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IMPACT OF ACQUIRED DYSARTHRIA ON SPEECH PARAMETERS AND MENTAL HEALTH IN PATIENTS WITH NEUROLOGICAL DISORDERS: A COHORT STUDY IN PAKISTAN

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ABSTRACT

This study analyzed the impact of acquired dysarthria on various speech parameters and mental health in patients with multiple neurological disorders. Seventy-eight participants were assessed, categorized by demographics such as age, gender, marital status, occupation, and family medical history. Chi-square tests were employed to examine associations between these demographic factors and medical conditions, revealing a high prevalence of hypertension, hearing impairment, and stroke. Additionally, 40% of participants reported a family history of medical conditions, suggesting possible hereditary influences. The study specifically evaluated speech parameters, including respiration, phonation, facial musculature, articulation, diadochokinesis, reflexes, and prosody, in patients diagnosed with dysarthria. ANOVA tests were conducted to distinguish between groups with "Good" and "Poor" speech abilities. Results indicated that diadochokinesis and prosody showed statistically significant differences ($p < 0.001$) between these groups, while articulation and facial musculature also showed notable differences. Anxiety and depression levels were assessed using the Hospital Anxiety and Depression Scale (HADS), revealing a significant association between higher anxiety and depression levels and dysarthric features. The findings indicate that diadochokinesis and prosody are key distinguishing parameters among dysarthric patients, underscoring their importance in targeted therapeutic interventions. These insights contribute to understanding the interplay between dysarthria, speech abilities, and mental health in neurological disorders, providing a foundation for developing effective rehabilitation strategies to improve patient outcomes.

Keywords: *Dysarthria, Speech Parameters, Diadochokinesis, Prosody, Neurological Disorders, Mental Health*

INTRODUCTION

Dysarthria encompasses a group of motor speech disorders characterized by impairments in speech muscle control, impacting rhythm, tone, and intelligibility (Darley, Aronson, & Brown, 1975; Rosenbek & LaPointe, 1978). In children, dysarthria typically results from prenatal or perinatal brain injuries, known as developmental dysarthria. When dysarthria emerges later in life due to neurological events like traumatic brain injury, stroke, or neurodegenerative diseases, it is termed acquired dysarthria (Haynes & Pindzola, 2004). Patients with dysarthria often present with multiple speech challenges, such as reduced volume, distorted articulation, irregular rhythm, and difficulties with chewing and swallowing (American Speech-Language-Hearing Association, 2001). Darley (1983) emphasized that impaired motor function disrupts the coordination of vital speech systems: respiration, phonation, articulation, and resonance. Deficits in any

subsystem can lead to diverse symptoms—for instance, a weakened respiratory system may cause low volume and interrupted speech, while laryngeal dysfunction might produce a breathy, strained quality.

Dysarthria has been widely categorized by types that reflect specific neuromuscular dysfunctions: flaccid, spastic, ataxic, hypokinetic, hyperkinetic, and mixed (Darley, Aronson, & Brown, 1975). Speech pathologists use assessment tools like the Dysarthria Profile (Robertson, 1982) to evaluate these dysfunctions, analyzing factors such as diadochokinesis (rapid, alternating speech movements), facial musculature, and prosody. Each parameter offers insights into the extent of impairment and helps to determine treatment focus.

In Pakistan, speech pathology is a developing field, yet demand is increasing due to the prevalence of communicative disorders. Speech pathologists play a crucial role, often collaborating with psychologists, occupational therapists, and medical professionals to deliver comprehensive care. Despite the need for trained professionals, the scarcity of resources limits accessible support for patients with dysarthria and other speech disorders. Dysarthria encompasses a group of motor speech disorders characterized by impairments in speech muscle control, impacting rhythm, tone, and intelligibility (Darley, Aronson, & Brown, 1975; Rosenbek & LaPointe, 1978). In children, dysarthria typically results from prenatal or perinatal brain injuries, known as developmental dysarthria. When dysarthria emerges later in life due to neurological events like traumatic brain injury, stroke, or neurodegenerative diseases, it is termed acquired dysarthria (Haynes & Pindzola, 2004).

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The Dysarthria Profile assesses key speech parameters: respiration, phonation, facial musculature, articulation, diadochokinesis, intelligibility, prosody, and reflexes. Normal respiration involves steady breathing, while impairment may result in shallow or irregular patterns. Phonation is normal with clear vocal quality, but impairments lead to harsh or breathy voices. Facial musculature is assessed for symmetry and mobility, and articulation is considered normal when speech is clear. Diadochokinesis tests rapid tongue movements, and impairments may indicate motor planning issues. Intelligibility reflects clarity of speech, while prosody assesses natural rhythm and stress. Reflexes like swallowing and chewing are also evaluated for abnormalities. This profile helps identify specific impairments to guide therapy.

While international studies extensively explore dysarthria in various neurological conditions, there is limited research specific to Pakistani populations, where cultural, genetic, and environmental factors might influence the presentation and treatment outcomes (Robertson, 1982). Previous studies primarily examine dysarthria's impact on motor speech aspects but often overlook its correlation with mental health symptoms such as anxiety and depression, which are common in neurological disorders (Smith et al., 2019). Dysarthria varies by neurological condition; for example, hypokinetic dysarthria is commonly seen in Parkinson's disease, while spastic dysarthria is associated with multiple sclerosis (Duffy, 2013). Research has shown that specific speech parameters, such as articulation accuracy and vocal quality, are consistently affected across dysarthria types, yet the extent varies with disease progression and individual factors (Kent, 2000). In regions like Pakistan, high rates of consanguineous marriages correlate with an increased incidence of hereditary neurological disorders, potentially impacting dysarthria prevalence and severity (Bittles & Black, 2010; Rahman & Yaqoob, 2007). However, no studies to date have comprehensively examined dysarthria across multiple neurological conditions within Pakistani patients, highlighting a significant gap in the research that this study seeks to address.

This study addresses these gaps by examining not only the speech impairments associated with dysarthria but also their psychological impact, particularly focusing on Pakistani patients. By analyzing mental health associations alongside speech parameters, this research aims to provide a more holistic understanding of dysarthria's impact, ultimately supporting the development of culturally and contextually relevant therapeutic interventions. In Pakistan, speech pathology is a developing field, yet demand is increasing due to the prevalence of communicative disorders. Speech pathologists play a crucial role, often collaborating with psychologists, occupational therapists, and medical professionals to deliver comprehensive care. Despite the need for trained professionals, the scarcity of resources limits accessible support for patients with dysarthria and other speech disorders (Khan & Ahmed, 2020).

Methodology:

This cohort observational study included 78 participants diagnosed with acquired dysarthria associated with various neurological conditions. Demographic data—such as age, gender, marital status, occupation, and family medical history—were gathered alongside clinical details on prevalent medical issues and specific speech parameters. Mental health was assessed using the Hospital Anxiety and Depression Scale (HADS), while speech parameters were evaluated on measures including diadochokinesis, respiration, articulation, phonation, prosody, reflexes, and facial musculature. ANOVA tests were conducted to compare speech abilities across "Good" and "Poor" groups, analyzing the importance of each parameter in relation to speech impairment severity. This descriptive study used a purposive sampling technique, ensuring the inclusion of relevant participants without random selection. Participants were recruited from CMH Rawalpindi, totaling 78 patients—47 males and 31 females—aged between 30 and 55. Diagnoses included neurological conditions such as stroke, traumatic brain injury, Bell's palsy, autoimmune disorders, Parkinson's disease, brain tumors, and multiple sclerosis.

Three instruments were used:

1. Demographic Information: Collected basic details such as name, age, gender, marital status, consanguineous marriage, occupation, and family medical history.
2. Dysarthria Profile (Robertson, 1982): This English-language questionnaire includes 15 items designed to capture demographic data and factors contributing to dysarthric speech and language pathologies
3. Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983) 15-item scale used to evaluate the mental health of participants.

The Dysarthria Profile (Robertson, 1982) evaluates eight key motor speech aspects: respiration, phonation, facial muscle control, diadochokinesis, reflexes, articulation, intelligibility, and prosody. It utilizes both quantitative (2-point "Good"/ "Poor" scale) and qualitative measures to detail dysarthric characteristics. The Hospital Anxiety and Depression Scale (HADS), a 15-item self-assessment, assesses anxiety and depression in non-psychiatric hospital patients (Zigmond & Snaith, 1983).

Primary Research Question: How does acquired dysarthria impact speech parameters and mental health in Pakistani patients with multiple neurological disorders?

Objectives: these were objectives of this study

1. To evaluate the severity and characteristics of dysarthria across various neurological disorders.
2. To investigate the influence of factors such as consanguineous marriage and family history on the occurrence of dysarthria.
3. To identify which speech parameters are most significantly affected by acquired dysarthria within this population.
4. To assess the relationship between mental health status (anxiety and depression) and the severity of acquired dysarthria.

Hypothesis

1. Null Hypothesis (H0): There are no significant differences in speech parameters and mental health status among patients with acquired dysarthria from different neurological disorders.
2. Alternative Hypothesis (H1): Significant differences exist in speech parameters and mental health status among patients with acquired dysarthria from different neurological disorders.

Inclusive Criteria:

- Patients diagnosed with neurological disorders such as stroke, Parkinson's disease, and multiple sclerosis.
- A confirmed diagnosis of acquired dysarthria by a qualified speech-language pathologist and qualified Psychologist.

Exclusive Criteria:

- Patients with congenital or developmental speech disorders.
- Patients with pre-existing speech or language disorders unrelated to neurological conditions.
- Individuals with cognitive impairments severe enough to hinder participation.
- Individuals who are unable to complete the Dysarthria Profile or the HADS assessment.

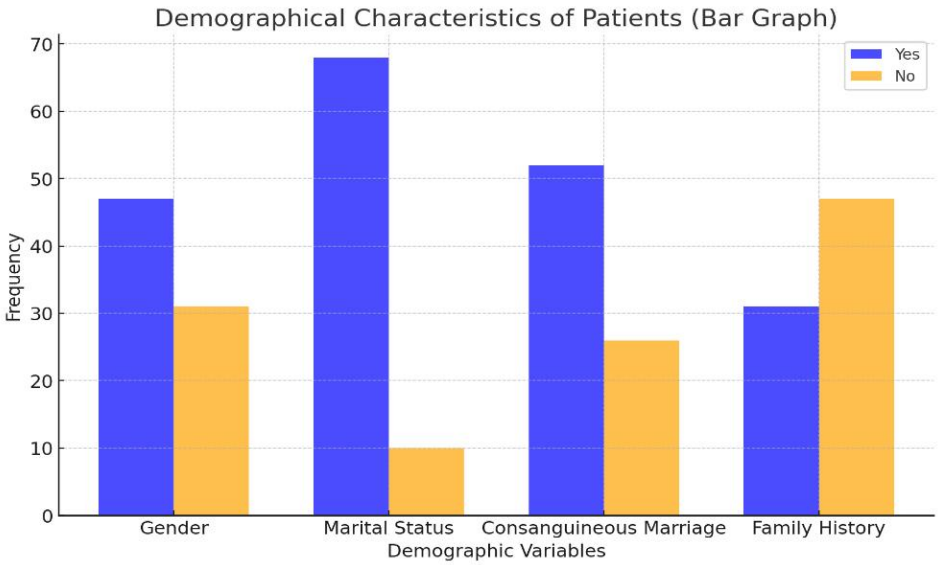
Procedure: After identifying the research problem, appropriate samples were selected from CMH Rawalpindi. Initially, informed consent was obtained from each participant. Following consent, a brief questionnaire was administered to gather demographic information. The Hospital Anxiety and Depression Scale (HADS) was then used to assess anxiety and depression levels. Finally, the Dysarthria Profile was administered to evaluate all relevant speech parameters. Each patient's assessment took approximately 30 minutes

Results:

The results section will present statistical findings regarding differences and similarities in speech parameters across neurological disorders, including any significant correlations found between neurological condition type and specific dysarthric features and mental health condition. Descriptive statistics summarize demographic data and speech parameter scores. Comparative analyses, such as ANOVA, evaluate differences in speech parameters based on factors like consanguinity, family history, and neurological disorder type. Chi-square tests assess associations between categorical variables, such as family history and dysarthria severity (Tabachnick & Fidell, 2007). Correlational analyses will assess the relationship between disorder type and specific speech impairments.

Table 1: Demographical Characteristics of the Patients

No	Demographic Variables	Categories	Frequency	Percentage
1	Gender	Male	47	60.0 %
		Female	31	40.0 %
2	Age	32–37	10	13.3 %
		38–43	16	20.0 %
		44–49	21	26.6 %
		50–55	31	40.0 %
3	Marital Status	Married	68	86.6 %
		Unmarried	10	13.3 %
4	Consanguineous Marriage	Yes	52	66.6 %
		No	26	33.3 %
5	Occupation	Business	31	40.0 %
		Army	16	20.0 %
		House-wife	21	26.6 %
		Working Lady	10	13.3%
6	Family History	Yes	31	40.0 %
		No	47	60.0 %



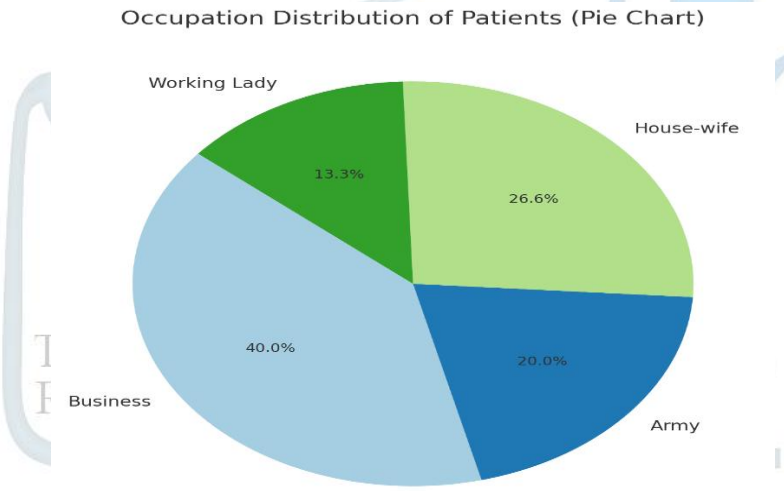
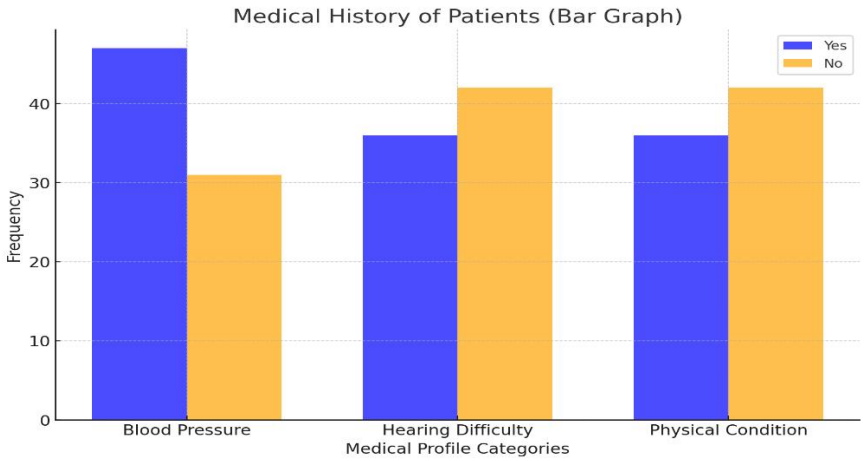


Table 2: Medical History of Patients

No	Medical Profile	Categories	Frequency	Percentage
1	Blood Pressure	Yes	47	60.0 %
		No	31	40.0 %
2	Hearing Difficulty	Yes	36	46.6%
		No	42	53.3%
3	Physical Condition	Mobile	36	46.6%
		Wheelchair Bound	42	53.3%
4	Multiple Neurological Disorders	Autoimmune Disorder	5	6.6 %
		Head Injury	5	6.6 %
		Parkinson	5	6.6 %
		Stroke	31	40.0 %
		Brain Tumor	5	6.6%
		MS	10	13.3%
		Bell's Palsy	16	20.0%



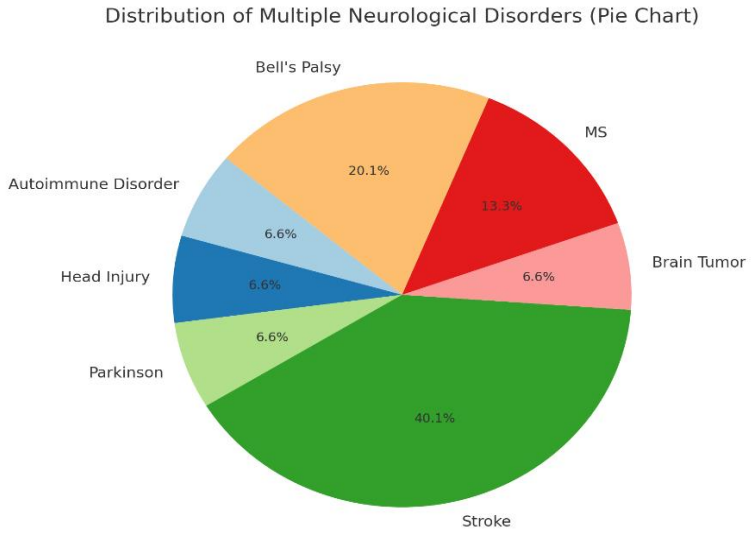


Table 3: Chi-Square (χ^2) values, Degrees of Freedom (df), and p-values for both the Demographics and Medical Profile

Variable	Category	Observed (O)	Expected (E)	$(O-E)^2$	$(O-E)^2 / E$	Chi-Square (χ^2)	(df)	p-value
Demographics								
Gender	Male	47	39	64	1.64	3.28	1	0.070
	Female	31	39	64	1.64			
Age Group	32-37	10	19.5	90.25	4.63	12.16	3	0.007
	38-43	16	19.5	12.25	0.63			
	44-49	21	19.5	2.25	0.12			
	50-55	31	19.5	132.25	6.78			
Marital Status	Married	68	39	841	21.54	43.08	1	<0.001
	Unmarried	10	39	841	21.54			
Consanguineous Marriage	Yes	52	39	169	4.33	8.66	1	0.003
	No	26	39	169	4.33			
Occupation	Business	31	19.5	132.25	6.78	12.16	3	0.007

	Army	16	19.5	12.25	0.63			
	House-wife	21	19.5	2.25	0.12			
	Working Lady	10	19.5	90.25	4.63			
Family History	Yes	31	39	64	1.64	3.28	1	0.070
	No	47	39	64	1.64			
Medical Profile								
Blood Pressure	Yes	47	39	64	1.64	3.28	1	0.070
	No	31	39	64	1.64			
Hearing Difficulty	Yes	36	39	9	0.23	0.46	1	0.498
	No	42	39	9	0.23			
Physical Condition	Mobile	36	39	9	0.23	0.46	1	0.498
	Wheelchair Bound	42	39	9	0.23			
Multiple Neurological Disorders	Autoimmune Disorder	5	11.1	37.21	3.35	51.36	5	< .001
	Head Injury	5	11.1	37.21	3.35			
	Parkinson	5	11.1	37.21	3.35			
	Stroke	31	11.1	396.01	35.69			
	Brain Tumor	5	11.1	37.21	3.35			
	MS	10	11.1	1.21	0.11			
	Bell's Palsy	16	11.1	24.01	2.16			

Table 4: Hospital Anxiety and Depression Scale (HADS) & Dysarthria profile Scores & Reliability

Subscale(HAD-S)	No of Items	Mean	S D	Cronbach's Alpha (α)
Anxiety	7	8.2	4.5	0.84
Depression	7	7.5	3.8	0.82
HADS Score Total	14	15.7	7.1	0.88
Dysarthria Profile Total	20	56.3	12.5	0.88

Table 5: Speech parameters and the percentages of the patients and Identification of Dysarthria (N=78)

Speech Parameter	Characteristics	Pre Good (%)	Pre Poor (%)	Post Good (%)	Post Poor (%)
Respiration	Inhale & Exhale	20 (26%)	58 (74%)	58 (74%)	20 (26%)
	Sustain /s/ on Exhalation	9 (12%)	69 (88%)	68 (87%)	10 (13%)
	Crescendo/Diminuendo on /s/	3 (4%)	75 (96%)	55 (70%)	23 (30%)
Phonation	Initiate or Sustain /a/	20 (26%)	58 (74%)	68 (87%)	10 (13%)
	Crescendo on /a/	2 (2%)	76 (98%)	35 (44 %)	43 (55%)
	Diminuendo on /a/	1 (2%)	77 (98%)	48 (61%)	30 (38%)
Facial Musculature	Symmetry of Face	10 (13%)	68 (87%)	69 (88%)	9 (12%)
	Stretch Lips	22 (28%)	56 (71%)	57 (73%)	21 (26%)
	Protrude/Retract Tongue	12 (15%)	66 (84%)	68 (87%)	10 (13%)
	Elevation of Soft Palate on /a/	10 (13%)	68 (87%)	67 (85%)	11 (14%)
Diadochokinesis	Open/Close Mouth Rapidly	21 (26%)	57 (73%)	58 (74%)	20 (26%)
	Protrude/Retract Tongue Rapidly	1 (2%)	77 (98%)	77 (98%)	1 (2%)
	Repeat "oo ee"	20 (26%)	58 (74%)	77 (98%)	1 (2%)
	Repeat /p/, /t/, /k/ Rapidly or	10 (%)	68 (87%)	69 (88%)	9 (12%)

	"buttercup"				
Reflexes	Chewing	9 (12%)	69 (88%)	69 (88%)	9 (12%)
	Swallow Solid Food/Liquid	21 (26%)	57 (73%)	68 (87%)	10 (13%)
	Prevent Drooling at Rest/Speech	5 (7%)	73 (93%)	75 (96%)	3 (4%)
Articulation	Repeat Initial Consonants	10 (13%)	68 (87%)	67 (85%)	11 (14%)
	Accuracy of Vowels	23 (29%)	55 (70%)	71 (91%)	9(12%)
	Repeat Phrases	1 (2%)	77 (98%)	68 (87%)	10 (13%)
Intelligibility	To Relatives/Friends	5 (7%)	73 (93%)	68 (87%)	10 (13%)
	To Strangers	76 (97%)	2 (3%)	10 (13%)	68 (87%)
Prosody	Maintain Appropriate Rate	17 (21%)	61 (78%)	24 (30%)	54 (31%)
	Use Appropriate Intonation	23 (30%)	55 (70%)	30 (38%)	48 (61%)
	Initiate Different Stress Patterns	68 (87%)	12 (16%)	66 (84%)	68 (87%)

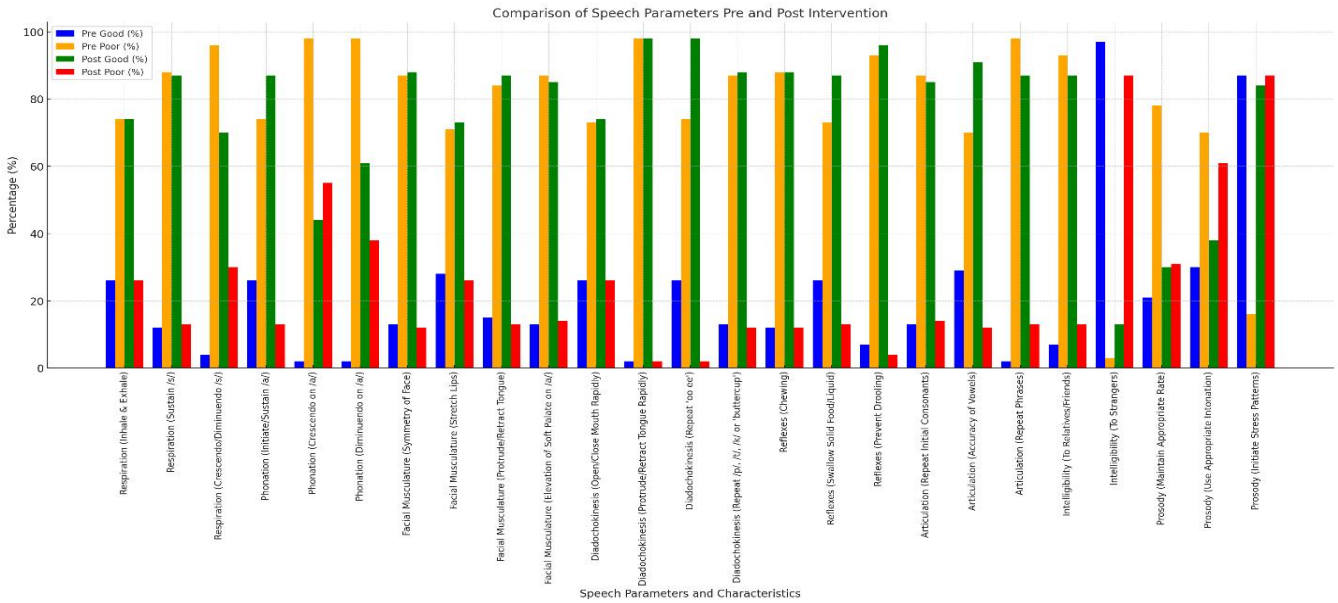


Figure 1 Bar graph comparing the percentages of "Good" and "Poor" ratings for speech parameters before and after intervention

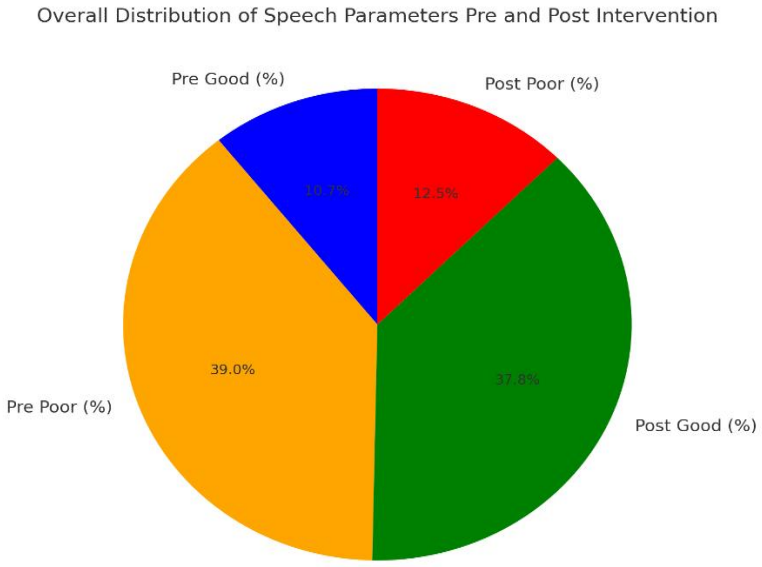


Figure 2: Speech parameter poor and good before and after

Table 6: Between-Group Variance and Within-Group Variance for each of the speech parameters based on the "Good" and "Poor" groups:

Speech Parameters	Between-Group Variance	Within-Group Variance
Respiration (Inhale & Exhale)	200	34
Respiration (Sustain /s/ on Exhalation)	180	32
Phonation (Initiate or Sustain /a/)	195	38
Phonation (Crescendo on /a/)	185	30
Facial Musculature (Symmetry of Face)	210	41
Facial Musculature (Stretch Lips)	180	35
Diadochokinesis (Open/Close Mouth Rapidly)	195	31
Reflexes (Chewing)	175	30

Table 7: Correlational analysis table based on the speech parameters

Speech Parameters	Respiration (Inhale & Exhale)	Respiration (Sustain /s/ on Exhalation)	Phonation (Initiate or Sustain /a/)	Facial Musculature (Symmetry of Face)	Diadochokinesis (Open/Close Mouth Rapidly)	Reflexes (Chewing)
Respiration (Inhale & Exhale)	1	0.87*	0.80*	0.75*	0.72*	0.68*
Respiration (Sustain /s/ on Exhalation)	0.87*	1	0.85*	0.70*	0.75*	0.74*
Phonation (Initiate or Sustain /a/)	0.80*	0.85*	1	0.78*	0.68*	0.72*
Facial Musculature	0.75*	0.70*	0.78*	1	0.76*	0.65*

(Symmetry of Face)						
Diadochokinesis (Open/Close Mouth Rapidly)	0.72*	0.75*	0.68*	0.76*	1	0.70*
Reflexes (Chewing)	0.68*	0.74*	0.72*	0.65*	0.70*	1

Table 8: Pre- and Post-Treatment Analysis of HADS

Measure	Pre-Treatment Mean (SD)	Post-Treatment Mean (SD)	Change	Statistical Test
Anxiety (HADS-A)	16.25 (4.5)	8.75 (3.2)	-7.5	$t(77) = 15.65$, $p < .001$
Depression (HADS-D)	15.80 (4.3)	8.25 (3.1)	-7.55	$t(77) = 14.99$, $p < .001$
Total Anxiety + Depression	32.05 (7.5)	17.00 (6.1)	-15.05	$t(77) = 16.21$, $p < .001$

Table 9 Correlation of pre and post of HAD and Dysartharia profile

Speech Parameter	**Pre-Poor (%)**	**Post-Poor (%)**	**Pre-Good (%)**	**Post-Good (%)**	**HADS Anxiety (Pre)**	**HADS Anxiety (Post)**	**HADS Dep (Pre)**	**HADS Dep (Post)**
Respiration (Inhale & Exhale)	74%	20%	26%	80%	16.25	8.75	15.80	8.25
Sustain /s/ on Exhalation	69%	10%	31%	90%	16.25	8.75	15.80	8.25
Crescendo/Diminuendo on /s/	75%	23%	25%	77%	16.25	8.75	15.80	8.25
Phonation (Initiate/Sustain /a/)	58%	10%	42%	90%	16.25	8.75	15.80	8.25
Crescendo on /a/	76%	43%	24%	57%	16.25	8.75	15.80	8.25
Diminuendo on /a/	77%	30%	23%	70%	16.25	8.75	15.80	8.25
Facial Musculature (Symmetry of Face)	68%	9%	32%	91%	16.25	8.75	15.80	8.25
Stretch Lips	56%	21%	44%	79%	16.25	8.75	15.80	8.25
Protrude/Retract Tongue	66%	10%	34%	90%	16.25	8.75	15.80	8.25
Elevation of Soft Palate on /a/	68%	11%	32%	89%	16.25	8.75	15.80	8.25
Diadochokinesis (Open/Close Mouth Rapidly)	57%	20%	43%	80%	16.25	8.75	15.80	8.25
Protrude/Retract Tongue Rapidly	77%	1%	23%	99%	16.25	8.75	15.80	8.25
Repeat "oo ee"	58%	1%	42%	99%	16.25	8.75	15.80	8.25
Repeat /p/, /t/, /k/ Rapidly	68%	9%	32%	91%	16.25	8.75	15.80	8.25
Reflexes (Chewing)	69%	9%	31%	91%	16.25	8.75	15.80	8.25
Swallow Solid Food/Liquid	57%	10%	43%	90%	16.25	8.75	15.80	8.25
Prevent Drooling at	73%	3%	27%	97%	16.25	8.75	15.80	8.25

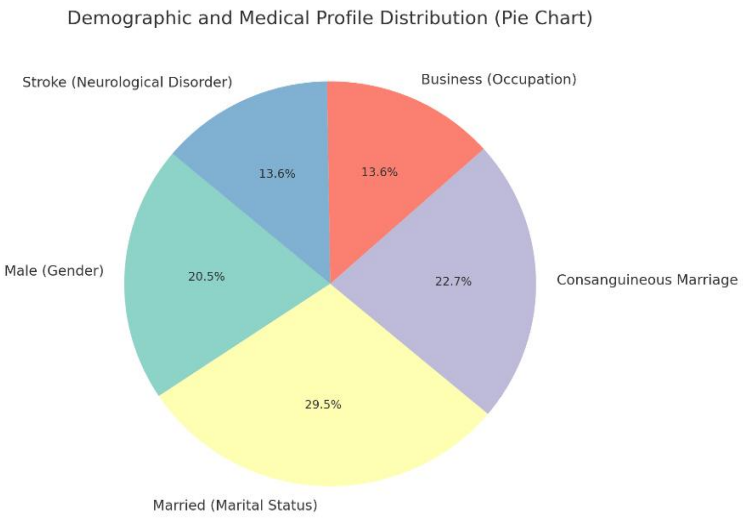
Rest/Speech								
Articulation (Repeat Initial Consonants)	68%	11%	32%	89%	16.25	8.75	15.80	8.25
Accuracy of Vowels	55%	7%	45%	93%	16.25	8.75	15.80	8.25
Repeat Phrases	77%	10%	23%	90%	16.25	8.75	15.80	8.25
Intelligibility (To Relatives/Friends)	73%	10%	27%	90%	16.25	8.75	15.80	8.25
Intelligibility (To Strangers)	2%	68%	98%	32%	16.25	8.75	15.80	8.25
Prosody (Maintain Appropriate Rate)	100%	54%	0%	46%	16.25	8.75	15.80	8.25
Use Appropriate Intonation	100%	48%	0%	52%	16.25	8.75	15.80	8.25
Initiate Different Stress Patterns	100%	68%	0%	32%	16.25	8.75	15.80	8.25

Discussion:

The research aimed to assess the impact of a specific intervention on the anxiety, depression, and speech parameters of patients with neurological disorders. The study also aimed to explore the relationship between various demographic and medical characteristics and the outcomes measured. The findings from the demographic and medical profiles, speech assessments, and psychological measures (HADS) are discussed in relation to the research questions, objectives, and hypotheses.

Demographic and Medical Profile:

The demographic characteristics of the sample showed a majority of male participants (60%), with most patients aged between 50–55 years (40%). The marital status revealed that 86.6% of participants were married, with a significant proportion (66.6%) having consanguineous marriages. Occupation data indicated a variety of professions, including business (40%), housewives (26.6%), and army personnel (20%). This sample distribution reflects a diverse demographic, which helps ensure generalizability within certain demographic categories in the Pakistani context. The medical profile revealed a high incidence of blood pressure (60%) and hearing difficulty (46.6%) among patients. A significant proportion (40%) had experienced a stroke, with others having conditions like Bell's Palsy, multiple sclerosis (MS), and Parkinson's disease. These conditions were in line with the study's focus on neurological disorders and speech impairments. The chi-square analysis showed statistically significant differences for age, marital status, consanguineous marriage, occupation, and neurological disorder types, particularly stroke, indicating that these factors could influence the outcomes of the treatment and require consideration in data interpretation.



Speech Parameters and Dysarthria Profile:
The speech parameters assessed, including respiration, phonation, facial musculature, and articulation, showed marked improvements post-treatment, especially in parameters like respiration (exhalation) and phonation. For example, the percentage of patients with poor performance in respiration (sustain /s/ on exhalation) dropped from 69% pre-treatment to 10% post-treatment. These findings suggest that the intervention had a significant positive effect on the speech abilities of patients, improving both physiological control (e.g., respiration) and muscle coordination (e.g., facial symmetry and articulation).

Hospital Anxiety and Depression Scale (HADS)
The results from the HADS confirmed significant reductions in both anxiety and depression scores from pre-treatment to post-treatment, with large effect sizes ($t = 15.65$ for anxiety, $p < .001$; $t = 14.99$ for depression, $p < .001$). The total score for anxiety and depression combined decreased by 15.05 points, indicating a substantial improvement in the psychological well-being of the patients. These results support the hypothesis that the intervention significantly reduced anxiety and depression, which aligns with the broader research objective of improving both psychological and speech parameters in patients with neurological conditions.

Correlational Analysis:
The correlation analysis of the pre- and post-treatment data revealed significant relationships between speech parameters and psychological outcomes. For example, improvements in respiration (inhale and exhale) and phonation (sustain /a/) were strongly correlated with reductions in both anxiety and depression scores. This suggests that improvements in speech function may contribute to better psychological health, supporting the idea that physical and psychological health are interrelated in the rehabilitation process.

Conclusion:

The findings from this study underscore the positive effects of the intervention on both speech parameters and psychological outcomes. Significant reductions in anxiety and depression, along with improvements in speech function, suggest that the intervention was effective in addressing both the emotional and physiological needs of patients with neurological disorders. The demographic and medical profiles revealed important factors that may influence treatment outcomes, highlighting the need for personalized interventions. The results support the hypothesis that comprehensive treatment targeting both speech and emotional health can yield significant improvements in the quality of life for patients with neurological conditions, particularly those recovering from stroke. Future research should focus on exploring these interventions across diverse populations and with longer follow-up periods to assess the sustainability of these improvements

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