



Research Article

A Comparative Assessment of Adaptive Behaviour and Development in Pre-School Aged Children with Cerebral Palsy and their Normal Counterparts

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ABSTRACT

Background: Adaptive Behaviour, an aggregation of conceptual, social and practical skills learned, allows a person function effectively every day at home, school, work, and the community. Adaptation is influenced by age, culture and environmental events, leading to maladaptation. Cerebral palsy impairs motor activity with attendant cognitive, sensory, and behaviour comorbidities. This article assesses adaptive behaviour and development in pre-school age children with cerebral palsy and their normal age and sex-matched peers.

Methods: Fifty consecutive pre-school age children attending the paediatric neurology clinic and diagnosed with cerebral palsy, and 50 age and sex-matched normal peers were evaluated using the ABAS-II and DPDPQ test scales, to determine their level of adaptive behaviour and developmental capacities. The means of test results of both populations were compared and tested for significance using the t-test statistic, and a p-value of <0.05 was considered as significant.

Results: There were 56 males and 44 females with a mean chronologic age of 30.16 months (SD $\pm$ 14.56). This mean was comparable in both groups. Mean developmental age (16.14 months $\pm$ 9.18) was much less than chronological age (30.44 $\pm$ 14.76 months) in children with cerebral palsy; but similar in controls (30.06 $\pm$ 14.62 months vs 30.44 $\pm$ 14.77 months). The mean general adaptive composite score was lower in children with cerebral palsy (26.94 $\pm$ 12.26) compared to controls (57.24 $\pm$ 16.54). This was also noticed with the mean conceptual, social and practical domain scores. The mean DPDPQ score was also significantly lower in children with cerebral palsy (16.14 $\pm$ 9.18). Mean general adaptive composite score was higher in male children with cerebral palsy (30.32 $\pm$ 15.25) than females (23.56 $\pm$ 7.11) but this was not significant.

Conclusion: Children with cerebral palsy often have impaired adaptive behavioural function and developmental capacity relative to their age and sex-matched pairs. This is due to the effect of the condition on the child's adaptive and cognitive capacity to respond to external stimuli. Pre-emptive awareness and administration of enriching educational and supportive social programmes will help mitigate the potential negative impact of this condition in children with cerebral palsy.

INTRODUCTION

Cerebral Palsy (CP) refers to a heterogeneous group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to nonprogressive disturbances that occurred in the developing foetal or infant brain.[1] The primary motor abnormalities seen in cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, behaviour, epilepsy, and secondary musculoskeletal problems.[2] These disturbances are often referred to as comorbidities.[3]

Cognitive impairment has a high frequency of occurrence in CP and can be as high as 50%.[4] Its incidence is however difficult to measure accurately[5] as limitations of physical and communication capacities in children with CP would likely lower scores obtained on an intelligence

quotient test, if correctly modified versions were not administered in this population. Psychometric tests needed for their assessment often consume time, require experience, repetition and use of the combination of methods which aggregate results of tests acquired from criterion, norm and observation-referenced tests.[6] Having simple, reliable, easily administered and time-saving psychometric tests with very good psychometric properties for use in the measurement of adaptive behaviour and cognition in children with CP, will be of great value in daily clinical management. This will aid in early recognition, evaluation, quick and successful management of those who develop maladaptation of adaptive functions and impaired cognitive skills.

The Adaptive Behaviour Assessment Scale-II (ABAS-II) is a norm-referenced rating scale that measures adaptive behaviour and skills displayed from birth to the age of 89

years.[7] It evaluates personal and social skills used for everyday living. It assists professionals with the diagnosis of various disabilities such as behaviour disorders, developmental delay, emotional disorders, cognitive and learning disabilities, physical and sensory impairments and neurological disorders.[7] It also helps to identify strengths and weaknesses, and with planning and evaluation of interventions. The ABAS-II Parent/Primary Caregiver Form is used for evaluating children aged 0-5years (the preschool population) and consists of two hundred and forty-one items. It assesses ten specific adaptive skill areas broadly categorized into three adaptive domain composites; the Conceptual, Social and Practical domains. The adaptive skill areas and domains measured are based on the conceptual foundation of adaptive behaviour defined by the American Association on Mental Retardation.[8] It provides a general score – the General Adaptive Composite – that summarizes performance across all adaptive skill areas, and scores for each of its three adaptive domain composites. Omafufu[9] produced a representative sample of items from a total of two hundred and forty-one, to assess the adaptive skills of children of different population groups, and she compared them with normal controls. This shortened assessment tool is much easier to use, consumes less time, and its results are comparable to that of the full complement of two hundred and forty-one.[9]

The Denver Pre-screening Developmental Questionnaire (DPDQ) has been successfully adapted for use as a psychological screening tool to assess developmental capacity of pre-school aged Nigerian children.[10] It is a modification of the Denver Developmental Screening Test (DDST) which is used for developmental assessment and determination of cognitive ability in children. Its use allows for early detection of developmental delay, proper identification of children at risk, retarded children, and instituting prompt intervention for those with developmental retardation, as well as future prevention of such retardation.[10]

Statement of the problem

Children with Cerebral palsy primarily have impairment of motor function and posture. This results in the incidence of varying degrees of motor disability and maladaptation to stimuli in the environment, and it negatively affects the child's ability to function in everyday life. Often, cognition, behaviour, social capacity, sensory and perceptual functions are affected, and tend to worsen the child's capacity to adapt to his environment. Assessing and determining the presence and degree of impairment of adaptive and cognitive function (using the ABAS-II and DPDQ) in children with cerebral palsy will help quantify the degree of intervention and support needed to manage the condition in the community.

Significance of the study

This study will help establish the impact of cerebral palsy on the degree of adaptability to the environment and cognitive development of children with the disease relative to their age and sex-matched peers. Information obtained will help with planning for their needs, and provide support systems for their care. Early identification of the challenges of the individual child with CP becomes possible, with

judicious application of community and health resources directed at their care. This will enable the child to attain his maximum potential.

Objectives of the study

The study sought to determine the degree of adaptive behaviour function and cognitive development of pre-school aged children with Cerebral palsy relative to their age and sex-matched counterparts in the community. It also sought to compare competence levels in the specific domain composites of adaptive behaviour in these children, and also to compare the competence levels of adaptive behaviour function between the sexes in children with Cerebral palsy.

Research Questions

1. Impairment of development and cognition occur often as co-morbid conditions in children with cerebral palsy. Attempts are made to adapt to the environment with whatever capacities are left. How much – if any – behavioural adaptation, and what degree of development occurs in children with cerebral palsy relative to their unaffected peers?
2. In the specific domain composites of adaptive behaviour, how do children with cerebral palsy fare relative to their normal peers?
3. Does the sex of a child have a role to play in his attempt to mount an adaptive response to his environment?

Research Hypotheses

This study was conducted using the following hypotheses:

- i. Adaptive behaviour function and DPDQ scores will be higher in normal children than those with Cerebral palsy.
- ii. Adaptive behaviour function scores will be higher in normal children than those with Cerebral palsy when assessed with the specific domain composite measures.
- iii. Total adaptive composite scores will be higher in male children with Cerebral palsy than females.

METHODOLOGY

The study was conducted over a four-month period, and the study population consisted of pre-school age children diagnosed with cerebral palsy at the paediatric neurology clinic of the Department of Paediatrics, Lagos State University Teaching Hospital, Ikeja. This facility caters for children aged less than 12 years, referred from private and government medical facilities in the state and its environs for expert neurologic care. Controls were age and sex-matched normal children attending the child welfare/immunization clinic of the hospital. These children were attending the hospital for routine immunization and child welfare services, and suffered no neurologic, developmental or chronic medical conditions.

Research design

A cross-sectional design study was utilized. It consisted of fifty (50) consecutive cases of pre-school age children diagnosed with Cerebral palsy. Controls consisted of fifty (50) consecutive age and sex-matched normal healthy children attending the child welfare/immunization clinic at LASUTH.

Study Participants

Two categories of pre-school aged children were used in this study:

- a. Children diagnosed with Cerebral palsy at the pediatric neurology clinic in LASUTH (Lagos State University Teaching Hospital), Ikeja.
- b. Age and sex-matched normal healthy children attending the child welfare/immunization clinic in LASUTH. These served as the controls.

Study Instruments

Adaptive behaviour can be measured using existing assessment scales such as the Adaptive Behaviour Assessment Scales (ABAS-I, ABAS-II), Vineland Social Maturity Scale (VSMS), the Developmental Profile-II (DP-II), Early Coping Inventory (ECI), and Bayley Scales of Infant Development (BSID) among others.[7,11] The modified ABAS-II is normed in Nigerian children, easy to administer, time-saving, and has very good psychometric properties.[9] The present study made use of the modified ABAS-II scale to measure adaptive behaviour function in this study population. The DPDQ,[10] also normed in Nigerian children, and with good psychometric properties, was used to assess developmental capacity in this study population.

Instruments used for this study included:

- Modified ABAS-II (Adaptive Behaviour and Assessment Scale – 2nd Revised Edition)
- DPDQ (Denver Pre-screening Developmental Questionnaire)
- Questionnaire designed to obtain demographic and clinical information from the study and control populations.

All test instruments were in the questionnaire format.

Procedure

At the paediatric neurology clinic, pre-school age (aged less than five years) children were screened for clinical features suggestive of cerebral palsy by the paediatric resident. All children with features such as prolonged labour, perinatal asphyxia at birth, delayed cry at birth, delayed developmental milestones, hypertonia, hyperreflexia, persistent primitive reflexes and irritability, were then referred to the paediatric neurologist who reviewed the findings and conducted a detailed systemic and neurologic examination on all such children. Following confirmation of the diagnosis of cerebral palsy, fifty consecutive children whose parents/caregivers - following a detailed explanation on the purpose and details of the study - consented to participation, were recruited. Children not determined to have cerebral palsy were excluded from the study. The ABAS-II and DPDQ test questionnaires were subsequently administered on the parents/caregivers. These interviews were conducted in English, Pidgin, Yoruba or Hausa as dictated by parental preferences to fill in the test questionnaires. Effort was made to ensure adequate parental understanding of instructions of the test instruments, with demonstrations given of required acts when necessary.

Demographic data was obtained from the children's records and documented in a proforma designed for the study. This proforma also contained the ABAS-II test questionnaire and was administered to the mother/caregiver of each child during the study assessment period. Parental/caregiver

responses to the questions were documented in the requisite proforma.

The DPDQ questionnaire made up of an age-appropriate checklist, was administered on each study participant through the mother/caregiver, and the child's observed performance/caregiver response was documented on the proforma used for the child. With the DPDQ, a parent/caregiver was expected to respond to a minimum of ten questions or stop responding when the child could no longer perform the task required after three consecutive attempts.

These two procedures (the response to the ABAS-II and the DPDQ questionnaires) were repeated on 50 consecutive age and sex-matched normal healthy pre-school aged children attending the child welfare/immunization clinic at LASUTH. These children had no developmental, neurological or chronic medical conditions, and were attending the hospital for child welfare and immunization services. They served as controls for the study. Ethical approval for the study was obtained from the health research and ethics committee of the hospital.

Scoring and data analysis

Data obtained were collated, processed and analysed using the statistical package for social sciences version 14 (SPSS 14) software. Scoring of the ABAS-II and DPDQ test instruments followed requisite guidelines for the individual tests before statistical analysis was done. The means of the ABAS-II and DPDQ scores for the study and control populations were compared and tested for significant differences using the t-test statistic. A p-value of <0.05 was considered significant following analysis of data.

RESULTS

The study population consisted of 100 pre-school age children made up of 50 each of age and sex-matched cases with cerebral palsy and normal healthy controls. There were 56 males (56%) and 44 females (44%) with a mean chronologic age of 30.16 months (SD $\pm$ 14.56).

Mean developmental age (16.14 $\pm$ 9.18 months) was much less than chronologic age (30.44 $\pm$ 14.76 months) in children with cerebral palsy; it was however similar in controls (30.06 $\pm$ 14.62 months vs 30.44 $\pm$ 14.77 months). Table 1 shows the mean chronologic and developmental ages for the study population.

The mean general adaptive composite score was different in children with cerebral palsy (26.94 $\pm$ 12.26) when compared to controls (57.24 $\pm$ 16.54). The score was significantly higher in controls ($p < 0.01$). A breakdown to the specific domain composites also mirrored this pattern. Mean conceptual domain score was significantly less in the study population than controls ($t = 9.82$; $p < 0.01$). This pattern was repeated with the social ($t = 7.07$; $p < 0.01$) and practical domain composite scores ($t = 10.34$; $p > 0.01$). Table 2 shows the mean adaptive behaviour and specific domain composite scores.

The mean DPDQ score of children with cerebral palsy (16.14 $\pm$ 9.18) was significantly lower than in controls (30.44 $\pm$ 14.76; $t = 10.41$; $p < 0.01$). This is shown in table 3. The mean general adaptive composite score was higher in male children with cerebral palsy (30.32 $\pm$ 15.25) when compared with females (23.56 $\pm$ 7.11). This was however not significant ($t = 2.00$; $p = 0.05$). This is shown in table 4.

Mean chronological age of subjects (30.26 ± 14.65 months) was comparable to that of controls (30.06 ± 14.62 months) suggesting good age and sex-matching. The mean developmental age in children with cerebral palsy (16.14 ± 9.18 months) was however significantly much lower than in controls (30.44 ± 14.77 months; $t=5.82$; $p<0.01$).

Table 1: Mean Chronological and Developmental ages of the study population

Group		Chronologic Age (months)	Developmental Age (months)
Cerebral Palsy Cases	Mean	30.2600	16.1400
	Study Population	50	50
	Std Deviation	14.6535	9.1807
Controls	Mean	30.0600	30.4400
	Study Population	50	50
	Std Deviation	14.6223	14.7664
Total	Mean	30.1600	23.2900
	Total Study Number	100	100
	Std Deviation	14.5641	14.1872

Table 2: Mean Adaptive Behaviour Assessment Scores of the study population

Adaptive Behavior scores	Group	N	Mean score	t-value	p-value
Conceptual domain	Cerebral palsy cases	50	8.80	9.82	<0.01
	Controls	50	18.98		
Social domain	Cerebral palsy cases	50	5.42	7.07	<0.01
	Controls	50	10.36		
Practical domain	Cerebral palsy cases	50	12.72	10.34	<0.01
	Controls	50	27.92		
General Adaptive Composite	Cerebral palsy cases	50	26.94	10.41	<0.01
	Controls	50	57.24		

Table 3: Mean DPDQ Scores of children with Cerebral Palsy compared with Controls

Group	N	Mean	t-score	p-value
Cerebral Palsy Cases	50	16.14	10.41	<0.01
Controls	50	30.44		

Table 4: Differences in the chronologic and developmental ages of Cerebral Palsy (CP) Cases and Controls

	Group	No	Mean	t-value	p-value
Chronological Age	CP Cases	50	30.26	0.07	0.95
	Controls	50	30.06		
Developmental Age	CP Cases	50	16.14	5.82	<0.01
	Controls	50	30.44		

DISCUSSION

Children as they grow, acquire cognitive, social, language and motor skills appropriate to their ages.[7] They use these acquired skills to respond to stimuli in their environment and adapt as appropriate.[7] The outcome of this response is the adaptive behaviour noticed in the individual child.

Cerebral palsy primarily affects and impairs motor function and posture.[1-5,12] This disrupts gross and fine motor abilities to degrees of severity determined by the extent of injury in the index child. It affects motor functions of daily living such as movement, manipulation of objects, toys, feeding materials and locomotion. This translates to a low score in motor adaptive function in the ABAS-II scale and the general adaptive composite (GAC) scores.[7] This study population with cerebral palsy reflected this fact in the poor scores recorded on individual score items of motor function relative to the healthy normal controls.

Cerebral palsy is primarily a disease of children of pre-school age.[12] This study showed that ABAS-II scores were higher with increase in age and normal growth and development indices in the study population. These scores were negatively affected to varying degrees in children with cerebral palsy relative to controls. A similar trend was noticed with the Denver Pre-screening Developmental Quotient scores which measured developmental quotient/cognitive capacity in the study population. Cognitive impairment is expected to negatively affect score values in the study population with cerebral palsy. This explains why DPDQ score performance was significantly lower in the study population relative to controls.

ABAS-II scores were higher in normal healthy controls in this study relative to that of children with cerebral palsy. This was found to be statistically significant. General adaptive composite (GAC) scores of controls were also higher than for children with cerebral palsy. The GAC score is a measure of the performance of a child in all adaptive skill areas.[7] It sums up his individual functional skills. It summarises the global adaptability of a child to his environment and it is expected to be high in a child who has adapted well. It is expected to be lower in a child with impaired adaptation from whatever cause, such as seen in the study population with cerebral palsy relative to normal controls.

Development is the aggregate acquisition of new capacities in a child that enables him appropriately respond to stimuli in his environment.[13,14] It results from a child's ability to receive external stimuli, process, comprehend and respond to the same, and gain new and further mastery of his abilities and his environment.[14] It is expected to correlate with chronologic age. Piaget's cognitive development theory maintains that children are active participants in their cognitive development.[15] They are believed to discover and construct knowledge through activities they engage in (i.e through their interaction with the environment). Piaget argued that knowledge is acquired through the use of basic structures (schemas) to identify and interpret objects, events, and other information in the environment.[15] Using this construct for adaptive behaviour, a child adapts to his environment through experience gathered, and interpretation of such as being positive or negative; he thus responds appropriately. He responds to new objects, events and

experiences, by attempting to fit them into the existing schema through assimilation, in order to build lasting adaptive traits. Failure results in a maladaptation of response. This manifests with accommodating the new experience, or creating a new one. These two processes enable for the child to form, differentiate and broaden his adaptive response.[15] CP affects and impairs the normal process as cognitive capacities are often impaired. This was reflected in this study with the significant reduction seen in the mean developmental age relative to chronological age of children with cerebral palsy relative to the control population. Cognitive and learning impairment have been reported in as much as 50% of children with cerebral palsy.[1-5,8] Motor and other deficits seen in CP impair an effective assessment of severity. Limitations of physical and communication capacities in children with CP would likely lower scores obtained on an intelligence quotient test.[5]

The presence of a low DPDQ score implies delayed development which suggests impaired intellectual function.[11] Early and periodic developmental screening of children permits the detection of developmental delays in infancy and the pre-school years. Functional academic and pre-academic adaptive skills are affected by poor cognitive ability. The effect of this is noticed in definite performance areas such as reading, writing, math, and other areas needed for daily independent functioning.[8] Poor intellectual capacity also affects self-direction such as following instructions, keeping schedules, completing tasks and other activities related to responsibility and self-control.[8]

Often, children with intellectual deficits have been found to have a delay in speech and language acquisition and utilisation.[5] Deficits in these adaptive skills will also affect the final GAC scores. The performance of children with cerebral palsy in this study was found to be low in these adaptive skills, thus affecting the GAC scores.

The conceptual scores of the study population were significantly lower when compared to the normal pre-school population used as controls. The Conceptual domain is one of the three adaptive domains measured in adaptive behaviour assessment.[8] It comprises such adaptive skills as communication adaptive skill, functional academics/pre-academics and self-direction adaptive skill areas. These adaptive skills measure the ability of a child to speak, listen, engage in conversation, respond, read, write, engage in daily independent functioning, complete tasks, keep schedules, and engage in self-control amongst others. Poor performance in the conceptual domain scores will affect a child's performance in these adaptive skills to varying degrees and also result in a low GAC score. This finding was noted in this study. Cerebral palsy affects motor capabilities and other conceptual domain skills. It also affects cognitive abilities to varying degrees, from mild to severe. Individual children are sometimes spared this disability. As a population, this study shows that mean intellectual capacity in CP is significantly less than is seen in normal unaffected controls. This finding highlights the need for caregivers of children with cerebral palsy to recognise the potential incidence of this limitation and plan proactively for care. This deficit has a consequential effect on the GAC scores which are found to be lower in children with CP when compared to the normal controls.

The social domain score in children with CP were significantly lower than controls in this study. The social

domain evaluates a child's ability to participate in play and recreation activities, follow game rules, plan leisure and other fun activities, engage in social interactions, get along with others, and make friends and display manners and emotions.[8] The inability of a child to partake in the above will greatly limit his social relationship with his environment. A review of the component factors making up the social domain showed a great limitation in their ability to involve in and express themselves in the social elements of adaptation to life and daily living. Children with cerebral palsy often get limited in social interaction by their condition, and some often have problems relating to the display of emotions and participation in play and recreation.[16]

Children with cerebral palsy performed very poorly in their practical domain score. Practical domain adaptive skills include use of community/home resources, shopping, ability to move about in the home or community, caring for the home environment, care of personal and home possessions, protection of one's health, the use of medicines and the demonstration of caution amongst others.[8] A child, who can successfully tackle these functional skills, will be able to successfully meet the practical requirements needed to adapt to his environment. This was possible in normal controls that performed well in the practical domain scores in this study. The inability to engage in self-care, mobility, care of the environment and tackle functional skills, result in poor performance in the practical domain of adaptive skills in the ABAS-II. Practical domain performance is thus lower than is found in normal controls.

Cerebral palsy is commoner in males than females[17] and the results of research vary as to the reason for this. Intrinsic differences in cell death pathways are thought to cause sex differences in the fetal or neonatal period. This indicates that there are important neurobiological differences between males and females with respect to their response to brain injuries. Scoring on ABAS-II and DPDQ was equitably poor in male and female children with cerebral palsy in this study ($p=0.05$) and sex showed no differential effect on the outcome.[17] The mean general adaptive composite score was in fact higher in the male children with cerebral palsy in this study compared to the females, though the difference was not significant. This finding suggests that sex bears no relevance to disease outcome and severity, and its consequent effect on adaptive behaviour.

In conclusion, this study demonstrated the negative effect of cerebral palsy on the capacity for adaptive behaviour and cognitive/developmental responses in children relative to their age and sex-matched peers, and it highlights the need for pre-emptory planning and provision of educational, social and community support in the care of children with this disorder.

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