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DETERMINANTS OF THE RELATIONSHIP BETWEEN GROSS MOTOR FUNCTIONAND INDEPENDENT ACTIVITIES OF DAILY LIVING PERFORMANCE IN CHILDREN WITH CEREBRAL PALSY

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ABSTRACT: *Cerebral palsy (CP) is a major cause of dependency in activity of daily living (ADL) in children. Effort at improving their functional performances has being the target of rehabilitation but the determinants remain elusive. This study determined the pattern of motor function and ADL performances in children with CP. It also investigated the relationship between motor function and ADL living performance and their determinants in the children.This cross-sectional analytical survey involved 104 children with CP in various hospitals in Lagos state. Their motor function was assessed using Gross Motor Function Measure-66 (GMFM-66) and ADL was assessed using Pediatric Evaluation of Disability Inventory- Computer Adaptive Test (PEDI-CAT).Thirteen (12.5%) were on level II level (limitations of walking long distances and balancing) of the GMFM-66, 14.4% in level III (uses hand-held mobility device), 21.2% in level IV (requires manual/powered mobility device) and 51.9% in level V (severe limitations in head and trunk control and requires extensive assistive device). The GMFM-66 score was explained by 56.3%, 62.8%, 49.1% and 32.0% of the variance of PEDI-CAT daily activity, mobility, social/cognitive and responsibility domain-scores respectively. There is strong relationship ($p<0.01$) between mobility domain-score and ADL performance, and weak relationship ($p=0.033$) between social/cognitive domain-score and ADL performance. Most children with cerebral palsy are highly dependent in activity of daily living are requires aids for functional performances. Independent daily activity living in children with cerebral palsy is relationship to their mobility performances and social/cognitive function.*

KEY WORDS: Cerebral palsy, functional independent performance, motor function

INTRODUCTION

Cerebral palsy (CP) is a significant cause of childhood physical disability (Eseigbe *et al*, 2014) involving non-progressive damage to a developing brain (Van der Slot *et al*, 2012). Varieties of occurrences at different times either in-utero, at birth or in early childhood result in cerebral palsy

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(Rosenbaum, 2003; Koman *et al*, 2004; Morris, 2007; Jr *et al*, 2013). Although the brain lesion in itself is static, these are changing disorders of motor function (Rosenbaum, 2003). These disorders result from injury to the brain during its development. As a result, neural connections are disrupted during their development and therefore contribute to impaired motor strength, motor function and coordination (Aisen *et al*, 2011). Thus, consequent body dysfunctions vary between individuals (Bottos *et al*, 2001; Engel *et al*, 2002). Cerebral palsy is not considered a simple single disease entity, but as a group of disorders (Damiano *et al*, 2009). Therefore, cerebral palsy describes a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain (Rosenbaum *et al*, 2007).

Studies between 1982 and 2012 have reported CP as the most common condition managed at neuro-pediatric clinics in various parts of Nigeria (Duggan and Ogala, 1982; Obi and Sykes, 1984; Asindi, 1986; Sathiakumar and yakubu, 1987; Izuora and Iloeje, 1989; Wammanda *et al,* 2007; Ogunlesi *et al,* 2008; Peters *et al,* 2008; Adelugba *et al,* 2011; Omole *et al,* 2013). This condition requires specialized care from both the health professionals and informal caregivers of the children involved in order to help them achieve functional abilities necessary for everyday life (Fatudimu, 2012).

Activities of daily living (ADLs) are tasks that are fundamental to supporting participation across school, home and community environments and these activities are undertaken routinely in everyday life, and they include personal care, functional mobility, and social tasks (Fricke, 2010). Activities of daily livings are conceptualized in the 'Activities and Participation' domain of the International Classification of Functioning, Disability and Health (ICF) and defined as life tasks required for self-care and self-maintenance such as grooming, bathing, eating, and doing chores (Christiansen and Baum, 1991). These tasks are classified as either personal ADLs tasks, which are oriented towards self-care (e.g. grooming, bathing) or instrumental ADLs tasks, which are oriented towards sustaining independence and require a higher level of physical and cognitive competency than personal ADLs (e.g. preparing meals, taking care of pets) (Law *et al*, 1996). Personal ADLs are more commonly performed by younger children, while adolescents also engage in an increasing number of instrumental ADLs tasks (James *et al*, 2014).

Gross motor and associated difficulties in children with CP often fall below the typical developmental trajectory (James *et al,* 2014). These children are also likely to experience difficulty with ADLs and their performance of these tasks is a high priority for parents (Cusick *et al,* 2006). It is necessary, therefore, for physiotherapists to assess ADLs based on outcome measures, to facilitate intervention planning and document outcomes (James *et al,* 2014). Outcome measures that are validated for children with CP should be used because the movement disorders and the disturbances of sensation, perception, cognition and communication which are associated with CP

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(Rosenbaum *et al,* 2007) will influence ADLs performance. In addition, the nature of the predominant movement disorder of CP (e.g spasticity) will affect children's independent ADLs performance differently compared with other developmental disabilities such as autism or Down syndrome (James *et al,* 2014).

Activity of daily living can be measured by assessing an individual's performance, capacity or capability. Performance describes what a person actually performs in his or her daily environment, capacity describes what a person can do in a standardized, controlled environment, and capability describes what an individual can do in his or her daily environment (Holsbeeke *et al,* 2009). Measures of performance are the most relevant for children as they capture everyday typical function (Young *et al*, 1996). In typically developing children, Gross Motor Function and ADLs ability is well established by the age of 5 years (Gallahue, 2006). In children with CP, there is delay in establishing this ability, even in children over 5 years of age with the best functional characteristics (Smits *et al*, 2010). Gross Motor Function is also an important basis for performance of independent activities of daily living (Smits *et al*, 2010).

Independent activities of daily living performance of children with CP are influenced by the impairments or limitations in the domains of ICF (World Health Organization, 2001). Nevertheless, the concept of activity reflects a child's capacity for doing daily activities, and participation indicates a child's actual performance in his or her activity of daily living (Ostensjo *et al*, 2006). However, a child's capacity is not always equal to his or her performance in the real world (Young *et al*, 1996). Therefore, both capacity and performance should be taken into account when assessing a child's independent activity of daily living (Tseng *et al,* 2011). The aim of this study was therefore to determine the relationship between Gross Motor Function and Independent Activity of Daily Living Performance domains (Daily Activity, Mobility, Social/Cognitive and Responsibility) in children with cerebral palsy.

Cerebral palsy (CP) is characterized by motor impairment and can present with global, physical and mental dysfunction (Krigger, 2006), with motor disability related to sitting, standing, walking and running appears as the main symptom in children with CP (Kwon *et al*, 2013). Assessment and treatment of CP have focused on Gross Motor Function (Kwon *et al*, 2013) with less attention and limited knowledge on the interplay among other contributing factors to this motor impairment.

Previous studies from Nigeria (Hamzat and Fatundimu, 2008; Tella *et al*, 2011; Eseigbe *et al*, 2012; Eseigbe *et al,* 2014) where gross motor function ability in children with CP was assessed in terms of severity using the Gross Motor Function Classification System (GMFCS). The GMFCS does not relate to the gross and skill performances in this population of children (Kwon *et al*, 2013). Although a previous study (Kwon *et al*, 2013) has compared the gross motor function with mobility domain of PEDI-FSS mobility, studies addressing the relationship between the Gross

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Motor Function with domains in PEDI-CAT are limited particularly in this part of the world. Hence, this study determined the pattern of motor function and ADL performances in children with CP. It also investigated the relationship between motor function and ADL living performance and their determinants in the children.

Subject selection

This study involved 104 children with cerebral palsy who were undergoing habilitation at the Lagos University Teaching Hospital (LUTH) Idi-Araba, Lagos, Lagos State University Teaching Hospital (LASUTH) Ikeja Lagos, Cerebral Palsy Center Surulere, Lagos and Modupe Cole Memorial Child Care and Treatment Home School, Lagos. Participants were selected if they were clinically diagnosed of cerebral palsy and are not more than 12 years of age. However, children with any neurodevelopmental and genetic problem other than cerebral palsy or a child with uncontrolled seizure or a child who has received selective dorsal rhizotomy surgery or a child who had received Intrathecal baclofen, or botulinum toxin injections in the lower limbs prior to study recruitment were excluded from this study.Prior to the commencement of the study, ethical approval was sought and obtained from the Health Research and Ethics Committees of the Lagos University Teaching Hospital (LUTH) Idi-Araba, Lagos (Health Research Committee assigned number: ADM/DCST/HREC/APP/254) and Lagos State University Teaching Hospital (LASUTH) Ikeja, Lagos (Health Research Committee reference number: LREC/10/06/576). Participant's parent/guardian was provided with information sheet which contains details of what the study was all about. Participant's parent/guardian then signs a statement of informed consent.The participants for this study were selected (figure 1) from the clinic and habilitation/children centre with large population of attendance for treatment session of children with cerebral palsy and closeness of the selected clinic/habilitation centres. These selections were based on the clinic day for paediatrics patients and habilitation home/school of cerebral palsy children. Participants were undergoing habilitation at Lagos University Teaching Hospital (LUTH) Idi-Araba, Lagos; Lagos State University Teaching Hospital (LASUTH) Ikeja, Lagos, Cerebral Palsy Center Surulere, Lagos and Modupe Cole Memorial Child Care and Treatment Home School, Lagos.

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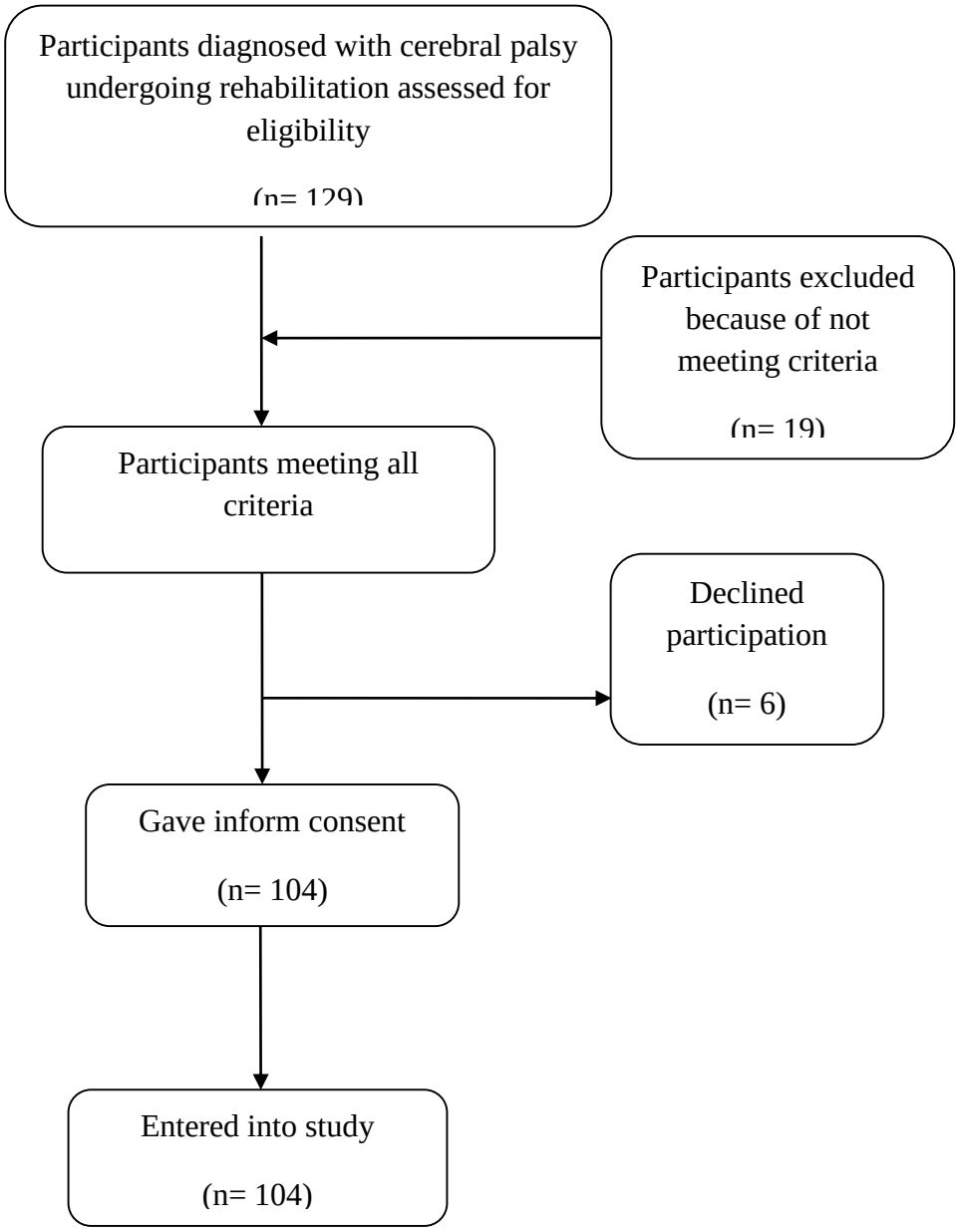

Figure 1: Stages of recruitment participants

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Research procedure for data collection

Children with cerebral palsy who passed the inclusion and exclusion criteria were recruited into the study as participants. Socio-demographic data such as name, home address, and contact phone number of parents/guardian, age, gender of participants were taken and documented with the aid of parents/guardian or the physiotherapist in charge of the child. Clinical data were also obtained from the case note and from physical assessment.

The children with cerebral palsy were assessed at the outpatient paediatrics unit of the physiotherapy department, where they attended physiotherapy session/treatment classes. The diagnoses of CP was confirmed by reviewing the case note and assessment of the child except in cerebral palsy center Surulere, Lagos where the diagnoses was confirmed with the help of the physiotherapist in charge of each of the participants because the case note of the participants were not readily available. The children were then grouped and classified according to their neuromotor type (Spastic, Ataxia and Dyskinetic) and distribution (Spastic Bilateral, Spastic Unilateral), using the hierarchical classification tree of cerebral palsy sub-types (Figure 5) (SCPE, 2000), which was recorded by the researcher. Gross motor function levels of children with cerebral palsy were classified using Gross Motor Function Classification System (GMFCS). Children were classified into 5 levels (Level I-V) based on the basis of their self-initiated movement with particular emphasis on sitting, walking, and wheeled mobility.

Gross motor function was evaluated by the researcher using translated GMFM-66-IS (ITEM SET) beginning with a pre-defined set of decision items. The child's score on each of these items guided researcher towards the item set most appropriate for that child. Evaluation was done in the assessment/gym/mat room free from disturbance (Russell *et al,* 2002). The GMFM-66-IS scores was calculated by following the decision tree process (Russell *et al,* 2009), using the item scores from the GMFM-88.

Independent Activity of Daily Living Performance was evaluated by the researcher using PEDI-CAT software preinstalled into the laptop of the researcher. Evaluation was conducted by the researcher through structured interviews with the parents or persons who are familiar with the child, using the PEDI-CAT (Haley *et al,* 2011). The PEDI-CAT software used statistical models to estimate a child's abilities from a minimal number of the most relevant items or from a predetermined number of items within each domain. The PEDI-CAT program then displays the results, including an item map, a scaled score, and an age percentile, instantly (Haley *et al,* 2010). A research assistant was recruited from the Cerebral Palsy Center Surulere, Lagos (Physiotherapist) for data collection of participants at the Center.

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Data analysis

Descriptive statistics of mean, standard deviation, frequency and percentage were calculated for the participants (gender, age distribution, GMFCS, neuromotor type and limb distribution). Univariate regression analysis was used to determine the relationship between gross motor function and independent activity of daily living performance. Multivariate regression analyses were used to explore the determinants of the relationship between Gross Motor Function and Independent Activity of Daily Living Performance in children with cerebral palsy. PEDI-CAT daily activity and mobility were successively the dependent variables. GMFM-66 and its interaction with separate GMFCS levels, neuromotor type and limb distribution were the independent variables.

RESULTS

Socio-demographic and clinical data of participants

A total of 104 children with cerebral palsy were eligible for the study after screening. All participants completed the study and their findings were analysed. Fifty-six out of 104 participants were males while 48 were females. The mean age for the participants was 44±36 months with more (45) of them less than 2 years of age (figure 2). Their neuromotor type was Spastic and their limb distributions of spastic subtype are as shown in figures 3 and 4. Most (51.9%) of the participants were in level V of Gross motor function classification system with none of them in level I (figure 5).

Pattern of gross motor function and Independent activity of daily living performances of participants

The pattern of GMFM-66 across GMFCS (level I-V) PEDI-CAT (daily activity, mobility, social/cognitive, responsibility) and neuromotor types (spastic unilateral, spastic bilateral, ataxic, dyskinetic) and neuromotor type (spastic unilateral, spastic bilateral, ataxic, dyskinetic) are presented in figures 6 and 7 respectively. The mean score of GMFM-66 across GMFCS was 49.4±7.9 (level II); 37.9±6.9 (level III); 28.9±6.7 (level IV); 18.3±7.9 (level V). The mean score of GMFM-66 across neuromotor types was 33.1±16.9 (spastic unilateral); 20.7±10.1 (spastic bilateral); 33.6±10.1 (ataxic); 34.0±13.3 (dyskinetic).

The mean score of PEDI-CAT daily activity across GMFCS was 47.9±7.4 (level II); 41.7±4.2 (level III); 38.6±3.1 (level IV); 36.6±2.4 (level V). The mean score of PEDI-CAT daily activity across neuromotor types was 42.6±7.7 (spastic unilateral); 36.8±2.8 (spastic bilateral); 41.6±6.4 (dyskinetic); 40.8±4.5 (ataxic). The mean score of PEDI-CAT mobility across GMFCS was 55.3±4.0 (level II); 51.5±1.6 (level III); 46.6±4.6 (level IV); 43.4±6.6 (level V). The mean score of PEDI-CAT mobility across neuromotor types was 50.5±6.7 (spastic unilateral); 44.2±7.2 (spastic bilateral); 50.0±5.2 (dyskinetic); 47.9±5.7 (ataxic). The mean score of PEDI-CAT

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social/cognitive across GMFCS was 51.5±8.6 (level II); 43.6±7.3 (level III); 40.7±7.4 (level IV); 36.0±5.3 (level V). The mean score of PEDI-CAT social/cognitive across neuromotor types was 41.1±11.4 (spastic unilateral); 37.0±5.6 (spastic bilateral); 43.4±9.5 (dyskinetic); 43.4±8.6 (ataxic). The mean score of PEDI-CAT responsibility across GMFCS was 29.6±6.3 (level II); 27.0±3.1 (level III); 25.2±0.9 (level IV); 25.1±0.5 (level V). The mean score of PEDI-CAT responsibility across neuromotor types was 27.0±3.7 (spastic unilateral); 25.2±1.1 (spastic bilateral); 26.4±4.3 (dyskinetic); 27.1±3.2 (ataxic).

Determinants of the relationship between Gross Motor Function and Independent Activity of Daily Living Performance in children with Cerebral Palsy

The result of the regression analysis showed that GMFM-66 scores explained 56.3%, 62.8%, 49.1% and 32.0% of the variance of PEDI-CAT daily activity, mobility, social/cognitive and responsibility scores, respectively (Table 1). The determinants of these relationships by GMFCS level, by neuromotor type and limb distribution are presented in table 2. No significant determinant by GMFCS level or by neuromotor type impairment was found for the relationship between GMFM-66 and PEDI-CAT. However, a significant determinant by the distribution of limb (spastic unilateral) (0.033) was found in the relationship between GMFM-66 and PEDI-CAT mobility.

DISCUSSION

The purpose of this study was to determine the pattern and relationship between gross motor function and independent activity of daily living performance in children with CP and also to explore the determinants of these relationships.

The result of this study showed that the male-to-female ratio of children with CP was 1.2**:**1. Although this study is neither a community survey nor set out to investigate the prevalence of CP, the result suggest that CP is slightly more common in male children than females. These finding is similar to the results of previous studies both in Nigeria and other countries of the world (Sathiakumar and Yakubu, 1987; Nottidge and Okogbo, 1991; Voorman *et al,* 2007; Hamzat and Fatudimu, 2008; Ogunlesi, *et al,* 2008; Belonwu *et al,* 2009; Pfeifer *et al,* 2009; Smits *et al,* 2010; Smits *et al,* 2011; Kwon *et al,* 2013; Obembe *et al,* 2013; Eseigbe *et al,* 2014) who have reported a slightly higher male preponderance. Although many hypotheses have been postulated, the reason for the male preponderance remains unclear (Johnston and Hagberg, 2007).

The result of this study showed that children with spastic type of CP were the most among the study population occurring in 57.7% of them. This may not be surprising as CP is a non-progressive and non-reversible injury to a developing brain which definitely will produce upper motor neuron syndrome (Puves, 2007). This is in agreement with the observations made in previous studies (Nottidge and Okogbo, 1992; Mutch *et al,* 1992; Beckung *et al,* 2007; Ogunlesi,

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et al, 2008; Belonwu *et al,* 2009; Hamzat and Fatudimu, 2009; Sigurdardottir *et al,* 2009; Obembe *et al,* 2013; Eseigbe *et al,* 2014). In this study the limb distribution of spastic subtype had 50% bilateral and 7.7% unilateral affectation. This is in agreement with observation made in previous studies (Belonwu *et al,* 2009; Hamzat and Fatudimu, 2009; Sigurdardottir *et al,* 2009; Obembe *et al,* 2013; Eseigbe *et al,* 2014). Although unilateral affectation of children is not uncommon, the most common one remains the bilateral type since the injury to the developing brain are not often selective but a gross affectation of the brain if the condition does not result from traumatic brain injury (Scrutton *et al,* 2004).

The children with ataxic subtype of CP were the least (13.5%) in this study. This may be due to dysfunction of the cerebellum with motor difficulties not apparent until late in the first year of life (Purves, 1995). Since CP occurs in the early developmental stage, it may not be uncommon that both the sensory and cerebellar functions may have been compromised resulting in varied forms of movement disorders (Rosembaum, 2003). This is in support of previous studies (Beckung *et al,* 2007; van Eck *et al,* 2009; Holsbeeke *et al,* 2009; Smits *et al,* 2010; Smits *et al,* 2011; Eseigbe *et al,* 2014). Obembe *et al* (2013) have earlier reported the physiologic forms of CP observed in their study as spastic (71.4%), dyskinetic (11.7%), ataxic (10.4%), and mixed (6.4%) which shows a little variation from the result of this study. The difference in results may be due to the fact that this study based the grouping of the children on their neuromotor types using the hierarchical classification tree of cerebral palsy sub-types (SCPE, 2000) rather than physiological presentation. The results of the classification of the gross motor function in this study showed that none of the children were categorized into level I with majority (51.9%) grouped into level V. This may pose more variability in the finding of this study in relation to other previous studies (Beckung *et al,* 2007; van Eck *et al,* 2009; Holsbeeke *et al,* 2009; Smits *et al,* 2010; Smits *et al,* 2011; Kwon *et al,* 2013; Eseigbe *et al,* 2014) who had more of their participating populations in levels I, II and III. The skewness of this data on level V may have been due to the fact that the participants in this study were recruited from the tertiary health institutions who treat and manage more of severe cases. Tertiary health institutions are apt to receiving more severe cases of cerebral palsy whose management could not be addressed at lower levels of health care delivery (Eseigbe *et al,* 2014).

The mean values of the gross motor function of participants in this study across the GMFCS: 49.4, 37.9, 28.9 and 18.3 (level II-V respectively) and 22.4, 34.0, and 33.6 across spastic, dyskinetic, ataxic neuromotor type respectively were contrary to that of Smits *et al* (2010) who reported mean values of 81.4, 66.8, 55.7, 44.2 and 21.2 across level I-V of GMFCS respectively and mean values of 67.5, 41.1, 68.3 across the neuromotor types: spastic, dyskinetic, ataxic respectively. The finding in this study could have been influenced by the severity of CP, where more than half of the children with CP were in levels VI and V of the GMFCS as compared to that of Smits *et al* (2010) where quite a large number of their participants were within levels I, II and III of the GMFCS.

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The result of independent activity of daily living performance in this study showed comparatively lower mean values across GMFCS and neuromotor type in daily activity, mobility, social/cognitive and responsibility domains of PEDI-CAT in relation to the finding in previous studies (Smits *et al,* 2010; Smits *et al,* 2011; Kwon *et al,* 2013). This also can be attributed to the presentations of the participants and the setting of recruitment. Smits *et al* (2011) recruited children between the age range of 4 years and 8 months and 7 years and 7 months while this study recruited children between 1 year and 12 years. Parents and caregivers often seek medical intervention due to disability in the functionality of the medically challenged relations, to improve their independent functioning. The result of spastic unilateral CP in PEDI-CAT daily activity and mobility was observed to have high mean value when compared to spastic bilateral in this study. This high value may be attributable to the topographical distribution of spasticity among participants and the effect of intervention on the participants as they were all receiving physiotherapy treatments. This is in agreement with the observation made by Kwon *et al* (2013) in PEDI-FSS self-care and mobility.
This study showed that independent activity of daily living performance is related to gross motor function in children with CP aged 1 to 12 years, explaining 56.3%, 62.8%, 49.1% and 32.0% of variance in daily activity, mobility, social/cognitive and responsibility domains of PEDI, respectively. This shows that improvements in gross motor function translate to improvement in functional performance and independent functioning in the participants. This improvement may be attributed to the physiotherapy intervention as the participants were recruited from the hospital setting. The result in this study (62.8% of variance in PEDI mobility) is similar to the finding in the study in Korea reporting (67.4% of variance in PEDI mobility) (Kwon *et al,* 2013) but in contrary to the studies conducted with PEDI in the Netherlands (90.0% of variance in PEDI mobility) (Smits *et al,* 2010) and Sweden (75.0%) (Ostensjo *et al,* 2004). These different results may be due to a translation gap that leads to obscurity of measurement criteria when the original items (PEDI) are applied. It could also result from the difference in childcare cultures and social environments where the studies were conducted.

The daily activity, mobility, social/cognitive and responsibility domains of PEDI-CAT showed a statistical significant correlation ($p < 0.05$) by GMFM-66. A moderate correlation 0.75, 0.71 and 0.57 was found in PEDI-CAT daily activity, social/cognitive and responsibility domains respectively which can be explained in the rates of intellectual disability affecting other normal systemic function, resulting in under development in physical function and cognitive function (Kwon *et al,* 2013). This study found no statistical significant evidence in exploring the determinants of the relationship between gross motor function and independent activity of daily living performance by GMFCS level or by neuromotor type, expect for limb distribution (spastic unilateral) (0.033) was found in the relationship between GMFM-66 and PEDI-CAT mobility. The result is similar to the finding in the study by Smits *et al* (2010). Who reported no significant moderation by GMFCS level or by type of neuromotor impairment was found for the relationship between GMFM-66 and either PEDI-FSS mobility or PEDI-CAS mobility.

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CONCLUSION

The outcome of this study shows that more males than females' children with cerebral palsy received physiotherapy treatment with most of them highly dependent in the performance of their activity of daily living. Spastic type of cerebral palsy with bilateral presentation was the most common cerebral palsy that is presented in the physiotherapy departments. The children with cerebral palsy in this study had lower GMFM-66 scores compared to results from other studies. The children with cerebral palsy in this study had lower independent activity of daily living performance as compared to those from other studies. In children with cerebral palsy, the GMFM-66 explained not only the mobility domain of the PEDI but also some aspects of the domains of daily activity, social/cognitive and responsibility. In children with cerebral palsy, the independent activity of daily living performance is directly related to gross motor function. No significant evidence determine in the relationship between motor function and independent activity of daily living performance in children with cerebral palsy.

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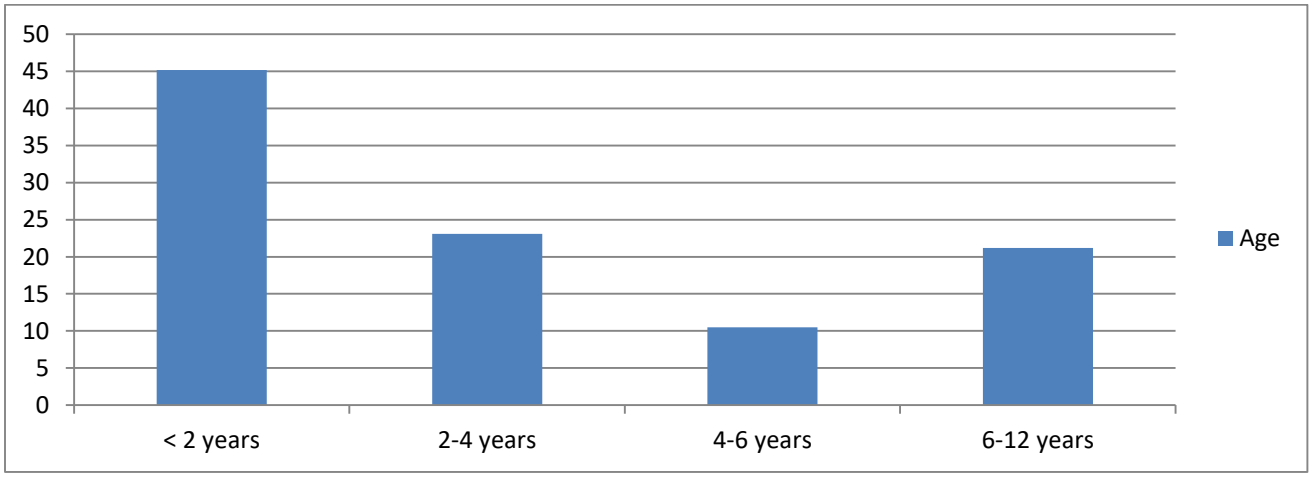

Figure 2: Age distribution of participants

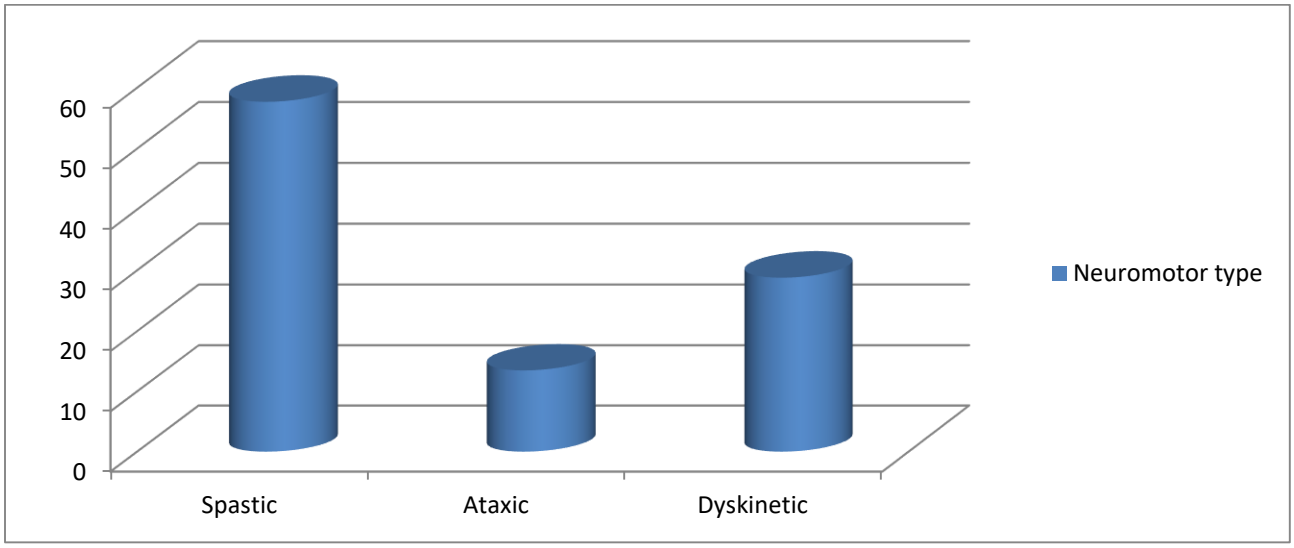

Figure 3: Neuromotor type Distribution of the Participants

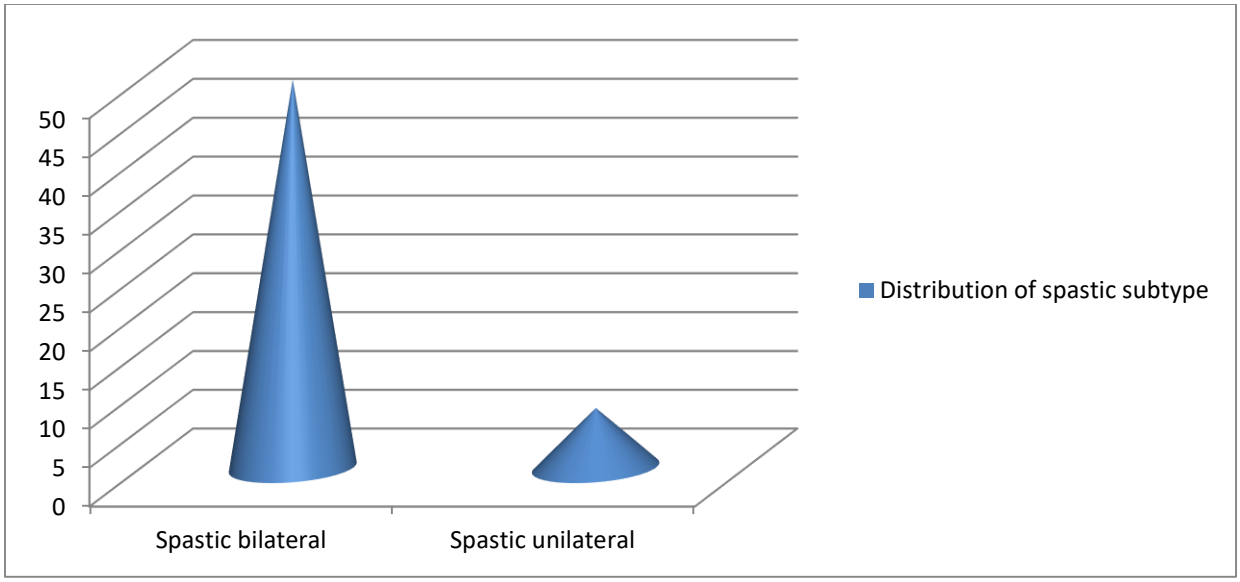

Figure 4: Limb distribution of spastic subtype of the participants

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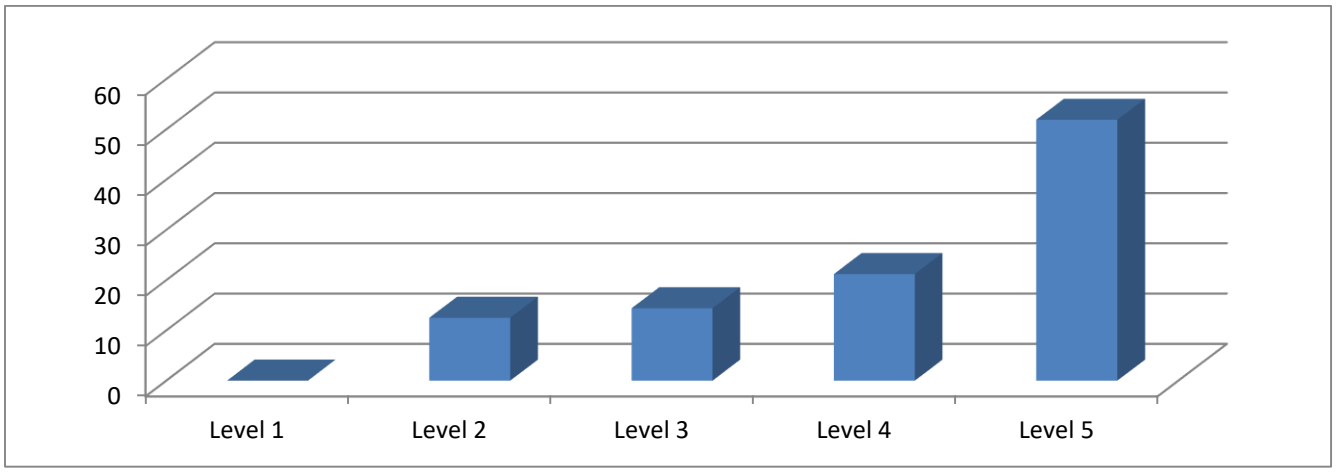

Figure 5: Gross Motor Function Classification System Distributions of participants

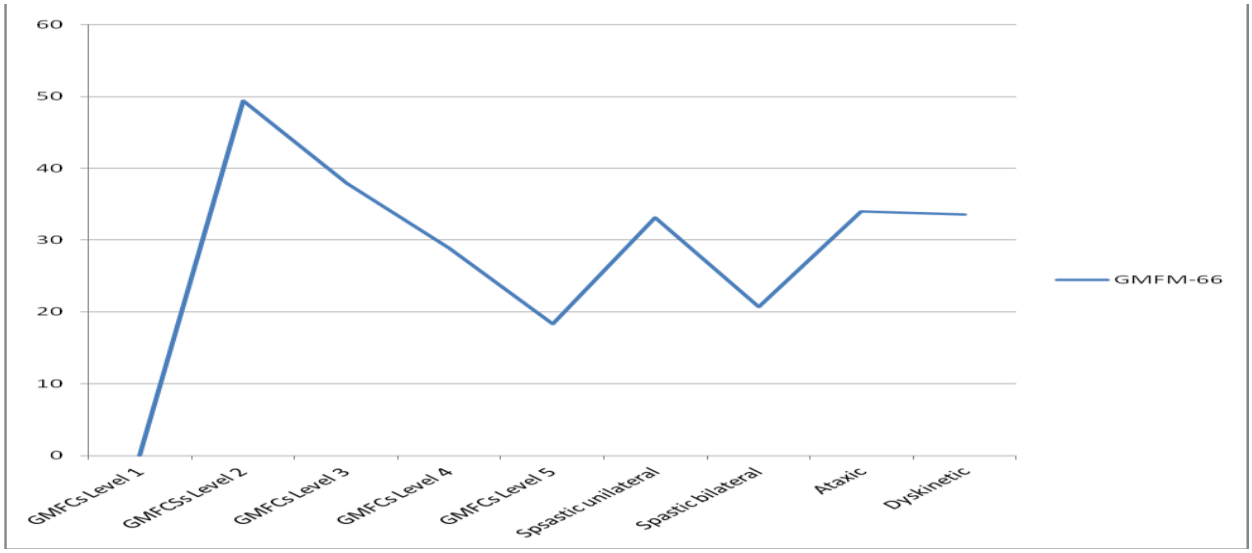

Figure 6: Pattern of mean GMFM-66 scores of the Participants across the GMFCS and Neuromotor types

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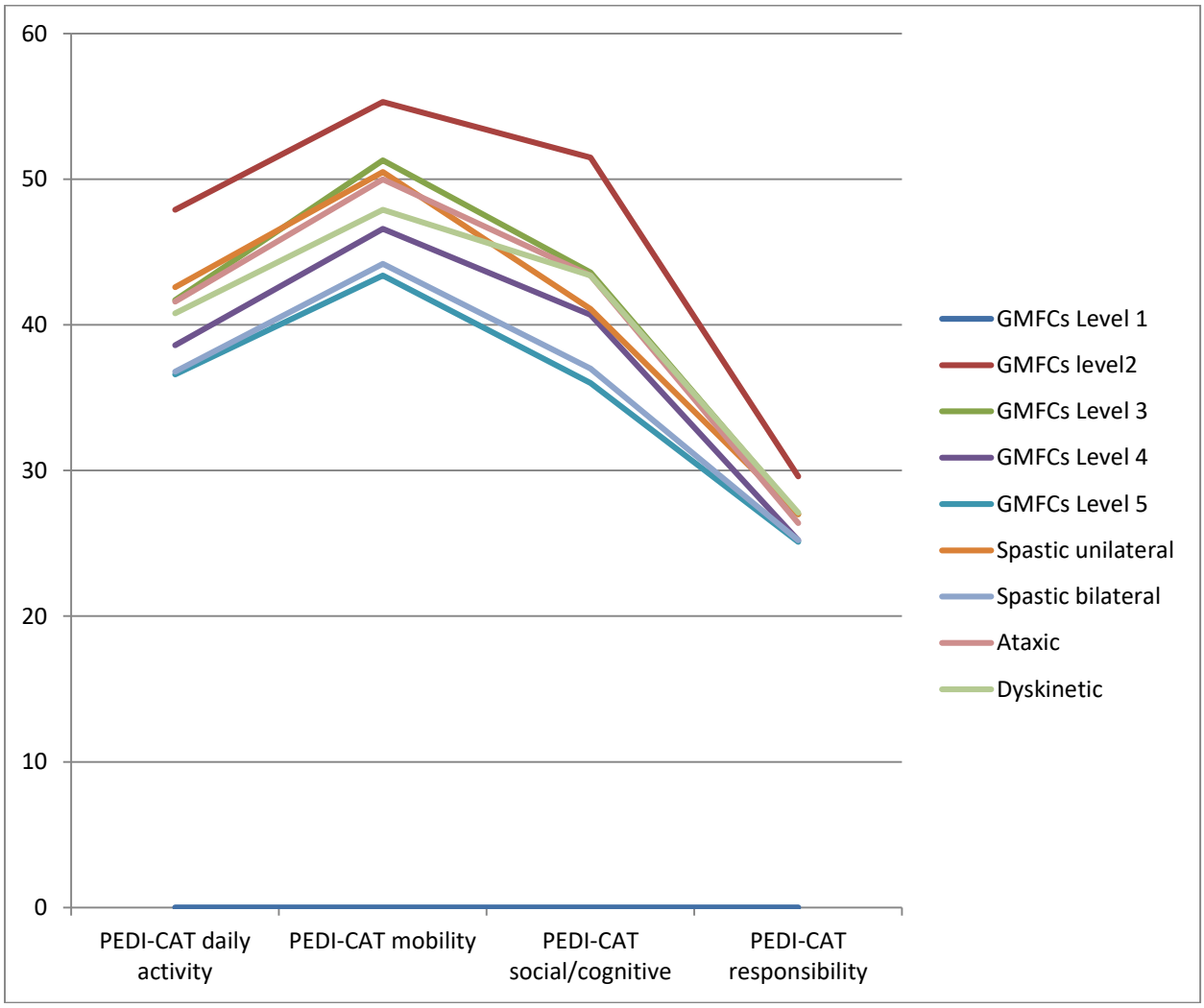

Figure 7: Pattern of mean PEDI-CAT scores of the Participants across the GMFCS and Neuromotor types

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Table 1: Relationship between PEDI-CAT and GMFM-66 by univariate linear regression analysis

Variable	r	r^2
PEDI-CAT		
Daily Activity	0.753*****	0.563*****
Mobility	0.795*****	0.628*****
Social/Cognitive	0.704*****	0.491*****
Responsibility	0.571*****	0.320*****

***Significance at p < 0.05**

key

PEDI-CAT: Pediatric Evaluation of Disability Inventory Computer Adaptive Test

GMFM-66: Gross Motor Function Measure-66

r= **Correlation Coefficient**

r^2= **Coefficient of Determination**

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Table 2: Interaction terms of GMFM-66 with GMFCS level, Limb distribution and neuromotor type by multivariate analysis for moderation

	PEDI-CAT			
	Daily Activity		Mobility	
	β±SE	p-value	β±SE	p-value
GMFM-66	0.73±0.03	<0.005	0.80±0.03	<0.005
GMFM-66*GMFCS II	0.47±0.21	0.103	0.15±0.25	0.635
GMFM-66*GMFCS III	-0.164±0.23	0.559	-0.11±0.26	0.702
GMFM-66*GMFCS IV	0.28±0.20	0.206	0.14±0.20	0.527
GMFM-66*GMFCS V	-0.05±0.104	0.747	0.08±0.09	0.588
GMFM-66*spastic CP	0.20±0.06	0.122	-0.05±0.56	0.682
GMFM-66*dyskinetic CP	0.076±0.08	0.689	0.20±0.08	0.299
GMFM-66*ataxic CP	-0.174±0.17	0.553	-0.02±0.19	0.944
GMFM-66*unilateral spastic CP	-0.40±0.13	0.324	-0.75±0.11	0.033*
GMFM-66*bilateral spastic CP	-0.10±0.08	0.479	-0.21±0.73	0.125

*** Significance at p<0.05**

key

PEDI-CAT, Pediatric Evaluation of Disability Inventory Computer Adaptive Test
GMFCS, Gross Motor Function Classification System
GMFM-66, Gross Motor Function Measure 66
β, slope
SE, standard error of slope

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