

Mechanisms Through Which Lordotic Posture Affects Learners With Cerebral Palsy's Speech Production Ability in Nairobi City County, Kenya

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Abstract

The purpose of the study was to investigate mechanisms through which Lordotic Posture affects learners with cerebral palsy's speech production ability in Nairobi City County, Kenya. The research focused on how different postures influence muscle coordination, stiffness, and breathing, which in turn affect speech production, particularly in the mouth, neck, and facial muscles. The research was guided by the myoelectric-aerodynamic theory of voice production, identifying posture as the independent variable and speech production as the dependent variable. A cross-sectional research design was employed, incorporating a review of relevant literature on posture and speech production in children with Cerebral Palsy (CP). The research involved 296 children aged 2 to 10 years diagnosed with (CP) and four paramedics, totaling 300 participants. A combination of systematic and random sampling techniques was utilized to choose the study population. To ensure the accuracy and consistency of the findings, the study measured validity and reliability using Cronbach's alpha and Kappa coefficients. Data were analyzed using SPSS software and presented in tables, charts, and frequency distributions. Participation in the study was voluntary, and all participants were assured of confidentiality and anonymity. The findings indicated that specific postural conditions significantly impact speech production. The study identified that improper posture influences phonation by altering breathing patterns and vocal structure positioning. On the basis of these findings, some recommendations were provided.

Key words: Kenya, Nairobi, Mechanisms, Lordotic Posture, Speech Production Ability

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Introduction

Cerebral palsy is a neurological condition present at birth that affects movement, posture, and speech abilities (Edwards et al., 2020). It is classified as a non-progressive disorder, meaning its symptoms do not worsen over time, and it is primarily linked to brain development abnormalities occurring before or during birth. The most common symptoms observed include exaggerated reflexes, frequent involuntary motions, and floppy or rigid limbs. William Little, an orthopedic surgeon in 1862, first defined cerebral palsy as a condition resulting from an injury to the brain within two years of a child's birth (Kim & Ashwal, 2023). However, with progressive research over the years, doctors believe that a definitive diagnosis of the condition should occur within five years, during which examinations would rule out the possibilities of other slow, progressive neurodevelopmental and metabolic diseases. Additionally, it is within these five years that doctors may observe different manifestations of the condition, including intellectual disabilities in 30-50% of cases, epilepsy in 15-60%, as well as behavioral, visual, and auditory abnormalities (RN, 2022).

One of the most common speech impairments is anarthria, a condition characterized by a complete inability to produce speech due to severe neuromuscular dysfunction. This condition results from significant motor impairments affecting the muscles involved in speech production, making verbal communication difficult or impossible. The wide variation in populations experiencing speech difficulties could be attributed to differences in the methodological approaches adopted by different researchers and variations in the definitions and measurements of what constitutes proper speech in respective studies.

Globally, surveys indicate that there are approximately 18 million people with cerebral palsy across all ages, with the majority experiencing speech production issues, including approximately 1 million individuals in the United States (McIntyre et al., 2022). Furthermore, it is shown that 1 in every 323 babies in the United States is diagnosed with cerebral palsy. While 75% of individuals with cerebral palsy experience chronic pain, it is estimated that 33% face mobility challenges due to weak muscles, including speech problems, and are confined to wheelchairs. These mobility challenges and various postural issues significantly impact speech production among these children (Damiano et al., 2022).

The prevalence and effects of cerebral palsy, including compromised speech ability in children, are suggested to be higher in Africa compared to other parts of the world, including Western countries such as the United States (Danis & Kutluk, 2021). For instance, a study conducted in rural Uganda by Namaganda et al. (2020) utilized a three-stage sampling and identification procedure to enumerate cerebral palsy cases and assess underlying causes. Although the causes of cerebral palsy were not a focus of this study, other elements, such as prevalence, remain significant, as they inform the extent to which speech production and communication in children are affected in this context (Leite, Jindal, Malek & Rosenbaum, 2022). Consequently, the study established a higher prevalence rate of cerebral palsy in rural Uganda, citing 3.1 cases per 1,000 live births. Among these children, many experienced delayed speech, fluency problems, and articulation disorders.

There are no official statistics in Kenya, however, on the prevalence and extent of difficulties associated with cerebral palsy. Estimates suggest that 3 in every 100 children in the country live with cerebral palsy and suffer from at least one or a combination of complications associated with the condition, such as speech production challenges (Barton et al., 2020). This implies that the area under study (Nairobi City) also lacks official statistics regarding prevalence, which hinders the estimation of the disease burden, particularly regarding speech production in children. Since 80% of children living with disabilities, including cerebral palsy, are in resource-poor settings such as the slums of Nairobi, the burden of disease related to the condition is likely higher in these areas, including significant challenges related to speech production (Mbugua, Kuria, & Ndeti, n.d.). In most cases, the assessment of prevalence and incidence rates in such resource-poor settings has remained a challenge over the years, resulting in insufficient statistics on the intensity of speech difficulties in children with cerebral palsy.

The research was guided by the myoelectric-aerodynamic theory of voice production. The theory states that vocal fold oscillation is determined and influenced by the interaction between aerodynamic stresses during breathing (Švec et al., 2021). The theory was proposed by Janwillem Van Den Berg, who explained that vocal fold oscillation is caused by the opening and closing of the portion of the glottal cycle. The glottal cycle is a process where air pressure is built beneath the vocal fold because lung compression primarily occurs during breathing. The building of pressure beneath the vocal folds results from the air that comes out of the lungs through the trachea and into the larynx, thereby making the vocal folds vibrate.

According to the myoelectric-aerodynamic theory, the interaction happens between muscle forces (MYO), elastic recoil forces (elastic), and aerodynamic forces (Švec et al., 2021). During the exhalation process, the vocal folds are in phonation positions, meaning that the Lateral cricoid arytenoids (LCA) and Interarytenoids (IA) put the vocal folds in a position to initiate a vibration cycle. The driving force behind the vibration is due to the force of inertia of the air that moves along the glottis, which can be enhanced or suppressed by supraglottal or subglottal vocal tract coupling (Herbst et al., 2023).

Most children with CP do not have a range of oscillation because their posture does not allow excellent breathing to facilitate voice production. Bad posture in children with CP decreases the oscillation ranges, putting pressure beneath the vocal folds and affecting speech production (Herbst et al., 2023). The myoelectric-aerodynamic theory of voice production can be applied to children with CP because their lack of proper posture affects their breathing system. When the breathing system was affected, voice production was affected because insufficient air passed through the glottis to facilitate voice production. This explains how postural issues in children with CP affect their respiratory system, influencing their speech production ability. The theory emphasizes the importance of breathing and the mechanical processes involved in voice production, providing a foundational understanding of how posture impacts speech in children with CP.

Statement of the Problem

Cerebral palsy, despite being a movement disorder, is directly related to articulation, phonation, and fluency disorders depending on a child's posture. Unlike other countries, such as the United States, where children affected by cerebral palsy have access to rehabilitation programs to help them cope with the challenges of their impairments, the Kenyan situation is characterized by exclusion, concealment, abandonment, as well as different forms of abuse.

However, it is important to know that few rehabilitation centers, mostly in Nairobi, offer services to these children.

Furthermore, surveys have also indicated that the cost of rehabilitation programs and services remains a significant barrier for the majority of parents and caregivers. For instance, parents may not be able to afford assistive devices such as wheelchairs for those who cannot walk and therapy services, especially those who come from low-income areas, including informal settlements.

Review of Related Literature

A research done by Boel et al. (2019) examined how lordosis posture in children with Cerebral Palsy affects the movement of lungs during inspiration and expiration and consequential effects on speech production. The study examined how postural abnormalities influenced lung movement during inspiration and expiration, ultimately affecting speech production. The research focused on children aged 5 to 12 years diagnosed with cerebral palsy. The study's sample size was 20 children using the cross-sectional study design. The research was comprised of 20 children (5-12 years old) with cerebral palsy, including physiological and acoustic measures. The research participants were asked to perform speech production tasks while their breathing patterns, posture, and speech production were recorded. Boel et al. (2019) showed that the lordosis posture in children with Cerebral Palsy affected the movement of the lungs during inspiration and expiration and consequently affected speech production. Furthermore, the authors showed that children with lordosis posture and Cerebral Palsy had shorter inspiratory and expiratory times, and the inspiratory and expiratory ratios were lower, leading to increased errors in the speech production task.

The research by Boel et al. (2019) provides valuable insights into how lordotic posture affects lung movement during breathing and its effect on speech production in children with cerebral palsy. However, their research was conducted in France, a high-resource setting, and focused on a relatively small sample of 20 children aged 5-12 years. While it highlighted the physiological and acoustic measures of speech production, the study does not consider children with cerebral palsy's unique challenges in low-resource environments, for example, those in Nairobi, Kenya.

Therefore, there is a need for more focused research targeting children aged 3-12 years in Nairobi, where access to rehabilitation services and healthcare resources may differ significantly. This research can introduce additional variables, such as socioeconomic factors, therapy availability, and environmental conditions that influence posture and speech. By examining the relationship between posture and speech production in this specific setting, the study can address the gap in understanding how these factors manifest and interact in low-resource regions. Moreover, it can provide culturally and contextually relevant findings informing interventions tailored to children with cerebral palsy in Nairobi rehabilitation centers.

Methodology

The study employed a cross-sectional design, commonly utilized in social sciences and public health research. This approach allows the researcher to capture a snapshot of the relationships between variables and their associated characteristics at a specific point in time. This approach comprehensively analyzes patterns and associations without tracking changes over an extended period. Unlike other designs, such as the experimental research design, where a researcher has an active role or intervention to create the required changes in the variables,

the choice of cross-sectional design helps the researcher to observe and make inferences based on the existing differences among the research subjects.

The selection of a research location determined the overall success of a proposed study as it enhanced the chances of accessing the research subjects. Hence, the data required to answer the research questions. When considering a potential location for a study, it was essential to identify the availability of resources, including time and financial obligation. Furthermore, it was also essential to consider the possibility and practicality of travel to access target research sites. As a result of these considerations, the researcher proposed to conduct the research study in various rehabilitation centers, a few selected hospitals, and cerebral palsy organizations in Nairobi City. Out of the 17 Sub-Counties in Nairobi City-County, the researcher proposed to sample at least one school serving learners with special needs from at least 10 Sub-Counties.

The 10 sub-counties comprised most of the total sub-counties and covered both resource-poor areas and those with advanced facilities for special needs learners. In addition to the schools, the researcher proposed collecting data from at least 10 sub-county hospitals in the 10 selected sub-counties. This selection of the sub-counties ensured that the researcher collected data from most areas of Nairobi City County, making it possible to replicate the findings in other parts of Nairobi. Even though special needs schools in other parts of the country and sub-county hospitals dealt with children with cerebral palsy, the researcher proposed limiting coverage to Nairobi City sub-counties due to logistical limitations on long-distance travel during the study. The number of children with cerebral palsy, special needs teachers, and other caregivers, for example, nurses, to be adopted as research subjects were expected to vary from one institution to another, depending on their capacity and availability.

The existing research was done in Nairobi City County, where 296 children with Cerebral Palsy (CP) were expected to have abnormal postures that affected their speech production. The study also used 2 speech therapists and 2 occupational therapists who helped those children with CP develop their speech within the special schools in Nairobi County. They were also chosen to take part in this research, bringing a total of 300 participants targeted for this study.

To ensure a representative sample of the target population was achieved, the researcher targeted children with cerebral palsy, including those in hard-to-reach areas within Nairobi City County. This was done to ensure these children detected no discrimination, which helped mitigate selection bias. The research utilized a purposive sampling to obtain the required sample from the 300 children brought in for treatment by the hospital's pediatrician, speech therapist, and other sources within Nairobi City, Kenya (Boel et al., 2019). This was achieved by first writing down the names of all children present in various hospitals and clinics due to Cerebral Palsy. The researcher then determined a sampling constant of 3 by dividing the population of 300 children by the sample size of 100. The researcher then randomly picked every child's name on the list until the researcher got 100 respondents for the sample size (Boel et al., 2019). The pediatrician and the 2 Speech Therapists representing most Nairobi Hospitals were selected purposively to help in sampling and to achieve the study objectives, which were some of the key players in the research.

The total sample size was comprised of 104 subjects, both males and females; 100 CP children were selected through random sampling, and 2 speech therapists and 2 occupational therapists were selected based on stratified sampling. This was approximately 35% of the registered members for this study. The sample was exemplary because it enabled the study to

gather the most relevant and sufficient details about the research (Bordoni & Varacallo, 2019).

Table 1: Summary of Sample Size for the Study

	Target population	Percentage (%)	Sampling Technique	Sample size
CP Children	296	35%	Purposive Sampling	100
Speech Therapists	2	100%	Stratified Sampling	2
Occupational Therapists	2	100%	Stratified Sampling	2
Total	300			104

Source: Field Data 2024.

The study utilized questionnaires and interview guides. Questionnaires were issued to the parents of children with cerebral palsy. Interview guides were administered to the speech and occupational therapists, respectively. The observation checklist was meant for learners with CP.

Since this study employed a cross-sectional research design, data collection was conducted through a semi-structured questionnaire. The questionnaire included open-ended questions to gather information on demographic characteristics, medical history, communication patterns, and postural stability (Denver et al., 2022). The instrument ensured that the researcher effectively gathered data from participants in a reliable, valid, and inexpensive manner. Furthermore, the researcher administered the questionnaire in various formats, including paper-and-pencil, online, and by telephone, to parents of children with CP.

The study utilized the interview guide instrument on Speech Therapists and pediatricians to obtain in-depth information concerning children diagnosed with Cerebral Palsy and having issues with speech production due to their abnormal posture.

This tool is designed to collect data on various aspects of a child's functioning, including posture and speech production. In relation to speech production, the checklist prompts observers to assess how a child's posture affects their ability to articulate sounds, control breath support, and maintain stability during communication attempts. The checklist included posture alignment during communication tasks, facial muscle engagement during speech, vocal quality, articulation clarity, and overall communication effectiveness.

Pre-testing research tools is essential. Piloting allows the researcher to determine whether the research instruments are effective. It also helps identify any ambiguities in locally developed questionnaires and reveals potential biases in the researcher's language. Pre-testing also makes it possible to determine if the chosen questions are understandable and in line with the study's goals. For the pilot study, which served as the study's main responder, the researcher used 10% of the total study population. Students from a variety of special schools in Nairobi City County made up the purposive sample size for the pilot research. The purpose of piloting was to explore the validity and dependability of the research tools.

Validity of the Study

While internal validity dealt with the extent to which the findings of a study deviated from established principles, external validity enhanced the generalizability of a study's findings and depended on internal validity. For example, the precision and consistency of the data gathered were critical to the validity of the proposed study's conclusions. To draw accurate

findings, it was crucial to make sure the data gathered were genuine and dependable (Steele et al., 2019). A careful assessment of the research techniques was required to guarantee the validity of this study.

In order to guarantee accuracy, dependability, and consistency in the results, this involved evaluating the sample strategies, data gathering tools, and data processing processes. More particularly, the researcher emphasized the external validity, owing to the need to adopt the recommendations regarding how posture could improve speech production among children living with cerebral palsy in Nairobi City County. The researcher, therefore, observed trends of consistency in both quantitative and qualitative data as recorded from one institution to another and established patterns of similarities and differences. These observations helped identify and isolate possible instances of bias and established remedial measures to remove the effects of bias during data gathering.

Reliability of the Study

The consistency of the respondents' questionnaire and interview guide was assessed using the test-retest method. To see if comparable replies would surface, the questionnaire was administered twice over the period of 12 days to the 5 sampled participants. To assess for reliability in the responses, the two results of each respondent were evaluated (Steele et al., 2019). The paramedic interview guide was also tested twice over two weeks with two paramedics. The respondents were utilized in the trial. The reliability of the two pairs of answers was then examined to confirm the reliability of the study.

Data Collection Procedures

The data gathering process for this study utilized both qualitative and quantitative methods. Semi-structured interviews were conducted with children with cerebral palsy (CP), their caregivers, and medical professionals to explore the relationship between abnormal posture and speech production. These qualitative interviews provided in-depth insights, while quantitative measures ensured a comprehensive analysis of the data (Steele et al., 2019). The research team quantitatively collected data through physical examinations of the children with CP. This involved measuring the posture of the children and observing their speech production. In addition, the team collected demographic data and medical records of the children with CP. This helped the researcher to understand the impact of abnormal posture on speech production. The research team used standardized methods and instruments to guarantee that the data gathered was precise and reliable (Steele et al., 2019). This involved the use of recognized posture and speech production assessments. The team also used validated methods to measure the demographic and medical data.

The researcher gave the research participants a thorough explanation of the study's goal and the length of the exercise before any data was collected. The study took about 20 to 25 minutes in every session. The participants were given enough time to adjust and ask questions before the exercise began. The participants, especially children with CP, were free to stop the exercise whenever they felt tired or unwilling to continue. The researcher was willing to reschedule the exercise or stop the process based on the participants' views. The participants received guarantees that any information they submitted would be kept private and used only for research. In order to ensure ethical compliance and participant safety, parents of children with cerebral palsy who voluntarily decided to participate in the study were asked to complete a permission form indicating their informed assent.

Data Analysis

The study employed a mixed-methods approach to analyze both quantitative and qualitative data. Quantitative data analysis was conducted using the latest version of SPSS, where descriptive statistics were utilized to summarize the data. Central tendency and dispersion measures were applied to provide insights into the distribution and variability of the gathered data (Tofani et al., 2020). The raw data entered in Excel was imported into the SPSS program for analysis. This involved establishing the mean, median, mode, and range to quantify the data. The codes were then entered into the computer and analyzed using the SPSS program. Descriptive statistics, including data frequencies and percentages, were obtained. For a clear visual aspect, the data was then displayed in tables, charts, and frequency distributions (Tofani et al., 2020). The researcher utilized content analysis to identify patterns, trends, and relationships from the data for qualitative data analysis. The researcher then analyzed data by looking for themes and categorizing the data based on the findings (Tofani et al., 2020). The researcher also utilized thematic analysis to identify and code the themes related to the research question.

Logistical and Ethical Considerations

All the operations and measures to guarantee the research's accomplishment were included in the research's logistics assessment.

Logistical Considerations

The data collection process commenced with the researcher obtaining formal authorization from relevant institutions. Approval was sought from Kenyatta University Graduate School, Kenyatta University Ethics Review Committee, the National Commission for Science, Technology, and Innovation (NACOSTI), the Nairobi County Commissioner, and the Nairobi County Director of Education. These approvals ensured compliance with ethical and regulatory requirements for conducting research.

Ethical Considerations

Participants were free to withdraw from the study at any time without facing any consequences, as their involvement was completely voluntary. Before data collection began, they were informed of their rights to ensure confidentiality and anonymity. To safeguard their privacy, personal identifiers were not included on any of the data collection instruments. The informed consent forms provided clear explanations of the study's objectives, potential risks, and benefits. All collected information was kept confidential and used solely for academic purposes to uphold the integrity of the research process. Participants were assured that their information would not be shared with unauthorized individuals. Additionally, all ethical protocols were followed, including approval from relevant ethics committees before data collection commenced. Upon completion of the study, data was securely stored and later disposed of in compliance with ethical research guidelines.

Findings and Discussions

Mechanisms Through Which Lordotic Posture Affects Speech Production

The table highlights the significant mechanisms through which lordotic posture impacts speech production, with findings indicating high frequencies and percentages for various factors.

Table 2: Mechanisms through Which Lordotic Posture Affects Speech Production

Mechanisms	Frequency	Percentage
Increased thoracic kyphosis	85	85%
Forward head position	83	83%
Reduction in intervertebral disc height	76	76%
Loss of bone mass	74	74%
Retraction of muscle chains	72	72%
Reduced elasticity and strength	65	65%
Cartilage ossification in the larynx	61	61%

Source: Field Data (2024)

The findings presented in table above revealed that a pronounced mechanism is increased thoracic kyphosis, reported by 85% of the cases, suggesting a strong correlation between poor spinal alignment and impaired respiratory function. This aligns with Boel et al. (2019), who demonstrated how lordotic posture affects lung movement, which is crucial for effective speech production. If the thoracic region is compromised, it becomes increasingly difficult for the lungs to expand fully during inspiration and to expel air effectively during expiration, thus disrupting the airflow integral to phonation.

Following closely, the forward head position, reported at 83%, exemplifies how alterations in cervical alignment parallel disruptions in breathing patterns. The extension of the neck in a forward position can shorten the cervical muscles and diminish their effectiveness, further impacting respiratory mechanics. This finding resonates with Boel et al. (2019), where children with Cerebral Palsy displayed abnormal breathing cycles attributable to inappropriate postural alignment. The dysregulation in head and neck positioning not only affects the physiologic processes involved in respiration but also places additional constraints on the articulatory function necessary for clear and fluent speech.

The reduction in intervertebral disc height (76%) and loss of bone mass (74%) also emerge as significant contributors to the overall mechanics of speech production impairment associated with lordotic posture. Research indicates that diminished disc height can lead to reduced spinal flexibility and stability, potentially limiting the range of motion necessary for optimal breath support during speech. Likewise, loss of bone mass can exacerbate postural challenges and further compromise respiratory capacity, reflecting the interconnectedness of structural integrity and functional outcomes. As Boel et al. (2019) noted, physiological impairments in lung movement can lead to shorter inspiratory and expiratory times, which changes in spinal health may exacerbate.

Moreover, the retraction of muscle chains (72%) and reduced elasticity and strength (65%) signal the implications of muscle functioning in maintaining proper posture. Muscles must work in coordination to facilitate effective breathing during speech, and any retraction may hinder their ability to engage fully. These muscular constraints may also contribute to the cartilage ossification observed in the larynx (61%) as the voice production mechanism becomes more rigid and less responsive due to poor postural alignment. The overall evidence suggests that the interplay between lordotic posture, respiratory mechanics, and speech production is complex, affecting the physical capability to speak and the acoustic characteristics of speech, as identified by Boel et al. (2019). The converse relationship between posture and speech underlines the need for comprehensive assessments in individuals with poor postural alignment, particularly in clinical populations like those with Cerebral Palsy, where such musculoskeletal factors can significantly impede effective communication.

Therapists identified that lordotic posture, characterized by an excessive inward curve of the spine, significantly impacts the alignment of the diaphragm and thoracic cavity. This misalignment disrupts the biomechanical relationships essential for efficient respiratory function. A study done by Casey (2022) noted that proper spine alignment is crucial for maximizing lung capacity and ensuring effective airflow during phonation. Restricted airflow, a direct consequence of lordotic posture, is critical for the production of sound; consequently, children with cerebral palsy (CP) presenting with this posture may struggle with tasks requiring sustained speech and appropriate articulation due to compromised respiratory support (Cantero et al., 2021).

A research study by Achmad and Ansar (2021) highlighted that children with CP often face additional challenges due to muscle tone abnormalities, further exacerbating the effects of lordosis on speech production. The misalignment extends to these children's respiratory systems and affects their ability to engage in effective articulation and phonatory control. Both speech and occupational therapists unanimously emphasized that interventions focusing on positioning devices and exercises targeting core muscle stabilization are critical for managing these issues. Such interventions aim to align the body properly and facilitate better respiratory function, which is fundamental for speech production.

During interviews, occupational and speech therapists were asked to share their thoughts on what options are available for patients with abnormal postures to speech among CP children, Occupational Therapist 1 had this to say.

Proper seating provides stability and support, allowing the child to focus on communication efforts without being hindered by discomfort or instability. (Occupational Therapist 1)

Occupational Therapist 2 said the following:

Using equipment like wedges or cushions helps improve head and neck alignment, which is crucial for clear speech. It is essential to collaborate with the speech therapy team to ensure that any positioning strategies we implement align with their goals for communication skills. (Occupational Therapist 2)

Speech Therapist 1 said as follows:

To improve speech in children with CP, augmentative and alternative communication (AAC) devices assist the children in expressing their thoughts and needs even if their verbal speech is affected. (Speech Therapist 1)

Speech Therapist 2 said as follows:

The oral-motor exercises help in strengthening the muscles involved in speech, even if the child's posture is not ideal. (Speech Therapist 2)

Further, the study used an observation checklist for learners with CP to establish whether they experienced difficulties in speech production. The results are displayed in Table below.

Table 3: Observation Checklist for Learners with CP

Statements	Frequency	Percentage
The learner exhibits exaggerated forward curvature of the lower back	42	42
Pelvic positioning affects the ability to maintain a neutral posture.	36	36
The learner's breath support is sufficient for sustained speech.	28	28
The learner's lordotic posture visibly influences the production of speech sounds	31	31
Adjusting posture improves speech clarity	29	29

Source: Field Data (2024)

The observation checklist in the table above highlighted critical aspects of postural challenges and their influence on speech abilities. First, the high frequency of learners exhibiting exaggerated forward curvature of the lower back (42%) indicates that postural misalignments, such as lordosis, are prevalent among learners with CP. Additionally, 36% of the learners demonstrated pelvic positioning issues, which affected their ability to maintain a neutral posture. The study also found that only 28% of learners had sufficient breath support for sustained speech, emphasizing the widespread respiratory challenges among this population. Notably, 31% of learners demonstrated visible influences of lordotic posture on speech production, while 29% showed improved speech clarity with postural adjustments. These findings align with previous studies that emphasize the impact of spinal misalignments on the ability to maintain optimal breath support for speech (Singh, 2021). A study by Mutai and Kimani (2023) in Kenya further supports this claim, noting that simple postural adjustments, combined with speech therapy, can significantly improve speech intelligibility in children with CP.

Correlation between the Abnormal Posture and Speech Production among Children Patients with CP

The relationship between abnormal posture and speech in children with Cerebral Palsy (CP) is a crucial area of research, as both factors significantly influence the overall development and quality of life of affected children. Understanding how these elements interact is essential for improving therapeutic strategies and support mechanisms tailored to their needs. In this section, the study examines several key aspects: the duration of suffering from Cerebral Palsy, the impact of abnormal posture on speech production, and the implications of these posture-related challenges on developing effective communication skills.

Duration of Suffering from Cerebral Palsy

The study explored the duration for which children have been diagnosed with Cerebral Palsy. The findings are displayed in the table below.

Table 4: Duration of Suffering from Cerebral Palsy

Duration	Frequency	Percentage
Less than 1 year	31	31%
2–5 years	45	45%
Over 5 years	24	24%
Total	100	100%

Source: Field Data (2024)

The findings indicate that 45% of children with cerebral palsy (CP) have experienced the condition for 2–5 years, while 31% have had it for less than a year and 24% for more than five years. The data suggests that many children with CP in Nairobi County receive early diagnoses and are monitored during their developmental years. Early identification is essential as it facilitates timely interventions to effectively address motor and speech impairments. These aspects of development are closely linked to postural stability, which plays a crucial role in a child's ability to communicate effectively (Mwangi *et al.*, 2021). Furthermore, research suggests that the severity of speech production difficulties is often correlated with the duration of the condition. As children with CP experience prolonged postural instability, their ability to engage in proper respiratory techniques and vocal control diminishes, exacerbating their speech challenges (Kimani *et al.*, 2022). These findings highlight the critical interplay between postural issues and speech production in children with CP. The longer the child endures the effects of Cerebral Palsy without appropriate intervention, the more entrenched these difficulties tend to become, leading to a challenging cycle that hinders both communication and social interaction skills.

Effect of Abnormal Posture on Speech Production

The study aimed to examine the effect of abnormal posture on speech production in children with cerebral palsy. The findings of this research are summarized and detailed in the table below.

Table 5: Effect of Abnormal Posture on Speech Production

Effect	Frequency	Percentage
No Effect	13	13%
Partially	29	29%
Severely	58	58%
Total	100	100%

Source: Field Data (2024)

The table above shows that a significant majority of children with cerebral palsy (CP) in Nairobi County experience speech production challenges due to abnormal posture. Specifically, 58% of respondents indicated that abnormal posture severely affects their child's speech production, 29% noted a partial effect, while only 13% reported no effect. These findings are consistent with research emphasizing the interdependence between posture and speech in CP patients. Proper posture facilitates adequate breath support and stability required for articulate speech. Conversely, abnormal posture can lead to respiratory inefficiency and impaired articulation, as observed in this study (Ngugi & Wanjiru, 2020). Severe postural

abnormalities often result in compounded difficulties, underlining the need for integrative therapies targeting both motor and speech functions.

Speech Intelligibility

The parents were asked to provide information regarding their child's speech patterns when they attempted to communicate with various individuals. The table below presents the findings of this inquiry.

Table 6: Results on Speech Intelligibility

Speech Intelligibility	Frequency	Percentage
Intelligible	4	4%
Partially Intelligible	19	19%
Very Unintelligible	77	77%
Total	100	100%

Source: Field Data (2024)

The results presented in the above table revealed that most children with cerebral palsy (CP) experience significant difficulties in speech intelligibility. A striking 77% of respondents indicated that their child's speech was unintelligible, while 19% described it as partially intelligible. Only 4% of children were reported to have intelligible speech. Speech intelligibility relies on effective coordination of the respiratory, phonatory, and articulatory systems, all of which are influenced by posture. Poor postural alignment, such as slouching or inability to hold the head upright, disrupts breath support and muscle coordination, leading to impaired speech production. According to Mwangi and Kariuki (2021), children with severe postural abnormalities often experience restricted airflow and reduced vocalization control, directly affecting their speech intelligibility. This explains why most children in the study are categorized as having very unintelligible speech.

The 19% of children with partially intelligible speech may represent those with milder forms of CP or those receiving interventions to manage postural and motor impairments. Interventions such as speech therapy and postural correction have enhanced articulation and somewhat improved intelligibility (Jones & Martin, 2021). However, partial intelligibility still poses barriers to effective communication, particularly in complex social contexts. Only 4% of children were reported to have intelligible speech. These cases could be attributed to early diagnosis, consistent therapeutic interventions, or less severe motor impairments. Studies have demonstrated that children with better motor control and postural stability achieve greater success in speech clarity (Jones & Martin, 2021). Intelligible speech in these children is often accompanied by enhanced participation in social and educational activities, highlighting the value of early intervention.

Summary of Study Findings

The study revealed that lordotic posture, characterized by an excessive inward curve of the spine, negatively influences speech production. This misalignment disrupts the positioning of the diaphragm and thoracic cavity, compromising respiratory function. This restriction in breath support is crucial for voice production, as it affects loudness and clarity. Additionally, the associated muscular imbalances arising from this posture lead to fatigue and discomfort, further complicating the articulation and intelligibility of speech. As a result, children with CP exhibiting lordotic posture experience restricted airflow, which is critical for sound

production. Consequently, these children face challenges sustaining speech and articulating words effectively, underscoring the importance of proper postural alignment in facilitating optimal respiratory support for speech.

The findings revealed that sway back posture was identified as a major contributor to poor breath control and muscle coordination during speech. This misalignment affects the ability to produce adequate airflow, resulting in slurred or strained articulation. Many children with this posture struggle to generate the required respiratory support for effective speech production. The findings emphasized that individuals experienced chronic discomfort or pain, diverting their attention and energy away from effective communication. The compounded effect of reduced lung capacity and impaired alignment contributes to difficulties in articulating sounds clearly, ultimately making it challenging to achieve intelligibility in speech.

Conclusion

The study concluded that posture significantly influences speech production in children with cerebral palsy (CP) in Nairobi County, Kenya. Specifically, lordotic posture was identified as having a negative impact on speech production, affecting vocal quality, breath control, and articulation. The excessive inward curve of the spine disrupts the proper alignment of the diaphragm and thoracic cavity, ultimately hindering respiratory function. The restricted airflow further complicates phonation, leading to diminished speech quality and clarity, particularly in children who rely on optimal respiratory support for effective communication.

Recommendation

The government should develop and implement inclusive policies focused on early intervention services for children with disabilities, specifically targeting posture correction and speech therapy to enhance communication outcomes for children with CP. The government should initiate nationwide awareness campaigns to educate the public about cerebral palsy, its effects on posture and speech, and the importance of early diagnosis and intervention. This would encourage families to seek medical advice and support early on. Also, the government should ensure that resources, such as therapy tools and educational materials, are readily available and accessible to families of children with CP. This accessibility will enhance therapeutic practices at home and in educational settings.

Conflict of interest statement

The authors of this paper have conflict of interest related to its content and publication.

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Citation: Ochieng, H. O & Ogogo, J. A. (2025). Mechanisms Through Which Lordotic Posture Affects Learners With Cerebral Palsy's Speech Production Ability in Nairobi City County, Kenya. *Journal of Popular Education in Africa*, 9(3), 5 – 21.

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