



Full Length Research Article

PERFORMANCE OF CHILDREN WITH CEREBRAL PALSY IN PLAY & LEISURE ACTIVITY ASSESSED ON GMFCS AND MACS

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ABSTRACT

Background: Cerebral palsy (CP) is a permanent, non-progressive neurological impairment resulting from a brain lesion, or lesions, that occur prior to, during or shortly after birth. Cerebral Palsy primarily affects body movement and muscle coordination. These Children are always deprived of love, attraction, and functional activity due to negligence & opportunity.

Objectives: of this study were to assess motor function and manual ability in children with cerebral palsy to measure their functional status on the basis of gross motor function classification system & Manual ability classification system.

Methodology: A Total of 82 subjects who fulfilled the inclusion and exclusion criteria were included in the study. Study was review all ACL injuries reported to the physiotherapists affiliated with the national professional, coaches, collegiate and youth judo players. Subject who fulfils, inclusion and exclusion criteria was assessed by questionnaire and interview. A judo player with 20 year experience had carry out interview to acquire information on ACL injury incidence with regard to situations.

Results: Showed the difference in number of ACL injury incidence between dominant side and non dominant side was statistically significant. ($X^2=17.24$, $p<.0001$). The difference in the number of ACL injury incidents between the two grip styles was not statistically significant ($X^2=2.56$, $p>.10$). The ACL injury occurrence when being attacked was greater than when being counterattacked than when attempting an attack however this was not statistically significant ($X^2=3.7$, $p>.05$). The result showed that direct contact technique was significantly greater than the indirect technique mechanisms ($X^2=29.64$, $p<0001$).

Conclusions: Results suggest that there is no gender differences were found in the total play participation but higher rates in social, creative and play lessons among females and indoor activity is higher than outdoor.

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INTRODUCTION

a non-progressive brain injury or malformation that occurs while the child's brain is under development. Cerebral Palsy primarily affects body movement and muscle coordination. Cerebral palsy causes physical impairment. An individual with Cerebral Palsy will likely show signs of physical impairment. However, the type of movement dysfunction, the location and number of limbs involved, as well as the extent of impairment, will vary from one individual to another. It can affect arms, legs, and even the face; it can affect one limb, several, or all. Every case of cerebral palsy is unique to the individual. Every case of cerebral palsy is unique to the individual.

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One person may have complete paralysis and require daily care, while another with incomplete paralysis might have slight movement difficulty and require little assistance.

Cerebral palsy is manageable

The impairment caused by Cerebral Palsy is manageable. In other words, treatment, therapy, surgery, medications and assistive technology can help maximize independence, reduce barriers, increase inclusion and thus lead to an enhanced quality of life. Play is the primary occupation of childhood (Bundy, 1997a; Bundy, 1997b; Parham, 2008; Reilly, 1974). It is recognized as having an important contribution to make to the health of an individual. When developing the theoretical foundations for the paradigm of occupation, Adolph Meyer stressed the importance of health being seen as a balance of work, rest, play, and sleep (Meyer, 1922). Along with work and rest, play was viewed as critical for daily living. In fact,

those who could not play were considered to be disabled (Lyons, 1987). These statements stress the importance of play in its necessity to normal child development. Usually, the play of children with disabilities is less varied, has a slower tempo and involves more time alone or with adults than the play of their able-bodied peers. Moreover, children with CP spend more time in quiet recreation, dependent activities, and activities of personal care, while spending less time in active recreation activities. The purpose of this study is to describe the overall play participation of preteen children with CP, aged 8-13 years, by measuring what activities they participate in using part of the Preteen Play Profile (PPP) (Henry, 2000), and to explore variations in participation in different play categories based on gross motor function, manual ability, CP distribution, gender and age.

Aims and Research Hypothesis

Aim 1: Describe the amount and type of play participation among children aged 8 -13 years with CP using the PPP.

- Describe differences in the amount and type of play participation in children with CP among the 8 play categories of the PPP.
- Identify the most common play activities children with CP participate in among the 59 play activities catalogued by the PPP.

Aim 2: Based on GMFCS (Palisano, 1997) and MACS (Eliasson, 2006) ability levels, differences in the amount and type of play activities children with CP participate in will be compared. The following hypotheses will be tested:

- Children who have a better gross motor function (GMFCS Levels I) will have the highest amount and most diverse of play activities and children with limited self-mobility (GMFCS Levels IV-V) will have the lowest amount and least diverse play activities.
- Children who have a better manual ability (MACS Level I) will have the highest amount and most diverse play activities and children with limited manual ability (MACS Levels IV-V) will have the lowest amount and least diverse play activities.

MATERIALS AND METHODS

Study Design- Mail survey selected because of High quality data in short time and exploratory nature. It's a traditional method.

Survey detail

- A cover letter of explanation of study and consent.
- A written self-report play survey that includes different pictures for easy explanation of play and leisure activities and asks the child if he or she has done each activity in the past year or not.
- A demographic data form includes families providing a description about their child sign/ symptom, type of CP and about their family.

- Diagrammatic explanation of Gross Motor Classification System (GMFCS) and the Manual Ability Classification System (MACS) for easy understanding & families are asked to mark the level that best represented their child's manual ability and gross motor function.

The survey was mailed to 100 preteen children with CP, aged 8 to 13 years whose families were agreed to participate. Out of 100 mailed envelop few of rejected due to personal reason but 94 families voluntarily participated in survey. Later one family rejected participation due to misshaping with their child, and finally 93 left to continue. Participant were selected on the basis of following criteria if they are diagnosed CP, aged between 8 to 13 yr and able to understand and respond simple command. Participant were rejected if they were not matching the age criteria, having developmental disorder, movement disorder, profound CP, other neurological diseases and unable to understand, uncooperative child.

Procedure: First mailed the entire packet with detailed explanation with aim of the study. For each activity, they circled yes or no if they had participated in this play activity in the past year. Families were asked to classify their child's movement ability using the Gross Motor Classification System (GMFCS) and manual ability using the Manual Ability Classification System (MACS) by circling the level that best represents their child's manual ability and gross motor function.

Preteen Play Profile (PPP): is a paper and pencil self-report measure designed for school-age children, between the ages of 8 and 13 years. PPP uses pictures to represent 59 play/leisure activity items that are common among children at this age. Those activities are divided into 8 play categories: Sports, Outdoor, Summer, Winter, Indoor, Creative, Social activities, and Lessons and classes. The child first answers question 1 (Do you do this activity?). If the response is "yes," the child then answers questions 2 through 5; (How often do you do the activity?), (How much do you like the activity?), (How good are you at the activity?) and (Who do you do this activity with?). In this study, however, we utilized only the first question of the PPP (Do you do this activity?). The question has both words and pictures to represent the activities. There are five blank spaces at the end of the profile so the child can add "other" activities in which he or she participated. It is important to ensure that the child understands either the words or pictures that represent the activities, as well as the responses to each question asked. Scores can be assigned to the child's responses in the following manner for the question (Do you do this activity): yes = 1, no = 0. Mean scores calculated for the play categories, such as sports, outdoor, summer, winter, indoor, creative, social activities and lessons and classes, and for the total scores for these 59 questions.

Gross Motor Functional Classification System (GMFCS)

Families were asked to classify their child's movement ability using the GMFCS by circling the level that best represents their child's gross motor function. [An evidence of high inter-rater reliability of the GMFCS when comparing independent parent and clinician scorings (intra-class correlation [ICC]

0.92) (Morris *et al.*, 2004; Morris *et al.*, 2006a; Morris *et al.*, 2006b)].

The Manual Ability Classification System (MACS)

Families were asked to classify their child's manual ability using the MACS (Table 2-4) by circling the level that best represents their child's manual ability. [An evidence of excellent inter-observer reliability between health professionals, with an intra-class correlation coefficient (ICC) of 0.97 (95% confidence interval [CI] 0.96–0.98)] (Eliasson, 2006).

RESULTS

While assessing patterns of play participation of children with cerebral palsy: - Differences in the amount and type of play participation of children with CP among the 8 play categories of the PPP. To answer this, the 8 play categories were analyzed using the Friedman test, which showed an overall difference in mean ranks ($p=0.000$, $2=382.485$). Mean rank was then used to order the 8 play categories from highest to lowest. Participation was the lowest in Lessons and the highest in Indoor play activities. It was found that children participated in a wide range of activities, with a total mean score of 60.8 (SD = 23).

Table 1. Parent-Reported Participant Characteristics (n=93)

		Number of children	% of children
Gender	Male	58	62.4
	Female	35	37.6
GMFCS	Level I	30	32.3
	Level II	24	25.8
	Level III	20	21.5
	Level IV	9	9.7
	Level V	10	10.8
MACS	Level I	18	19.4
	Level II	38	40.9
	Level III	20	21.5
	Level IV	10	10.8
	Level V	7	7.5

Table 2 shows the mean scores and standard deviation of the overall play participation, median and IQR by play categories and total participation & the play categories in the PPP.

Table 2. Mean Play Participation of Children with Cerebral Palsy by the Play Categories of the Preteen Play Profile (PPP)

Play Category	Mean Rank	Mean	SD	Min.-Max.
Indoor	8.44	81.2	22.2	11.1-100.0
Creative	6.59	62.7	28.0	0.0-100.0
Social	6.43	60.8	23.3	0.0-100.0
Summer	5.74	53.8	22.9	0.0-100.0
Outdoor	4.18	40.9	20.4	0.0-88.9
Winter	3.46	33.1	20.9	0.0-75.0
Sports	2.70	25.2	25.7	0.0-80.0
Lessons	2.05	16.9	17.1	0.0-71.4

Note. Friedman Test, $P=0.000$

Assessment 2: Identify the most common play activities children with CP participate in among the 59 play activities catalogued by the PPP:- In this study, I found that 97% of the children with CP were watching television, 97% were listening to music, 95% were going out to eat and 92% of the children were using the computer.

Table 3 shows the first 16 activities with the highest frequencies that children with CP participated in. The top 16 activities were reported to allow for comparison with the normative data of the PPP, which also reported the top 16 play activities that the typically developing children participated.

Assessment 3: Patterns of Participation in Clinical Subgroups of the GMFCS and the MACS: - Identify the differences in the amount and type of play participation in children with CP of different GMFCS and MACS levels (Palisano *et al.*, 2007; Palisano *et al.*, 1997). Clinical subgroups were defined according to gross motor function measured by the GMFCS or the manual ability measured by the MACS.

- Based on the GMFCS, there was a significant difference for the total play participation ($p = 0.000$, $F = 6.876$) in which play participation decreased in children from GMFCS level I (least limitations) to V (most limitations). For individual play categories, there were significant differences between levels in play participation in Sports, Outdoor, Summer, Winter, Indoor and Creative activities ($p = .001$, $.000$, $.014$, $.025$, $.009$, and $.036$ respectively). Table 4, shows play participation in lessons and social activities was almost similar for children at all levels of the GMFCS except for participants in Level V, which marked reduced participation.
- Based on the MACS, there was a significant difference in the total play participation ($p = .000$, $F = 8.560$). Play participation was the most at MACS level II and the least at MACS level V. Total play participation of children in MACS level I was less than those in level II. However, this difference was not significant. For individual play categories, significant differences were observed in participation in Sports, Outdoor, Summer, Indoor and Creative activities. Table 5 No significant differences in play participation of play categories were found in Winter, Lessons, and Social activities. Play participation scores did not present as clear a pattern, but reduced play participation by those at Level V on both scales was clearly evident.

DISCUSSION

Play Participation

Aim 1.a: Describe differences in the amount and type of play participation in children with CP among the 8 play categories of the PPP. This study found that children with CP participated most in indoor play (Swinth and Tanta, 2008). reported that time needed to get ready to go outside, weather, pressure to meet goals in other areas, and safety and liability concerns are some of the reasons that hinder outdoor play for children with disabilities. However, children with CP are not the only ones reporting less outdoor activity participation.

This study also found that children with CP participated least in active physical play including those activities under sports and outdoor play categories. Also, Majnemer *et al.* (2008) characterized participation in leisure activities in 9 year-old children with CP and reported that child participation was the lowest in active physical activities and community-based activities.

Table 3. Play Activities that Most Children aged 9-13 years with Cerebral Palsy Participated in Using the Preteen Play Profile (PPP)

Play Activity	Typical Children Normative Data	# of children Participating	Percentage (%)
1. Watch Television	#4	90	96.8
2. Listen to Music	#8	90	96.8
3. Go out to Eat	#12	88	94.6
4. Use Computer	#7	85	92.4
5. Go Shopping	-	83	89.2
6. Play on Play ground	-	81	88.0
7. Go Swimming	#5	80	86.0
8. Talk on phone	-	78	83.9
9. Play Board Games	#16	77	82.8
10. Draw or Paint	#13	77	82.8
11. Hang out with friends	#1	77	82.8
12. Go to Movies	#2	76	82.6
13. Read	#10	76	81.7
14. Go on a Picnic	-	75	80.6
15. Play in Snow	#3	72	77.4
16. Play Video Games	-	72	77.4

Table 4. Play Participation in Preteen Play Profile by the Five Levels of Severity of the Gross Motor Function Classification System (GMFCS)

Play Categories	GMFCS I (n=30)		GMFCS II (n=24)		GMFCS III (n=20)		GMFCS IV (n=9)		GMFCS V (n=10)		Statistic#	P value
	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)		
Sports	38.7	26.7	28.3	25.0	14.0	20.6	13.3	14.1	10.0	21.6	18.71	.001
Outdoor	55.2	18.3	45.4	12.2	32.2	17.3	27.2	15.8	16.7	14.1	36.71	.000
Summer	56.3	24.7	62.0	15.8	50.0	15.2	58.3	24.2	30.0	29.0	12.48	.014
Winter	39.2	20.4	39.6	16.3	25.0	21.5	22.2	19.5	25.0	23.6	11.14	.025
Indoor	85.2	17.6	87.0	15.9	86.7	17.1	69.1	32.3	55.6	27.2	13.62	.009
Creative	70.0	22.3	63.7	22.7	67.1	27.5	58.7	35.3	32.9	34.4	10.29	.036
Lessons	19.0	19.6	13.7	16.0	14.3	14.7	22.2	14.5	18.6	19.1	3.03	.553
Social	63.7	18.8	60.8	22.2	65.5	19.0	58.9	30.2	44.0	34.4	3.45	.485
Total	57.2	14.0	53.2	10.2	48.6	11.6	44.4	17.9	31.2	23.2	6.87	.000

Table 5. Play Participation in Preteen Play Profile by the Five Levels of Severity of the Manual Ability Classification System (MACS)

Play Categories	MACS I (n=18)		MACS II (n=38)		MACS III (n=20)		MACS IV (n=10)		MACS V (n=7)		Statistic#	P value
	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)		
Sports	37.8	29.0	28.9	24.9	21.0	23.8	8.0	10.3	8.6	22.7	13.76	.008
Outdoor	51.9	17.5	47.7	17.7	36.1	18.0	23.3	13.3	14.3	15.3	29.63	.000
Summer	54.9	28.2	59.2	16.4	57.5	20.4	40.0	16.5	30.4	34.5	10.83	.028
Winter	38.9	21.4	35.5	19.8	27.5	21.3	30.0	19.7	25.0	25.0	3.94	.414
Indoor	84.0	19.9	91.2	9.7	77.2	23.8	65.6	27.9	54.0	29.7	16.80	.002
Creative	69.0	19.8	69.5	25.8	62.1	22.4	47.1	34.4	32.7	40.2	10.13	.038
Lessons	18.3	16.1	16.2	16.3	15.0	19.9	20.0	15.4	18.4	21.4	1.86	.761
Social	65.0	15.8	68.2	17.8	55.0	26.3	51.0	22.8	40.0	39.2	8.41	.078
Total	55.7	12.9	56.5	10.5	46.7	13.5	38.3	16.2	29.8	27.0	8.56	.000

Aim 1.b: Identify the most common play activities children with CP participate in among the 59 play activities catalogued by the PPP. Watching television and listening to music were tied as the children's most common play activities. This was consistent with the results from Imms *et al.* (2008) and Law *et al.* (2006), who found that frequency of engagement in watching television in children with CP was 97.4% and 99.5%, respectively.

Manual Ability and Gross Motor Function

Aim 2: Identify the differences in the amount and type of play participation of different GMFCS and MACS levels in children with CP. This study found that among CP distribution, gender, family type, MACS, GMFCS, number of

siblings and center/facility, the level of manual ability (MACS) and the gross motor function (GMFCS) were the only predictors of play participation. In other words, children seemed to match the amount of their play participation and their play preference to their abilities. By doing this, preteen children with CP preserve self-esteem and minimize disruption to play skills. Moreover, a strong correlation was found between the GMFCS and the MACS ($r = .778, p = .000$).

Manual Ability Classification System (MACS)

In this study, the MACS was used to classify children based on manual ability. Impaired upper limb function affects children with CP and was the main factor contributing to decreased play participation.

When evaluating play participation, it is necessary to determine the expected level of achievement on each level of the MACS in order to decide which manual ability skill facilitated or hindered play participation. The current results do not support the hypothesis that children in MACS Level I had the highest amount of overall participation and most diverse play activities. In fact, participation of children in Level II was higher than those in Level I. However, children with limited manual ability (MACS Levels IV-V) had the lowest amount and least diverse play activities. This observation warrants further investigation. It is unclear whether this difference was arbitrary or due to reasons inherent to the study. One possible explanation is that parents might have found the distinctions between Level I and Level II on the MACS unclear. On the MACS, children in Level II performed almost the same activities as children in Level I, however, the quality of performance was decreased or the performance was slower in Level II.

Gross Motor Classification System (GMFCS)

Children with CP were classified based on their gross motor function using the GMFCS. The children in this study were unequally distributed between the levels of the GMFCS; 32.3% Level I, 25.8% Level II, 21.5% Level III, 9.7% Level IV, and 10.8% Level V. It is noteworthy that the highest proportion of children was classified in Level I of the GMFCS. The current results support the hypothesis that children in GMFCS Level I had the highest overall participation and most diverse play activities. Furthermore, children with limited self-mobility (GMFCS Levels IV-V) had the lowest amount and least diverse play activities.

Conclusion

Play participation in preteen children with CP has had limited examination in the literature. The present study provided an initial description of the patterns of play participation based on gross motor function and manual ability. Despite the absence of a comparison group, the findings of this study contributed to our understanding of patterns of participation in children with CP who are 8 to 13 years. This study suggested that preteen children with CP have play patterns that were indoor rather than outdoor, sedentary rather than active, lack structure, and some were not age appropriate. Children's play participation was predicted mainly by the severity of the manual ability and gross motor function. It was found that children with quadriplegia who are in Levels IV and V on both the MACS and GMFCS are the most at risk groups of decreased play participation. No gender differences were found in the total play participation but higher rates in social, creative and play lessons among females.

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REFERENCES

- Bundy, A. 1997a. Play and playfulness: What to look for. In L. Parham & L. Fazio (Eds.), *Play in occupational therapy for children* (pp. 52-66). St. Louis: Mosby.
- Bundy, A. 1997b. *The Test of Playfulness*. Fort Collins, CO: Colorado State University.
- Eliasson, et al. 2006. The Manual Ability Classification System (MACS) for children with cerebral palsy: Scale development and evidence of validity and reliability. *Developmental Medicine & Child Neurology*, 48(549-554).
- Henry, A. 2000. *Pediatric Interest Profiles (PPP)*. San Antonio: Therapy Skill Builders
- Imms, C., Reilly, S., Carlin, J. and Dodd, K. 2008. Diversity of participation in children with cerebral palsy. *Developmental Medicine & Child Neurology*, 50(5), 363-369.
- Kenneth A. Stem, my child at cerebralpalsy.org, definition, facts about cerebral palsy; an informative website.)
- Law, M., King, G., King, S., Kertoy, M., Hurley, P. and Rosenbaum, P. et al. 2006. Patterns of participation in recreational and leisure activities among children with complex physical disabilities. *Developmental Medicine & Child Neurology*, 48(5), 337-342.
- Lyons, M. 1987. A taxonomy of playfulness for use in occupational therapy. *Australian Occupational Therapy Journal*, 34, 152-156.
- Majnemer, A., Shevell, M., Law, M., Birnbaum, R., Chilingaryan, G. and Rosenbaum, P. et al. 2008. Participation and enjoyment of leisure activities in school-aged children with cerebral palsy. *Developmental Medicine & Child Neurology*, 50(10), 751-758.
- Meyer, A. 1922. The philosophy of occupational therapy. *Archives of Occupational Therapy*, 1, 1-10.
- Morris, C., Galuppi, B. and Rosenbaum, P. 2004. Reliability of family report for the Gross Motor Function Classification System. *Developmental Medicine & Child Neurology*, 46, 455-460.
- Morris, C., Kurinczuk, J. J., Fitzpatrick, R. and Rosenbaum, P. L. 2006b. Do the abilities of children with cerebral palsy

- explain their activities and participation? *Developmental Medicine & Child Neurology*, 48(12), 954-961.
- Morris, C., Kurinczuk, J., Fitzpatrick, R. and Rosenbaum, P. 2006a. Reliability of the manual ability classification system for children with cerebral palsy. *Developmental Medicine & Child Neurology*, 48(12), 950-953.
- Palisano, et al. 1997. Development and reliability of a system to classify gross motor function in children with cerebral palsy. *Developmental Medicine & Child Neurology*, 39(4), 214- 223.
- Palisano, R., Copeland, W. and Galuppi, B. 2007. Performance of physical activities by adolescents with cerebral palsy. *Physical Therapy*, 87(1), 77-87.
- Palisano, R., Rosenbaum, P., Walter, S., Russell, D., Wood, E. and Galuppi, B. 1997. Development and reliability of a system to classify gross motor function in children with cerebral palsy. *Developmental Medicine & Child Neurology*, 39(4), 214-223.
- Parham, D. 2008. Play and occupational therapy. In D. Parham & L. Fazio (Eds.), *Play in occupational therapy for children*. St. Louis: Mosby.
- Reilly, M. 1974. *Play as exploratory learning*. Beverly Hills, CA: Sage Publications.
- Swinth, Y. and Tanta, K. 2008. Play, leisure, and social participation in educational settings. In D. Parham & L. Primeau (Eds.), *Play in occupational therapy for children* (pp. 301-317). St. Louis: Mosby.
