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Phonological and Syntactical Processing among Adolescents with Stuttering

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Abstract

Literature reports that in children and adults, individuals with stuttering perform poorly on phonological processing tasks, and syntactic abilities when compared to age-matched individuals with no disfluencies. The present study focuses on phonological and syntactic processing abilities among adolescents with disfluencies. The abilities were also compared to age-matched peers with no dysfluency. The prospective comparative study involved 32 participants, comprising two groups of 16 adolescent (11-19 years of age) participants each. One group consisted of adolescents with disfluencies and the other group included typically fluent adolescents. English was their second language. Four tasks measuring phonological and syntactical processing were administered to all participants. Tasks administered were: Rhyme judgment task in L2, Phoneme blending task in L2, Phonological memory task (repetition of nonwords in L2), and evaluation of syntactic and semantic appropriateness of sentences. Scores of the Control group and adolescent group with stuttering were compared using independent t test. Statistically significant differences were seen for all the tasks. The accuracy and time taken for completion of these tasks were compared across both the groups. Adolescents who stutter exhibited impaired performance on phonological and syntactic processing tasks while their fluent counterparts did not. The findings were similar to those of studies on children and adults with stuttering. Adolescent individuals with stuttering exhibit poorer performance on speech processing tasks such as rhyme judgment, syntactical judgment, and non-word repetition.

Keywords: Adolescents, Disfluencies, Phonological, Processing, Stuttering, Syntactical.

Introduction

"A fluency disorder can be defined as an interruption in the flow of speaking characterized by atypical rate, rhythm and various disfluencies [e.g., repetitions of sounds, syllables, words, and phrases; sound prolongations; and blocks], this can also be accompanied by excessive tension, speaking avoidance, struggle behaviors, and secondary mannerisms" (1). Various theories have been proposed to explain the cause of stuttering. The theories proposed span from biological, genetics, behavioral and neurocognitive origins. Covert Repair Hypothesis is a model which tries to connect linguistic processes and motor processes into one working model of stuttering. It illustrates the link between formulating an accurate phonetic plan and fluent speech. This hypothesis explains the use of a monitoring system that checks the accuracy of speech generated. Speech monitoring happens when formulating a phonetic plan, and prior to the implementation of the articulatory commands. Based on this hypothesis, individuals can detect an error in their internal phonetic plan when they are formulating what they want to say; if an error in the internal phonetic plan is detected, the speaker interrupts the planning of the phonological sequence and makes a repair in the plan. An attempt to repair errors immediately before its production results in a fluency break (2). According to the model, individuals who exhibit dysfluencies have an impaired ability to encode a phonological sequence, resulting in a delay in activating the target phonemes when placed in competition with other phonemes (3). A study reported that children who exhibited disfluencies also produced a greater variety and higher phonological processes than children who did not stutter (4).

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Phonological Processing and Stuttering

Phonological processing has been defined as the use of phonemes in one's language to process spoken and written language. Phonological processing can be broken down into three categories: phonological awareness, phonological working memory, and phonological retrieval (5). These components are considered essential for speech production. Phonological awareness is the ability of an individual to segment, blend and manipulate the phonemes in a word. Phonological memory is the ability to maintain and retrieve auditory presented phonological information. Phonological retrieval can be defined as the ability to retrieve the coded phonetic information rapidly. Performance on tasks of phonological awareness and phonological memory reflects the processes occurring during phonological encoding, hence, this provides a valuable research tool to investigate phonological encoding abilities in individuals who stutter (6, 7). Previous studies conducted on both children and adults with stuttering have reported that performance in both groups when compared to their fluent peers shows some difference in their phonological processing abilities (7). The prevalence of a co-occurring phonological disorder is also higher in individuals who have disfluencies than those without dysfluencies (8). A study in 2008 examined the phonological awareness abilities in 5–6-year olds and reported that the performance of children who stutter (CWS) is poorer than their fluent peers (children who do not stutter (CWNS)) though scores obtained were within normal limits suggested by the norms of standardized test scores (9). Another study in 2008 investigated the phonological awareness abilities in 18 adults who stuttering (AWS) and found no significant difference between groups. However, AWS were significantly slower to repeat a nonword pair when compared to a real word pair. On accuracy related tasks, both groups performed similarly (10). Similarly a 2020 study reported significant between-group differences on all tasks administered, indicating deficits in phonological representation, and planning in CWS (11). It has been found that adults who stutter (AWS) were significantly slower in a rhyme judgment task compared to adults who do not stutter (AWNS), suggesting ongoing challenges in phonological processing among AWS (12). A similar study has reported slower reaction times in AWS compared to AWNS, particularly in complex rhyme conditions (13). Based on the literature survey of studies assessing phonological awareness in both children and adults who stutter the following conclusions can be drawn:

- Phonological processing abilities differ between CWS and CWNS (9, 11).
- The differences in phonological processing abilities persist into adulthood (12).
- Despite differences in phonological processing abilities, performance accuracy may not always differ between individuals who stutter and those who do not. Differences have been observed in performance between CWS and CWNS, but these differences did not reach statistical significance, indicating that while there may be trends, individual variation exists (14).

Overall, these findings highlight the importance of phonological processing abilities in both children and adults who stutter, and highlight potential areas for assessment when evaluating individuals with stuttering. According to "Baddely's theoretical model of memory", phonological memory can be described as the ability to maintain in memory a phonological code that can be used in daily speech (15, 16). It is a component of phonological processing and is evaluated using nonword repetition or digital recall tasks. Nonword repetition involves the following processes which include auditory processing during aural presentations of the Nonword, encoding the acoustically presented information into its phonological representation and holding this in working memory, followed by motor planning and execution of the response (17). In children, it was found that CWNS outperformed CWS in nonword repetition tasks, particularly for three-syllable non-words (18). Another study observed similar results, with CWS showing more errors, especially in longer non-words (19). Research has also noted reduced phonemic accuracy in CWS, particularly among younger children (20). Research indicates that AWS exhibited less effective phonological encoding abilities and more inconsistent articulatory coordination compared to adults who do not stutter (AWNS), particularly with longer and more phonologically complex non-words (21, 22). Studies have highlighted deficits in phonological

working memory in AWS, particularly in maintaining fluent speech under complex task conditions (23, 24). Overall, these studies suggest that both children and adults who stutter may experience challenges in phonological memory tasks, which could contribute to difficulties in speech production and maintenance of fluent speech.

Syntactic Processing and Stuttering

The multifactorial model of stuttering posits that various factors, including linguistic variables, interact to contribute to the onset and persistence of stuttering (25). It was found that disfluent utterances in children with stuttering were often longer and more complex than fluent utterances, suggesting a potential association between syntactic complexity and stuttering severity (26, 27). However, it was reported that syntactic complexity did not significantly impact stuttering frequency in adolescents, highlighting the complexity of the relationship between linguistic variables and stuttering (28). Further insights into the linguistic deficits associated with stuttering have been provided by studies examining grammatical awareness and syntactic processing abilities. One study found that children with stuttering exhibited lower accuracy in grammatical judgment tasks compared to fluent peers, indicating potential difficulties in grammatical awareness (14). Similarly, another study reported that individuals who stutter showed decreased accuracy in online grammatical judgment tasks, particularly for complex sentences, suggesting deficits in syntactic processing (29). In addition to grammatical deficits, studies have highlighted slower speech initiation times and decreased accuracy in syntactic encoding tasks among individuals who stutter. Researchers found that adults who stutter exhibited slower speech initiation times for syntactically complex sentences compared to fluent peers (30). Studies conducted on children reported that children who stutter benefited more from syntactic primes in sentence-structure priming tasks, suggesting deficits in grammatical encoding (31). Studies have also reported that children who stutter produced more dysfluencies in syntactically complex utterances (32). Overall, the evidence suggests that both children and adults with stuttering may exhibit subtle phonological and syntactical processing deficits contributing to the disfluencies observed in this population. The exact nature of these deficits and their effect on fluency intervention requires further investigation. There is strong evidence in literature, for deficits in phonological and syntactic processing abilities in individuals who stutter. This evidence supports models such as the covert repair hypothesis. Such evidence is well documented for age groups of children as well as adults with stuttering with limited data available on the phonological and syntactic processing abilities of adolescents. Adolescent age sees sudden changes in many aspects of biological, social and emotional aspects of the individual. There is an increased usage of complex language and in complex challenging social situations. Therefore, the data from this age group may help scrutinize postulates of the model, examine interplay between linguistic processes and motor processes. The aim of the present study is to evaluate phonological and syntactic processing abilities among adolescents with dysfluency and compare their processing abilities with adolescents who have no dysfluency

Methodology

The participants in the study included adolescents with and without dysfluencies, from the ages of 11-19 years. This age range was selected in accordance with the definition given by the World Health Organization, where the adolescent period ranges between the ages of 10 – 19 years. Participants were divided into two groups. Group 1 included 16 adolescents diagnosed with stuttering (experimental group). Group 2 included 16 age matched controls. Participants in the experimental group were recruited in a convenient sample when they enrolled for assessment at Dr. S.R. Chandrasekhar Institute of Speech and Hearing during the academic year of February 2023 to August 2023. The L1, primary language of all the subjects was Kannada.

Inclusion criteria for individuals with dysfluency (Experimental group)

- Individuals diagnosed with stuttering based on Stuttering Severity Instrument for Children and Adults- third edition, (SSI-3). Stuttering should be present at least for a period of 3 months. The Institute at which the authors are part of and where the data was collected, has an authorized version of SSI-3 and it is being used routinely for clinical assessment of

dysfluency. It is the main tool for assessment of severity of dysfluency at the Institute.

- Age-adequate language level – Participants must achieve the pass criteria on The Manipal Manual of Adolescent Language Assessment (MMALA) - Domain A.
- Participants' medium of instruction while schooling must be English. Academic grade should be average grade point or higher in previous three years.
- Participants must be conversant in English.
- On self-rating 5-point scale, score a minimum of 3 on the domains of listening, speaking, reading, and writing.

Inclusion criteria for individuals without dysfluency (Control group)

- Age-adequate language level – Participants must achieve pass criteria on The Manipal Manual of Adolescent Language Assessment (MMALA) - Domain A.
- Participants' medium of instruction while schooling must be English.
- Participants must be conversant in English.
- No self-reported history of childhood language disorder, phonological disorders or learning disability.

Exclusion criteria for individuals with dysfluency (Experimental group)

- Individuals with self-reported hearing impairment or a history of speech and language delay.
- Individuals with poor academic performance based on failure rate- below 50 percent grade average in annual examination of previous three years
- Individuals with self-reported or clinically identified neurological problems causing stuttering.

Exclusion criteria for individuals without dysfluency (Control group)

- Individuals with self-reported hearing impairment or a history of speech and language delay.
- Individuals with poor academic performance based on failure rate- below 50 percent grade average in annual examination of previous three years.

Materials

Four tasks were administered to evaluate phonological and syntactical processing abilities of adolescents who stutter and their performance was compared to a group of adolescents with no dysfluency. All participants were evaluated and tasks administered at the clinical test room of the Institute where the authors work.

Tasks Include

- Rhyme judgment task in L2 - English to assess phonological awareness. 80-word pairs in English (12).
- Phoneme blending task in L2 - English to assess phonological awareness, 20 items. Words were chosen from different sources. e.g non words were from Dyslexia Assessment Profile for Indian Children (DAPIC). All words content validated with the help of 10 adolescent subjects (not part of the study groups).
- Repetition of nonwords in L2 - English to assess phonological memory, 36 non-sense words (23). Content validation was done by asking Two Final Year Graduate students of SLP to transcribe the words in IPA.
- Evaluating the syntactic and semantic appropriateness of sentences (33). Five Final-year students of Msc SLP served as content validation judges and target sentences were rated for their appropriateness for the study and the age group.

Procedure

All the following tasks were administered to subjects on a one-on-one basis, with the main author as principal investigator administering the tasks and recording the responses. The responses were later validated by the principal investigator and two other authors of the study. Testing was conducted in a regular office space with the subject seated comfortably. It's a familiar place for the subject as he/she would have visited the place for assessment and consultation for dysfluency. Primary author is the clinician for the subjects and therefore rapport would additional help the task being performed as naturally as possible. Subjects were instructed that performance in these tasks do not reflect on their general ability in any way and they can take their own time with pressure on performance or completion in a particular time period. Participants were allowed to familiarize themselves with each task before testing began. All these would positively impact anxiety. Self-awareness and its influence on the test were not particularly addressed in this study. Adolescents

are expected to be aware of their difficulties and as no judgment are passed, verbal or through body language influence of this confounding factor is considered either similar across all the participants or minimal in its influence.

Rhyme Judgment Task: The task stimuli consisted of 80-word pairs of English. The participants had to read the word pairs and decide if they rhymed. A stimuli sheet was provided to the participants and they were asked to check the box under "rhyme" if the word pairs rhymed, and to check the box under "no rhyme" if they did not. Practice trials were provided before commencing the task. The time taken to complete the task and the number of errors were recorded. The time was recorded using the built-in stopwatch on the 'One Plus 8T' phone. Maximum score is 80.

Phoneme Blending Task: The task stimuli consisted of 20 items i.e. words in English. The software (RecForge 11- Version 1.2.8.4g) was used to record and play the stimulus. Participants were required to hear the phonemes, blend them, and identify the target word from an option of three words. High frequency real words and nonsense words were present in the options provided. The stimuli were presented via earphones (JBL C100S), participants were required to circle the target word on the stimuli sheet. Practice trials provided before commencing the task. Number of errors was recorded after completing the task. Maximum score is 20.

Non-word Repetition Task: Nonsense words were presented via the earphones (JBL C100S). The participant was instructed to repeat the words heard. The words were two- syllables, three-syllables and four -syllables in length. The software (RecForge 11- Version 1.2.8.4g) was used to play the stimulus. Replaying the stimulus was permitted for up to 6 trials. If the stimulus was played and the participant was unsure of the word or produced an inaccurate word, it was considered as an inaccurate trial. The number of trials required for the accurate production of the word was recorded and a score was assigned based on performance. Scores were allotted based on the trial number in which the participant was able to repeat the target word accurately. e.g., Accurate production in the 1st trail resulted in a score of 1 and an accurate production in the 6th trial resulted in a score of 6. If the participant was not able to produce the word accurately, it resulted in a score of 7. Higher scores indicated that participants required more trials. Hence, a higher the score, poorer the performance. If participants exhibited stuttering while repeating a word, that trial was not considered while scoring and participants were given another chance to produce the word without replaying the stimulus. Maximum score is 252.

Syntactical Judgment Task: 30 stimuli sentences, in L2 English, were provided on the stimuli sheet and the participant was asked to decide if the sentence provided was, "mixed up", "silly", or "okay". "Mixed up" sentences were syntactically incorrect sentences or sentences which were jumbled up. "Silly" sentences were grammatically accurate sentences which were not plausible. "Okay" sentences are those sentences which are both syntactically and semantically accurate. Patients were asked to check the respective boxes after reading the sentences provided. Practice trials were provided before commencing the task. The time taken to complete the task and number of errors made were recorded. The time was recorded using the built in stop watch on the 'One Plus 8T' phone. Maximum score is 30.

Statistical Analysis: The data was collected on stimuli sheets which were analyzed by the researcher. The collected data was entered on Microsoft Excel and was subjected to statistical analysis using the software SPSS package version 20. Descriptive statistics and group comparisons were applied. The test of normality was conducted to check if the data meets the assumptions of normality. The scores were calculated for each task. Mean scores were then computed for each task of the two groups separately. An Independent sample t-test was performed to assess the significant difference in mean scores between the experimental and control group.

Results and Discussion

The present study aimed at investigating the phonological and syntactical processing abilities of adolescents with dysfluencies and compared their performance to typically fluent peers matched in terms of age (within 12 months), educational performance, and linguistic abilities. Shapiro-Wilk test was conducted to assess the normality of the data and the results revealed that the data satisfies the assumptions of normality ($p > 0.05$). Hence parametric test (independent sample t-test) was conducted to assess the significant difference in

the mean score of each parameter between the experimental and control group.

Rhyme Judgment

As seen on Table 1, the mean values for 'time' and 'errors' are lower for the control group when compared to the experimental group, while SD values were similar. An independent sample t-test was performed to assess the significant difference in mean scores between the experimental and control group. The result indicates that there is a statistically significant difference in mean scores across the groups ($t(30) = -2.33$, $p < 0.05$) but no significant difference was observed in the time taken to complete the rhyme judgment task ($t(30) = -1.95$, $p > 0.060$) since the p-value was greater than the preferred alpha value of α =5%. The results indicate that adolescents with stuttering when compared to typically fluent peers did not show statistically varied performance in terms of time, however adolescents with stuttering made more errors while performing the rhyme judgment task.

Table 1: Comparison of Time and Errors for Rhyme Judgement Task between Experimental and Control Group

Parameters	Experimental (Mean± SD)	Control (Mean± SD)	t	df	p-value	95% of Confidence Interval	
						Lower Limit	Upper Limit
Time	285.81 ± 60.40	244.62 ± 58.67	-1.956	30	0.060	-84.18493	1.80993
Errors	19.81 ± 8.61	12.62 ± 8.81	-2.333	30	0.027	-13.47970	-0.89530

Time measured in seconds
Errors measured as the number of incorrect responses

The current study revealed notable differences in rhyme judgment performance among individuals with stuttering across different age groups. Adolescents exhibited reduced accuracy compared to fluent peers, echoing findings from previous researchers (12, 13). Based on the evidence in the literature, adults with stuttering demonstrated slower reaction times, suggesting a potential speed-accuracy trade-off strategy (12). In contrast, one study indicated that children with stuttering showed no significant differences in reaction time, and reported comparable rhyme judgment abilities between children who stutter and their fluent peers (34). These disparities hint at developmental variations in processing strategies and emphasize the need for further investigation into the underlying mechanisms driving rhyme judgment performance in individuals who stutter.

Phoneme Blending

As seen on Table 2, the mean values of accuracy scores were better for the control group (91.56±6.51) when compared to the experimental group (84.68±10.87). An independent sample t-test was performed to assess the significant difference in mean scores between the experimental and control group. The results revealed that there is a statistically significant difference in the mean accuracy scores and mean error scores on the phoneme blending task across the groups ($t(30) = 2.170$, $p < 0.05$; $t(30) = -2.170$, $p < 0.05$) The fluent group made significantly fewer errors, and hence performed with higher accuracy on this task when compared to adolescents with stuttering.

Table 2: Comparison of Accuracy and Error Scores of Phoneme Blending between Experimental and Control Group

Parameters	Experimental (Mean± SD)	Control (Mean± SD)	t	df	p- value	95% of Confidence Interval	
						Lower Limit	Upper Limit
Accuracy Score	84.68±10.87	91.56±6.51	2.170	30	0.038	0.40417	13.34583
Error score	3.06± 2.17	1.68±1.30	-2.170	30	0.038	-2.66917	-0.08083

Accuracy scores measured as the number of correct responses
Error scores measured as the number of incorrect responses

In the present study, adolescents who stutter showed significantly poorer performance on phoneme blending tasks, consistent with prior research (35). Researchers found similar results among adults with stuttering as well, noting that adults who stutter exhibited deficits in phonological processing tasks (7, 12). Additionally, phonological processing difficulties have been

reported in children who stutter, supporting our findings (9, 35, 36). However, one study reported non-significant differences in phonological awareness between dysfluent and fluent children. The discrepancy in the results of different studies may potentially be due to variations in tasks employed (14). This discrepancy underscores the importance of considering task complexity. However, similarity in findings of phonological awareness deficits in preschoolers who stutter, and the present study may suggest that such deficits may persist beyond early school years (11). These findings collectively suggest that individuals who stutter experience ongoing phonological processing challenges, particularly evident when task complexity increases.

Nonword Repetition

A higher mean score was obtained if the participant required more trials to accurately repeat the nonword. Hence, a higher mean score is indicative of lower accuracy and greater trials on the nonword repetition (NWR) task. As seen on Table 3, the mean values for 'total scores' were higher for the experimental group (72.56±23.97) when compared to the control group (48.50±9.78). An independent sample t-test was performed to assess the significant difference in mean scores between the experimental and control group. The authors reported that there is a statistically significant difference in the mean scores for 2 syllables, 3 syllables, and 4 syllables nonword repetition scores between the groups. ($t(30) = -2.957$, $p<0.05$; $t(30) = -2.163$, $p< 0.05$; $t(30) = -3.789$, $p<0.05$). The results indicate that adolescents with stuttering performed poorly on repetition of nonwords at all syllable lengths when compared to their fluent peers. An overall higher mean score obtained by the stuttering group indicates that the participants required more trials for accurate performance in the task.

Table 3: Comparison of Non word Repetition Parameters between Experimental and Control Group

Parameters	Experimental (Mean± SD)	Control (Mean± SD)	t	df	p- value	95% of Confidence Interval	
						Lower Limit	Upper Limit
2syllable NWR	19.87±6.44	14.43±3.53	-2.975	30	0.006	-9.19330	-1.68170
3syllable NWR	23.68±11.13	17.18±4.51	-2.163	30	0.039	-12.63798	-0.36202
4syllable NWR	29.00±12.25	16.87±3.70	-3.789	30	0.001	-18.66047	-5.58953
Total scores	72.56±23.97	48.50±9.78	-3.717	30	0.001	-37.28345	-10.84155

The present study reveals that adolescents who stutter exhibit significant difficulties in nonword repetition tasks compared to their fluent peers, indicating underlying deficits in phonological memory. This finding aligns with prior research showing reduced phonological encoding abilities in children with stuttering (18, 19). Unlike previous findings suggesting a "breaking point" at three syllables, our study unveils consistent difficulties across two, three, and four-syllable lengths in adolescents who stutter. These phonemic accuracy deficits observed in younger stuttering groups suggest a continuity of phonological challenges into adolescence (20). Studies on adults also indicate persistent difficulties in nonword repetition accuracy, potentially linked to impaired phonological working memory (21, 23). Measuring phonological memory ability through non-word repetition tasks has also been linked to predicting persistence and recovery of stuttering and hence can be considered a valuable tool to assess phonological memory (37). Therefore, the results of the present study provide valuable insights into the persistent nature of phonological memory deficits in individuals who stutter, emphasizing the importance of early intervention strategies to address these challenges throughout development.

Syntactical Judgment

As seen on Table 4, the mean values for 'time' and 'errors' are lower for the control group when compared to the experimental group. An independent sample t-test was performed to assess the significant difference in mean scores between the experimental and control group. The result indicates that there is a statistically significant difference in mean error scores and time taken to complete the grammar judgment task across the groups ($t(30) = -2.806$, $p < 0.05$; $t(30) = -3.021$, $p< 0.05$). The authors reported that the adolescents who stutter made significantly more errors and required a longer time to complete the grammar task when compared to age matched typically fluent peers.

Table 4: Comparison of Time and Errors of Syntactical Judgment between Experimental and Control Group

Parameters	Experimental (Mean ± SD)	Control (Mean ± SD)	t	df	p-value	95% of Confidence Interval	
						Lower Limit	Upper Limit
Time	192.31± 65.22	140.1 ± 22.80	-3.02	30	0.005	-87.46	-16.90
Errors	5.18 ± 3. 20	2.62 ± 1.74	-2.80	30	0.009	-4.427	-0.69

Time measured in seconds

Errors measured as the number of incorrect responses

The present study highlights the notable syntactical challenges experienced by adolescents with stuttering, as evidenced by their extended completion time and increased errors on grammar judgment tasks compared to typically fluent peers. These findings align with prior research, which observed lower accuracy among stuttering individuals, particularly with complex sentences, indicating persistent deficits in syntactical processing (29). Similarly, researchers have also highlighted how children who stutter struggle to encode grammar but benefit from syntactic primes to develop syntactic structures, reinforcing the results of the present study (31). Research has also found differences in grammatical awareness between children with and without stuttering, supporting the notion of subtle language difficulties in stuttering individuals (14). Research has also reported contradictory neural functioning between stuttering and fluent groups (38). The overall body of evidence, including the present study, suggests a consistent pattern of syntactic processing differences in individuals who stutter. Therefore, further investigation is warranted to explore syntactic processing differences in stuttering populations, focusing on refining assessment methodologies, and elucidating the underlying neural mechanisms involved.

Limitations

Study had a limited number of subjects. Subject inclusion was based on their availability and their consent to participation. Though they met the inclusion criteria, study may not have been able to control for all confounding factors, known or unknown. However efforts were made to include participants with similar linguistic background, Age-adequate language level on a standard assessment tool and absence of history confounding conditions such as phonological disorder, childhood language disorders.

Conclusion

The present study contributes to the growing body of literature on phonological and syntactic processing deficits in individuals who stutter. Building on prior research, the study aimed to assess these abilities in adolescents with dysfluency compared to typically developing peers. Utilizing tasks such as rhyme judgment, phoneme blending, nonword repetition, and syntactical judgment, the study revealed that adolescents who stutter exhibited poorer performance on phonological and syntactic processing tasks compared to their fluent counterparts. Previous studies on linguistic tasks also have reported differences in performances among group with stuttering and group with no stuttering. Those studies were carried out in children and adult age groups (2, 3). Strengths of the study include its focus on an adolescent stuttering population, addressing a gap in existing literature. However, limitations such as the small sample size and reliance on a single task for syntactic processing assessment warrant caution in generalizing the findings. Future research could replicate the study with a larger sample size, investigate potential correlations between the severities of stuttering and phonological processing, and explore syntactic processing using more complex stimuli. Bilingualism contributes to challenges in syntactical processing as well as phonological processing. Its influence on dysfluency would also be an interesting aspect that future studies can consider.

Abbreviations

AWNS: Adults Who Do Not Stutter, AWS: Adults Who Stutter, CWNS: Children Who Do Not Stutter, CWS: Children Who Stutter, DAPIC: Dyslexia Assessment Profile for Indian Children, MMALA: Manipal Manual of Adolescent Language Assessment, NWR: Non-Word Repetition, SSI: Stuttering Severity Instrument.

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Author Contributions

Arunya Manoj: Conceptualization, Data Collection, Writing, Suresh T: Supervision, Methodology, A. Srividya: Review & Editing**,** Praveena Babu: Statistical Analysis, Data Interpretation.

Conflict of Interest

The authors of this work state that they have no conflicts of interest about this publication.

Ethics Approval

The Institutional Ethics Committee of Dr. S R Chandrasekhar Institute of Speech and Hearing has approved the study.

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