

# Characteristics of gross motor function among children with spastic cerebral palsy aged between 2–4 years

Mohammad Habibur Rahman, Samena Akter Kakuli, Ehsanur Rahman, Md. Obaidul Haque, Md. Shofiqul Islam, Shamima Islam Nipa

## ABSTRACT

**Introduction:** Cerebral palsy (CP) describes a group of disorders that affects movement and posture, causing activity limitations attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication and behaviour by epilepsy and by secondary musculoskeletal problems. **Methods:** A cross sectional prospective type of study design was used to find out the characteristics of gross motor function among children with spastic cerebral palsy aged between 2–4 years. The study was conducted at pediatric unit of CRP. **Results:** Total participants were 114 whose mean age was 2.96 years. Sociodemographic results

found large number of participants (68.4%) was underweight. In medical factors, majority of the participants did not have history of jaundice, pneumonia, visual and auditory problems. GMFCS level showed majority of the participants (28.9%) were in level 5 which means they required assistance for mobility. **Conclusion:** Cerebral palsy causes activity limitations and participation restriction. The present study found different sociodemographic, medical factors and GMFCS level with status of limitations among children with spastic CP between age range of 2–4 years.

**Keywords:** Cerebral Palsy, Gross motor function, Gross-motor functional classification system scale (GMFCS), Spasticity

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## INTRODUCTION

Motor function development has been regarded as normal phenomena during the developmental period through infancy to adulthood in case of children without any neurological disease or disorders [1]. Cerebral palsy (CP) describes a group of disorders that affects movement

and posture, causing activity limitations attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, and behaviour by epilepsy and by secondary musculoskeletal problems [2]. There are four predominant motor types of CP such as spastic, ataxic, dyskinetic and mixed types. Spastic CP is the most common and accounts for 70–75% of all cases, dyskinetic 10–15% and ataxic is less than 5% of cases [3]. The prevalence of CP is varying in range around the world. In United Kingdom, the prevalence of cerebral palsy was 3 per 1000 live births [4], in Australia approximately 2–2.5 per 1000 live births [5], in the United States of America 2.4 per 1000 live births [6], in India the estimated incidence was around 3 per 1000 live births [7] and in Bangladesh the prevalence of CP was 6.1 per 1000 of live births [8]. In reality, the consequences of CP cause the lifelong dependency on their family due to impairments in body structures and activity limitation due to impairments. These impairments negatively affect the gross motor function of CP children and retard their development and restrict participation in daily activities [1]. Each CP children is unique and their level of impairments and limitation in activities of daily livings is different. Different evidence showed that gross motor functional classification system scale (GMFCS) is worldwide accepted to measure the gross motor functions. In GMFCS, there are four age ranges such as under two years, 2–4 years, 4–6 years, and 6–12 years. Each of the age range has five levels with different activities level in which such as: level: 1 characteristics was children walk as preferred method of mobility without any aids, sits on floor and manipulates objects with both hands, can get off floor independently and level: 5 characteristics was all areas of motor function are limited, unable to maintain head control and require assistance for all mobility [9]. Therefore, identification of gross motor functional status and their limitations within the age range 2–4 years would form a platform to which physiotherapist can start working in future time. From the best knowledge of the researcher, there is no relevant study published earlier. Thus, conduction this study would broaden the knowledge about the common gross motor functional limitations in Bangladeshi spastic CP children aged between 2–4 years in relation to CP children worldwide.

## RESEARCH QUESTION

What are the characteristics of gross motor functions among children with spastic cerebral palsy aged between 2–4 years?

## STUDY OBJECTIVES

To find out the socio-demographic factors of children with spastic CP between 2–4 years of age, to show the characteristics of medical factors such as convulsion, jaundice, neonatal pneumonia, birth trauma, auditory and visual problem and to demonstrate the frequency of use of assistive and orthotic device for maximization of gross motor functions.

## MATERIALS AND METHODS

### Study design

A cross-sectional descriptive study design was used to find out the characteristics of spastic CP children between 2–4 years of age.

### Study area/site

The study was conducted at paediatric unit of Centre for the Rehabilitation of the Paralysed (CRP).

### Study period

The study duration was from July 2015 to April 2016.

### Sample size

Total 114 children with spastic CP aged between 2–4 years was recruited using convenience sampling technique.

### Inclusion criteria

Patients with the diagnosis of cerebral palsy, limited age group between 2–4 years of age, both male and female were included in this study.

### Exclusion criteria

Undiagnosed CP children, age below two and above four years.

### Data management and analysis

Data was analyzed by descriptive statistics with SPSS software version 20.0.

## RESULTS

### Socio-demographic

From the total participants 114, the mean age ( $\pm$ SD) of the participants was 2.96 ( $\pm$  0.87) years. Male

children were 67 (58.8%) and female were 47 (41.2%). In addition, 38 (33.3%) participants lived in urban area and 76 (66.7%) in the rural area of Bangladesh. 67 (58.8%) participant’s birth was attended in house and 47 (41.2%) participant’s birth was attended in the hospital or clinic. BMI of 114 participants showed that underweight was 78 (68.4%), normal weight 30 (26.3%), overweight 5 (4.4%) and obese 1 (0.9%) (Figure 1).

### Medical

Among 114 participants, 55 (48.2%) participants had convulsion whereas 59 (51.85%) participants did not have, 34 (29.8%) participants had history of jaundice and in contrast 80 (70.2%) did not have jaundice, 33 (28.95) had birth trauma but 81 (71.1%) did not have history of birth trauma, 38 (33.3%) participants had history of pneumonia after birth but 76 (66.7%) participants did not have, 11 (9.6%) participants had auditory problem after birth but 103 (90.4%) did not have, 10 (8.8%) participants had history of visual problem and in contrast 104 (91.2%) did not have. Muscle tone in the upper and lower limb is given in Table 1. The involved extremities of upper and lower limb showed that majority of the participants had four limbs involved 58 (50.9%) and least number of participants 8 (7.0%) had one hand and two legs affected by spastic tone (Table 2).

The distribution of gross motor function of 114 participants showed that majority of the participants 33 (28.9%) were in level 5. It means that all the functions were limited and required assistance for mobility. The least number 11 (9.6%) of participants were in level 1. It means child can walk independently without any mobility aids (Figure 2).

Table 1: Frequency (%) of muscle tone in upper and lower limb

Muscle tone	Upper limb (Frequency)	Muscle tone	Lower limb (Frequency)
No increase tone	14 (12.3)%	No increase tone	2 (1.8)
Slight	44 (38.6)%	Slight	24 (21.1)
Slight+	26 (22.8)%	Slight+	36 (31.6)
Considerable	20 (17.5)%	Considerable	35 (30.7)
More marked	7 (6.2)%	More marked	13 (11.4)
Rigid	3 (2.6)%	Rigid	4 (3.4)
Total	114 (100)%		114 (100)

Table 2: Limb involvement by spastic tone of cerebral palsy children

Limb involvement	Frequency
One leg and arm (one side)	11 (9.6)
Four limbs (arms and legs)	58 (50.9)
One hand and Two legs	8 (7.0)
Two legs (Sometimes arm)	37 (32.5)
Total	114 (100)

### Orthotic device

Among 114 participants, 75 (65.8%) participants used orthotic or assistive device for mobility and 39 (34.2%) did not use.

### DISCUSSION

In the current research, the mean age of the participants was 2.96 years. Male children were 67 and female were 47. In addition, 38 (33.3%) participants lived in urban area and 76 (66.7%) in the rural area of Bangladesh. One study [10] investigated the gross motor function and associated disorder among children with cerebral palsy. Among 200 participants, 103 participants were male and 97 were female. Thus it was disclaimed that male participants were greater in number in both studies. Another study [11] found that males were related more commonly with developmental disorder than female and the authors also did not find the reasons for difference. Despite of similarity, there was inequality in selection of participants between this study and Soleimani et al. study. In the current study, participants were included in age range only 2–4 years whereas Soleimani only studied children with CP between much wider age ranges of 4–12 years.

BMI of 114 participants in this research showed that Majority (68.4%) of the participants were underweight. However, one study conducted to find out the correlation between BMI and various motor severities among children

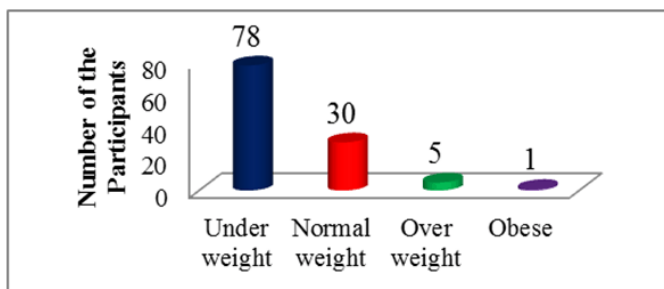


Figure 1: Body mass index of the Participants.

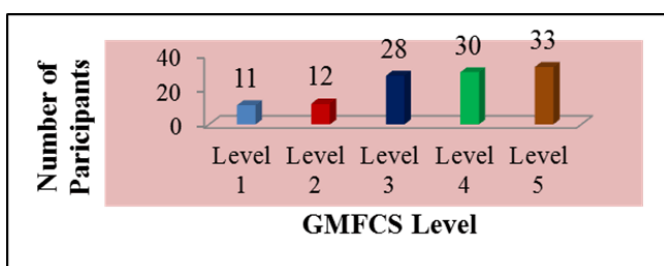


Figure 2: The GMFCS level among participants.

with CP. In their study, majority of the CP children were underweight as well [12].

In the current research, more number of the participants (51.85%) did not have neonatal convulsion. Besides, one study [13] showed that 31.9% children had history of convulsion whereas 68.1% did not have convulsion. In addition, the present research showed that majority of the participants did not have jaundice (70.2%), pneumonia (66.7%), auditory problem (90.4%) and visual problem (91.2%). In contrast, another study [14] investigated that jaundice (25.5%), pneumonia (35.5%), and neonatal seizures (58.1%) were the leading risk factors for in their study. Participants who also found neonatal convulsion was one of the prominent risk factor of causing CP. Both of the studies were different in design in which Gulten et al. tend to find out the risk factors of CP whereas the present study aim was to find out the snapshot of gross motor functions of CP children.

In this study, muscle tone in the upper and lower limb varied. In upper limb highest percentage of participants (38.6%) had slight tone in upper limb and contrast highest percentage of lower limb muscle tone was slight+ (31.6%). The involved extremities of upper and lower limb showed that majority of the participants had four limbs involved 58 (50.9%) and least number of participants 8 (7.0%) had one hand and two legs affected by spastic tone. A growing number of evidence [15, 16] found spastic type among all CP children. In Bangash et al. study, there was 75% spastic type of cerebral palsy in which diaplegic 35%, quadriplegic 30% and hemiplegic 10%. Conversely, in Sigurdardottir study there was 78% spastic CP in between 1990–1996 and 87% in between 1997–2003 and this study also concluded that there was significant association between spastic CP and motor impairments in GMFCS level; I to V.

The distribution of gross motor function of 114 participants showed that majority of the participants 33 (28.9%) were in level 5. It means that all the functions were limited and required assistance for mobility. The least number 11 (9.6%) of participants were in level 1. It means child can walk independently without any mobility aids. However, in reviewing one study [17] it was found that in age group four years there were 29.2% in level 1, no participants occupied in level 2, 12.5% in level 3 and 83.3% cumulatively in level 4 and 5.

Among 114 participants, 75 (65.8%) participants used orthotic or assistive device for mobility and 39 (34.2%) did not use. A survey was conducted to identify the users of assistive device by children with physical disabilities [18]. The study surveyed 224 children with physical disabilities in which 106 was children with CP. However, among 224 children, 83.06% (n = 103) children benefited from using orthoses and mobility aids in the light of parents point of view. However, the current study and study conducted by Hung et al. found almost similar results in parent's opinion regarding improvement of mobility after using orthotic or assistive devices. In contrast, the basic differences between them were in this study all

the patients were CP and Hung study was comprised of children with physical disabilities.

## CONCLUSION

Cerebral palsy (CP) causes activity limitations and participation restriction among children with CP. From the best knowledge of the researcher, gross motor plays an important role in the milestones of development of children. Through the results of this study, it has widened the door of current gross motor function limitations among children with CP who attended at CRP. Besides, physiotherapists working in pediatric unit of CRP would have the idea about the characteristic of gross motor functions among children with spastic CP age range between 2–4 years. In future, the researcher recommends to study on the factors that affects the gross motor functions of children with CP with varying age range.

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## Author Contributions

Mohammad Habibur Rahman – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, revising it critically for important intellectual content, Final approval of the version to be published

Samana Akter Kakuli – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Ehsanur Rahman – Substantial contributions to conception and design, Analysis and interpretation of data, Drafting the article, Final approval of the version to be published

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Shamima Islam Nipa – Substantial contributions to conception and design, Analysis and interpretation of data, Drafting the article, Final approval of the version to be published

## Guarantor

The corresponding author is the guarantor of submission.

## Conflict of Interest

Authors declare no conflict of interest.

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