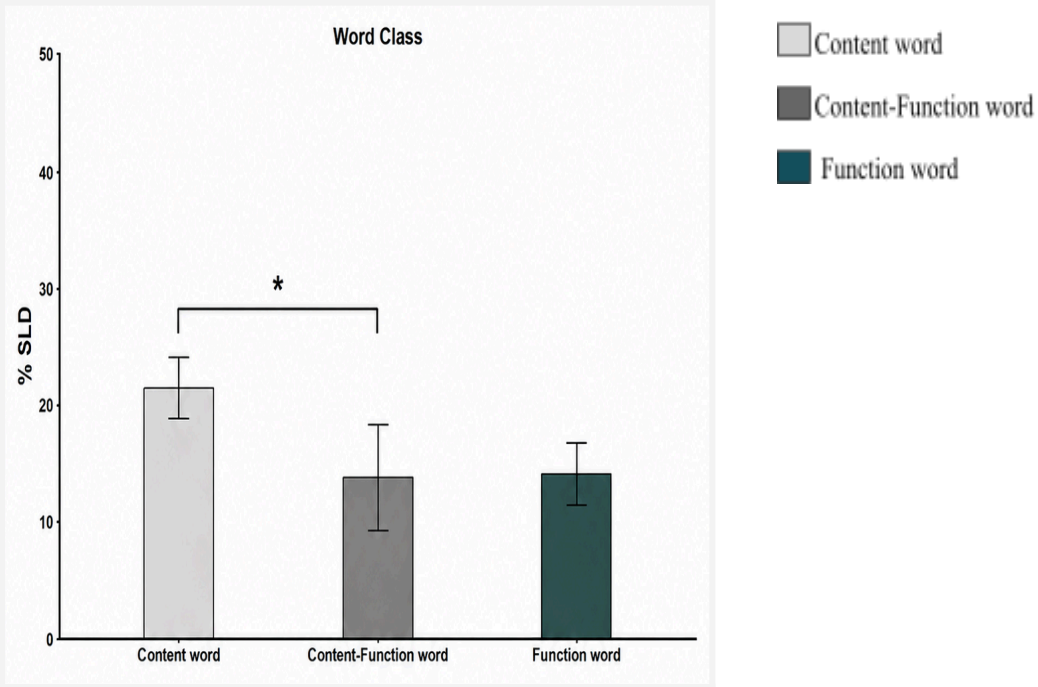


Figure 4.6

Comparison of stuttering frequency across inflectional morphology

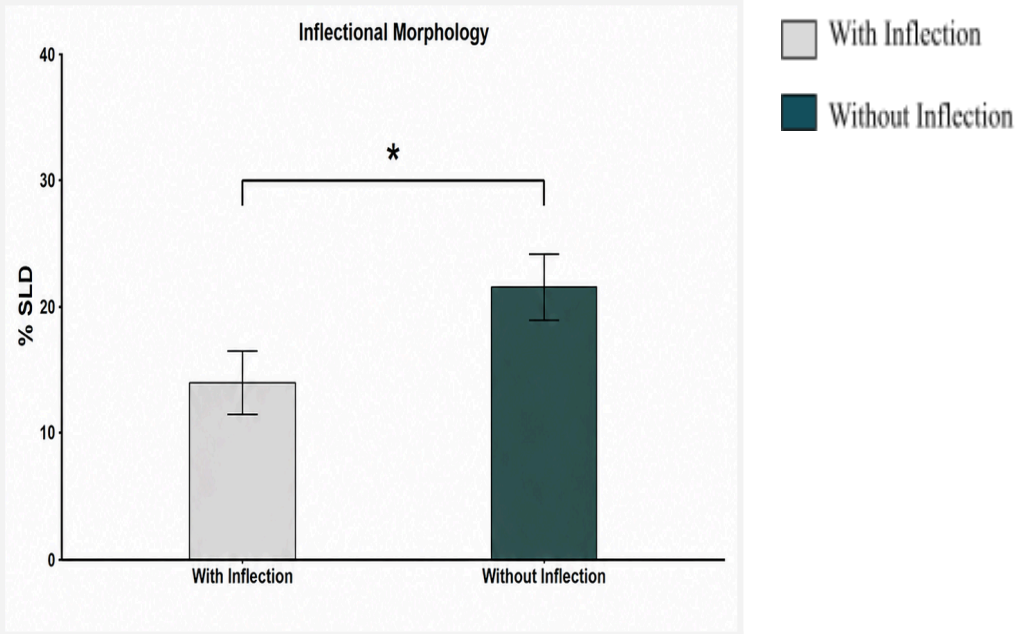


Table 4.2

Mean, Median and standard deviation values for frequency (in percentage) of stuttering in relation to the morphological factors (word class & word inflections) in Kannada speaking school-aged CWS.

Factors	Mean	Median	SD
Word class			
Content words	21.45	17.81	14.34
Function words	14.08	8.70	14.57
Content-Function words	13.78	0.00	24.76
Word inflections			
With inflections	14.01	9.70	13.61
Without inflections	21.53	18.92	14.34

4.3. Intra-rater and Inter-rater reliability

For both intra-rater and inter-rater reliability, Intraclass Correlation Coefficient value was computed for three participants in each of the linguistic factors considered in the study. The value of Intraclass Correlation Coefficient obtained was higher than 0.9 for almost all the phonological and morphological factors, indicating high intra and inter rater reliability. The values are provided in Table 4.3.

Table 4.3

Intraclass Correlation Coefficient value for Inter-rater and Intra-rater reliability

Linguistic factors	Intraclass Correlation Coefficient for Intra-rater reliability	Intraclass Correlation Coefficient for Inter-rater reliability
Phonological factors		
Phoneme Position	0.840	0.750
Phoneme Class	0.992	0.992
Word Length	0.999	0.999
Phonological Complexity	0.943	0.943
Morphological factors		
Word Class	1.00	1.00
Word Inflections	1.00	0.993

CHAPTER 5

DISCUSSION

The aim of the study is to investigate the effect of phonological and morphological factors on speech disfluencies of Kannada-speaking school-aged CWS. Four phonological factors (phoneme position, phoneme type, word length, & IPC) and two morphological factors (word class & word inflections) were evaluated in this study. It was theorised that the pattern and degree of phonological and morphological factors in Kannada-speaking school-aged CWS may differ from those seen in similar age groups or other age groups in English and other languages. The results showed few notable findings.

5.1. Phonological factors

In the first analysis, phoneme position was compared. Comparison was done between initial-position, medial-position and final-position, because unlike English, where consonant-final words are prevalent; Kannada has unique phonotactic characteristics which is the "open-endedness" of its words i.e., all Kannada words end in a vowel (Nag-Arulmani, Reddy, and Buckley., 2003). Hence, the likelihood of occurrence of stuttering in the final position is rare. In addition to this, dysfluencies were observed in the final position of the borrowed words and hence, not analysed in this study. In this study, comparing the stuttering frequency between the word-initial and word-medial positions revealed a significant difference between the two positions, with a significantly higher stuttering frequency in the initial position. This result is supported with earlier investigations in school-aged CWS (Alqhazo & Al-Dennawi, 2018; Bloodstein, 1960) and preschool CWS (Natke et al., 2004). Researchers found that word-initial sounds are more likely to cause stuttering, which may be because of higher demands on the motor speech system due to the trigger in utterance planning. Given the age of the children, the speech motor system is still being developed and hence more prone to breakdown due to increase in linguistic demand. Similarly, Bircan et al.

(2023) confirmed that initial positions were most vulnerable, reinforcing the universality of onset difficulty across languages.

The second factor considered for the analysis is phoneme type i.e., stuttered words commencing with consonants and stuttered words commencing with vowels. There is a significant difference between words commencing with consonants and vowels, with stuttering frequency being higher for words commencing with consonants. This finding is similar to the existing literature in school-aged CWS (Alqhazo & Al-Dennawi, 2018) and preschool CWS (Rahmalina et al., 2023). Consonant articulation demands greater articulatory precision and motor coordination than vowel articulation, words that begin with consonants are more likely to stutter than those that begin with vowels (Seth & Maruthy, 2019). Through a study conducted in the Kannada-speaking AWS, Jayaram (1983) revealed that higher stuttering rate was for those words having initial consonants as compared to initial vowel sounds. The investigator further noted a hierarchy in which stuttering for unvoiced consonants was relatively higher followed by vowels and voiced consonants. Hence, this study revealed that school-aged CWS followed a similar pattern like AWS regarding phonemes, which might be due to phonological complexity of consonants.

The third factor considered was word length, and there was a significant effect observed between word length and stuttering in school-aged CWS. Findings revealed higher stuttering frequency on monosyllabic words than on any words with varying word length. According to the literature, stuttering is more frequent on longer words than on shorter ones in AWS, as it could be due to the increase in linguistic and motor demand for longer words (Brown & Moren, 1942; Soderberg, 1966; Wingate, 1967; Venkatagiri et al., 2017; Aryal & Maruthy, 2023). Furthermore, in CWS mixed findings were reported. Dworzynski et al. (2003) found increased stuttering frequency on shorter words in German-speaking school-aged CWS, whereas Alqhazo and Al-Dennawi (2018) stated that increase in

stuttering frequency with an increase in word length in Jordanian school-aged CWS. Moreover, few other studies report no significant effect of word length on stuttering in preschoolers (Seth & Maruthy, 2019; Rahmalina et al., 2023). Studies done on AWS usually include both oral reading tasks as well as the spontaneous speech sample. Even though there is a likelihood that AWS will tend to avoid long or complex words in their spontaneous speech sample, it cannot be applicable to oral reading because AWS has to read whatever he/she comes across. Besides, in case of CWS, the speech sample taken for analysis is confined to the spontaneous speech sample because of still developing reading skills of CWS. The advantage of speech elicitation task like spontaneous speech samples is the ecological validity which allows a child to produce speech at a level appropriate to their level of phonological development, so they could rule out other potentially confounding factors, such as the makeup of a text which could be too easy for adult readers or too difficult for children. Only spontaneous speech samples were considered in this study and therefore there could be a possibility that children might have avoided the longer words. Given the age of the participants in this study, there is likelihood of simplifying phonologically complex words. The less number of stuttered on multi-syllabic words can also be attributed to the fact that there is less frequent use of multisyllabic words in the spoken Kannada language. Many multisyllabic words get reduced to tri-syllabic words through vowel elimination. Take for example /kumbalakai/ (meaning = pumpkin) which has four syllables gets reduced to /kumblakai/ with three syllables only. Therefore, linguistic factors like word length might not affect the disfluencies in school-aged children the same way as it does in adults.

Final analysis under the phonological factor is Index of Phonological Complexity. Findings from this study revealed there is significant difference between phonological complexity between non-stuttered words and stuttered words, with stuttered words having

higher mean phonetic complexity scores than fluent ones. These findings corroborated with findings in Turkish-speaking school-aged CWS (Uysal et al., 2021). This study highlights the effect of phonetic complexity on stuttering frequency. Kannada being an agglutinative language, characterised by the extensive use of suffixation, phonological complexity plays a significant role in speech production. Due to this, words become structurally dense lexical items. This increased complexity demands greater planning time during speech processing. As supported by the EXPLAN model (Howell & Au-Yeung, 2002), such planning demands may exceed the available execution time, thereby increasing the likelihood of stuttering. Therefore, linguistically complex words in Kannada due to their linguistic composition are more prone to disfluencies. Additionally, this tendency is further influenced by other interacting factors, including cognitive load, speech rate, and environmental conditions.

5.2. Morphological factors

Stuttering frequency was compared across content word, content-function word and function word in word class and words with inflection and word without inflection in inflectional morphology. Results revealed the significant effect of word class and word inflection on the stuttering frequency.

The first factor analysed was word class. Comparison of stuttering frequency between content words, content-function words and function words were carried out. Findings of this study showed a significant effect of word class on stuttering frequency, with being higher stuttering on content words. Findings of this study corroborates with the study done in school-aged CWS in English (Au-Yeung et al., 1998), in Korean language (Choi et al., 2020) and Turkish (Bircan et al., 2023). While few studies show no significant effect on word class in preschool CWS (Seth & Maruthy, 2019) and school-aged CWS (Alqhazo & Alfwaress, 2022), most of the studies in the literature contradicts with the present findings as

they state function words being highly stuttered than content words in preschool CWS (Bloodstein and Gantwerk, 1967), in school-aged CWS (Dworzynski et al., 2003; Natke et al., 2004) and AWS (Juste et al., 2012). According to EXPLAN theory, stuttering arises from a mismatch between the time required for linguistic planning and the execution time. Hence, CWS tend to repeat or prolong function words as a stalling strategy while preparing for more complex content words. However, in languages like Kannada, where utterance usually begins with content words. Due to the linguistic structure of Kannada, stuttering was higher on content words in this study, unlike findings in English-speaking CWS. This pattern aligns more closely with the studies conducted on adults who stutter (AWS) (Jayaram, 1981; Maruthy et al., 2015), suggesting a shift in the stuttering frequency from function words to content words as the individual grows older, with transition seen around the adolescence phase (Juste et al., 2012).

The second factor analysed under morphological factors was word inflections. Results revealed a significant effect of word inflections on stuttering frequency, with higher stuttering frequency seen on words without inflections. This part of morphological factor is less researched and existence of the literature in this regard is sparse. Alqhazo & Al-Dennawi (2018) revealed that stuttering rate is higher for inflected words than non-inflected words for school-aged CWS, while, few studies found no significant effect of inflectional morphology on stuttering frequency in preschool CWS (Seth & Maruthy, 2019; Rahmalina et al., 2023). The increased proportion of disfluencies observed for words with inflection is typically attributed to the increased linguistic complexity and overall word length. However, the participants in this study were young CWS with still-developing language skills, they tend to simplify linguistically complex forms into simple forms. This simplification reduced both word length and linguistic complexity, thereby lowering linguistic processing demands and, therefore, decreasing the stuttering frequency on words

with inflection. Hence, inflectional morphology being a morphological factor has a definitive effect on stuttering rate, irrespective of adding inflections to the utterances.

Overall, the findings of the study revealed that both linguistic factors i.e., phonological and morphological factors significantly influence stuttering in Kannada-speaking school-aged children who stutter (CWS). Among these factors, phoneme position (word-initial position), phoneme type (consonant-initial words), and phonological complexity (IPC) were the most significant contributors to increase the disfluency, addition to this, word class and inflection also demonstrated a significant effect, with higher stuttering observed on content words, however, the effect of inflection was mediated by developmental factors, as younger children tended to simplify complex linguistic forms, thereby reducing linguistic load and overall reduction in disfluency.

CHAPTER 6

SUMMARY AND CONCLUSION

The main purpose of this study was to determine the effect of phonological and morphological factors on the Kannada-speaking school-aged CWS. 30 school-aged CWS who are native speakers of Kannada with confirmed diagnosis using SSI-4 were taken in this study. Spontaneous speech sample was audio-video recorded and subsequently transcribed using IPA. A total of 300 syllables were analyzed to calculate stuttering frequency. Under phonological factors, percentage of stuttering for phoneme position, phoneme type, word length and IPC scores were calculated. Results showed significant effects of all the variables on the stuttering frequency. Higher stuttering frequency were seen for initial phoneme position, words beginning with consonants, monosyllables and higher IPC scores for stuttered words. Stuttering frequency was high for monosyllables was explained due to avoidance of longer words by children and reduced prevalence of lengthier words in Kannada language. Moreover, in morphological factors, percentage of stuttering for word class and inflectional morphology were calculated. Significant effect was observed for the word classes and inflectional morphology on stuttering disfluencies. The higher disfluency rate on content words and words with no inflections were the findings of the study. Due to still-developing linguistics skills, children tend to simplify linguistic complexity like inflections, hence, words with inflection have reduced stuttering rate.

To conclude, this study shows a significant effect of all the variables on the frequency of disfluency in Kannada-speaking School-aged CWS. Findings of the word length, word class and inflectional morphology contradicts the previous studies done in other languages which could be described due to the differences in the linguistic structure between Kannada and other languages like English, German, Spanish, Arabic, Indonesian

and Persian. Hence, this study highlights the importance of the linguistic structure of the language and its effect on the pattern of stuttering.

Clinical Implications

- Present study highlights the nature of stuttering in a more specific way, by understanding the interplay between the effects of different linguistic factors.
- Findings helps the clinician to investigate through the lens of linguistic structure of the language for better individualized treatment planning.

Limitations of the Study

- Study included all the severity of stuttering without subgrouping them for better comparison.
- Speech samples elicited using the spontaneous speech only, other elicitation tasks were not included.

Future Directions

- Future research should be a comparison of pre-school, school-aged children and adults, so better perspective in terms of exchange of stuttering from young age to adulthood could be studied.
- Studies can be done using other tasks like oral reading.
- Studies can also investigate the effect of linguistic factors in other Indian languages and compare it with current study.

REFERENCES

Abdalla, F., Robb, M. P., & Al-Shatti, T. (2010). Stuttering and lexical category in adult Arabic speakers. *Clinical Linguistics & Phonetics*, *24*(1), 70–81. https://doi.org/10.3109/02699200903420316

Alqhazo, M., & Al-Dennawi, S. (2018). The linguistic aspects of the speech of Jordanian children who stutter. *International Journal of Pediatric Otorhinolaryngology*, *109*, 174–179. https://doi.org/10.1016/j.ijporl.2018.04.003

Alqhazo, M., & Alfwaress, F. (2022). Stuttering frequency on content and function words in pre-school and school-age Jordanian Arabic-speaking children who stutter. *Psychology of Language and Communication*, *26*(1), 1–17. https://doi.org/10.2478/plc-2022-0001

Al-Tamimi, F., Khamaiseh, Z., & Howell, P. (2013). Phonetic complexity and stuttering in Arabic. *Clinical Linguistics & Phonetics*, *27*(12), 874–887. https://doi.org/10.3109/02699206.2013.823242

Anderson, J. D., & Wagovich, S. A. (2010). Relationships among linguistic processing speed, phonological working memory, and attention in children who stutter. *Journal of Fluency Disorders*, *35*(3), 216–234. https://doi.org/10.1016/j.jfludis.2010.04.003

Aryal, D., & Maruthy, S. (2023). Linguistic factors and stuttering in Nepali speaking adults who stutter. *Clinical Linguistics & Phonetics*, *37*(3), 258–271. https://doi.org/10.1080/02699206.2022.2049880

Au-Yeung, J., Howell, P., & Pilgrim, L. (1998). Phonological words and stuttering on function words. *Journal of Speech Language and Hearing Research*, *41*(5), 1019–1030. https://doi.org/10.1044/jslhr.4105.1019

Au-Yeung, J., Gomez, I. V., & Howell, P. (2003). Exchange of disfluency with age from function words to content words in Spanish speakers who stutter. *Journal of speech,*

language, and hearing research : JSLHR, *46*(3), 754–765. https://doi.org/10.1044/1092-4388(2003/060

Bircan, B. B., Kara, İ., & Kayıkcı, M. E. K. (2023). Syllable- and word-based measures of stuttering in speech samples of Turkish-speaking school-aged children. *Clinical Linguistics & Phonetics*, *38*(3), 185–202. https://doi.org/10.1080/02699206.2023.2186764

Bloodstein, O. (1960). The development of stuttering: II. Developmental phases. *The Journal of Speech and Hearing Disorders, 25*(4), 366–376.

Bloodstein, O., & Gantwerk, B. F. (1967). Grammatical function in relation to stuttering in young children. *Journal of Speech and Hearing Research*, *10*(4), 786–789. https://doi.org/10.1044/jshr.1004.786

Brown, S. F. (1937). The influence of grammatical function on the incidence of stuttering. *Journal of Speech Disorders*, *2*(4), 207–215. https://doi.org/10.1044/jshd.0204.207

Brown, S. F. (1938a). Stuttering with relation to word accent and word position. *Journal of Abnormal & Social Psychology*, *33*(1), 112–120. https://doi.org/10.1037/h0062149

Brown, S. F., & Moren, A. (1942). The frequency of stuttering in relation to word length during oral reading. *Journal of Speech Disorders*, *7*(2), 153–159. https://doi.org/10.1044/jshd.0702.153

Brown, S. F. (1945). The loci of stutterings in the speech sequence. *Journal of Speech Disorders*, *10*(3), 181–192. https://doi.org/10.1044/jshd.1003.181

Choi, D., Sim, H., Park, H., Clark, C. E., & Kim, H. (2020). Loci of stuttering of English and Korean-speaking children who stutter: Preliminary findings. *Journal of Fluency Disorders*, *64*, 105762. https://doi.org/10.1016/j.jfludis.2020.105762

Deepa, A., & Savithri, S. R. (2010). *Re-standardization of Kannada articulation test. Student research at AIISH Mysore (Vol. VIII part B speech-language pathology, pp. 53–65)*. Mysore: All India Institute of Speech and Hearing

Dworzynski, K., Howell, P., & Natke, U. (2003). Predicting stuttering from linguistic factors for German speakers in two age groups. *Journal of Fluency Disorders*, *28*(2), 95–113. https://doi.org/10.1016/s0094-730x(03)00009-3

Eichorn, N., & Donnan, S. (2021). Word-Final Disfluencies in a School-Age Child: Beneath the tip of the iceberg. *Language Speech and Hearing Services in Schools*, *52*(4), 967–977. https://doi.org/10.1044/2021_lshss-21-00005

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/brm.41.4.1149

Field, A. (2005). *Exploring data* (3rd ed.). London: Sage

Griggs, S., & Still, A. W. (1979b). An analysis of individual differences in words stuttered. *Journal of Speech Language and Hearing Research*, *22*(3), 572–580. https://doi.org/10.1044/jshr.2203.572

Howell, P., Au-Yeung, J., & Sackin, S. (2000). Internal structure of content words leading to lifespan differences in phonological difficulty in stuttering. *Journal of Fluency Disorders*, *25*(1), 1–20. https://doi.org/10.1016/s0094-730x(99)00025-x

Howell, P., & Au-Yeung, J. (2002). The EXPLAN theory of fluency control applied to the diagnosis of stuttering. *Amsterdam Studies in the Theory and History of Linguistic Science Series, 4*, 75–94.

Howell, P. (2004). Assessment of some contemporary theories of stuttering that apply to spontaneous speech. *Contemporary Issues in Communicative Sciences and Disorders, 39*, 122–139.

Howell, P., Au-Yeung, J., Yaruss, J. S., & Eldridge, K. (2006). Phonetic difficulty and stuttering in English. *Clinical linguistics & phonetics*, *20*(9), 703–716. https://doi.org/10.1080/02699200500390990

Iimura, D., Takahashi, S., Fukazawa, N., Morita, N., Oe, T., & Miyamoto, S. (2021). Effect of linguistic factors on the occurrence of stuttering-like disfluency among Japanese-speaking preschool children who stutter. *Clinical Linguistics & Phonetics*, *37*(1), 1–16. https://doi.org/10.1080/02699206.2021.2001048

Jakielski, K. J. (n.d.). *Motor organization in the acquisition of consonant clusters- ProQuest*. https://search.proquest.com/openview/e3c556421c6b8f8dbeebf23f42fe1fdd/1?pq-origsite=gscholar&cbl=18750&diss=y

Jayaram, M., 1981. Grammatical factors in stuttering. *Journal of the Indian Institute of Science, 63*(6), 141-147.

Jayaram, M. (1983). Phonetic influences on stuttering in monolingual and bilingual stutterers. *Journal of Communication Disorders, 16*(4), 287–297.

Jayaram, M. (1984). Distribution of stuttering in sentences. *Journal of Speech Language and Hearing Research*, *27*(3), 338–341. https://doi.org/10.1044/jshr.2703.338

Juste, F. S., Sassi, F. C., & de Andrade, C. R. F. (2012). Exchange of disfluency with age from function to content words in Brazilian Portuguese speakers who do and do not stutter. *Clinical Linguistics & Phonetics*, *26*(11–12), 946–961. https://doi.org/10.3109/02699206.2012.728278

Lakkanna, S., Venkatesh, K., Bhat, J. S., & Karuppali, S. (2021). *Assessment of language development: A Manipal Manual*.

Maruthy, S., Raj, N., Geetha, M. P., & Sindhu Priya, C. (2015). Disfluency characteristics of Kannada-English bilingual adults who stutter. *Journal of Communication Disorders, 56*, 19–28.

Nag‐Arulmani, S., Reddy, V., & Buckley, S. (2003). Targeting phonological representations can help in the early stages of reading in a non‐dominant language. *Journal of Research in Reading*, *26*(1), 49–68. https://doi.org/10.1111/1467-9817.261005

Natke, U., Sandrieser, P., Van Ark, M., Pietrowsky, R., & Kalveram, K. T. (2004). Linguistic stress, within-word position, and grammatical class in relation to early childhood stuttering. *Journal of Fluency Disorders*, *29*(2), 109–122. https://doi.org/10.1016/j.jfludis.2003.11.002

Rahmalina, R., Sudana, D., Arianingsih, A., Sunendar, N. F., & Saifullah, A. R. (2023). Phonological and morphological factors of Indonesian children's stuttering. *Humanus*, *22*(2), 237. https://doi.org/10.24036/humanus.v22i2.125926

Riley, G. (2009). *Stuttering severity instrument* (4th ed.). Austin, TX: Pro-Ed.

Rosenthal, R. (1991). *Meta-analytic procedures for social research* (2nd ed.). Newbury Park, CA: Sage.

Savithri, S.R., Jayaram, M., Kedarnath, D., & Sanjay, G. (2005). Speech rhythm in Dravidian language – Kannada. *Journal of Acoustic Society of India, 33,* 352–355.

Seth, D., & Maruthy, S. (2019). Effect of phonological and morphological factors on speech disfluencies of Kannada speaking preschool children who stutter. *Journal of Fluency Disorders*, *61*, 105707. https://doi.org/10.1016/j.jfludis.2019.105707

Smith, M., & Howell, P. (2013). Stuttering patterns in Japanese and English preschool-aged and school aged children. Journal of the Phonetic Society of Japan, 17, 83–89. http://discovery.ucl.ac.uk/1522292/

Smith, A., & Weber, C. (2017). How stuttering Develops: The Multifactorial Dynamic Pathways Theory. *Journal of Speech Language and Hearing Research*, *60*(9), 2483–2505. https://doi.org/10.1044/2017_jslhr-s-16-0343

Soderberg, G. A. (1966). The relations of stuttering to word length and word frequency. *Journal of Speech and Hearing Research*, *9*(4), 584–589. https://doi.org/10.1044/jshr.0904.584

Steever, S. B. (2019). Introduction to the Dravidian languages. *In Routledge eBooks (pp. 1–44). https://doi.org/10.4324/9781315722580-1*

Stuttering. (2017, March 6). NIDCD. https://www.nidcd.nih.gov/health/stuttering

Takahashi, S., Iimura, D., & Ishida, O. (2024). Linguistic Factors Associated with Stuttering-Like Disfluencies in Japanese Preschool and School-Aged Children Who Stutter. *Journal of Communication Disorders*, *112*, 106473. https://doi.org/10.1016/j.jcomdis.2024.106473

Throneburg, R. N., Yairi, E., & Paden, E. P. (1994). Relation between phonologic difficulty and the occurrence of disfluencies in the early stage of stuttering. *Journal of Speech Language and Hearing Research*, *37*(3), 504–509. https://doi.org/10.1044/jshr.3703.504

Upadhyaya, U. P. (1972). *Kannada phonetic reader.* Mysore: Central Institute of Indian Languages.

Uysal, A. A., Fidan, D., Al-Tamimi, F. Y., & Howell, P. (2021). Phonetic complexity and stuttering in Turkish-speaking children who stutter. *Clinical Linguistics & Phonetics*, *35*(10), 996–1009. https://doi.org/10.1080/02699206.2020.1866674

Venkatagiri, H. S., Nataraja, N. P., & Deepthi, M. (2017). Stuttering in relation to the morphophonemics of Kannada. *Clinical Linguistics & Phonetics*, *31*(4), 313–329. https://doi.org/10.1080/02699206.2016.1259353

Williams, D. E., Silverman, F. H., & Kools, J. A. (1969a). Disfluency Behavior of Elementary-School stutterers and Nonstutterers: LocI of Instances of Disfluency.

Journal of Speech and Hearing Research, *12*(2), 308–318. https://doi.org/10.1044/jshr.1202.308

Wingate, M. E. (1967). Stuttering and word length. *Journal of Speech and Hearing Research*, *10*(1), 146–152. https://doi.org/10.1044/jshr.1001.146

Yairi, E. and Ambrose, N. (2005). *Early Childhood Stuttering*. Austin: Pro Ed.

Yairi, E. (2007). Subtyping stuttering I: A review. *Journal of Fluency Disorders, 32*, 165–196.