Original Research Article **Allied Science**

International Journal of Pharma and Bio Sciences **ISSN 0975-6299**

THE PREVALENCE OF DEVELOPMENTAL COORDINATION DISORDER IN SCHOOL GOING CHILDREN OF WEST INDIA

DR. SANJIVANI N DHOTE (PT)[1]*, DR. MANISHARATHI (PHD)[2] AND DR. TUSHARPALEKAR (PH.D)[3]

*[*1]Department of Neurosciences , Dr. D. Y. Patil College of Physiotherapy, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India.*
[2]Department of community based rehabilitation , Dr. D. Y. Patil College of Physiotherapy, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India.
[3]Department of Musculoskeletal , Dr. D. Y. Patil College of Physiotherapy, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India.

ABSTRACT

Development specifies maturation of functions. It is related to the maturation and myelination of the nervous system and indicates acquisition of a variety of skills for optimal functioning of the individual.[1]Considering the importance of timely diagnosis of DCD andthe child's performance on the BOT-2 will allow the physical therapist to identify areas of strength and areas of need in regards to the child's gross motor functioning, and can therefore help to guide treatment.The early diagnosis of DCD can be helpful to prevent the future secondary complications. So purpose of this study is to find out the prevalence of DCD on BOT-2 in 5 to 15 years school going children. : It was a cross-sectional analytical study conducted in schools of Pimpri-Chinchwad area. This study included 516 students assessed by Using BOT-2nd edition. Prevalence of DCD was 1.16% (95%CI 0.43% to 2.51%). Where as female showed more prevalence of Developmental coordination disorder than Male

KEYWORDS: *Prevalence, Developmental coordination Disorder , School going childrens, motor proficiency.*

DR. SANJIVANI N DHOTE (PT)[1]*
Department of Neurosciences ,Dr.D.Y.Patil College of Physiotherapy, Pimpri, Pune, India.

***Corresponding Author**

Received on : 13-03-2017
Revised and Accepted on : 20-05-2017
DOI: http://dx.doi.org/10.22376/ijpbs.2017.8.3.b222-229

INTRODUCTION

Growth is an essential feature of life of a child that distinguishes him or her from an adult. The process of growth starts from the time of conception and continues until the child grows into fully mature adult. The terms growth and development are often used together. These are not interchangeable, because they represent two different fact of dynamics of change, i.e; those of quantity and quality. Growth and development usually proceed concurrently, but may not always be interrelated[1].Since the early 1900s, the scientific community has acknowledged a large group of children with movement skill difficulties who have not been diagnosed with a general medical condition [2]. This difficulty in motor skill competence, observed in children who are developing well intellectually, is termed 'developmental coordination disorder' (DCD). DCD is a recognized syndrome that was described by the World Health Organization in 1992 [3] and has been included in the diagnostic manuals of the American Psychiatric Association since 1989[4] . "Developmental coordination disorder (DCD) is defined, using the Diagnostic And Statistical Manual Of Mental Disorders, Fourth Edition (DSM-IV), as a condition marked by a significant impairment in the development of motor coordination, which interferes with academic achievement and/or activities of daily living (ADL). These difficulties are not due to a general medical condition (eg, cerebral palsy) and are in excess of any learning difficulties is present[5]. DCD is a highly prevalent disorder (5-6% of school-aged children) so it is likely that there is at least one child with DCD in most classrooms. One of the challenges of identifying children with DCD is the variety of ways in which it is revealed.[6] The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) provides four criteria to classify a child as having DCD[4]. The difficulties may be considered to be mild, moderate or severe. Even though this condition is observed by many school teachers, as well as physical and occupational therapists, it is not an easy diagnosis to make due to multi-faceted diagnostic criteria and terminology problems[6]. Outcome measurements used to assess gross motor development in infants and children up to age 5, including the Peabody Developmental Motor Scale[7], second edition and the Alberta Infant Motor Scale[8]. When children age out of either the PDMS-2 or the AIMS, one standardized assessment option physical therapists have is the Bruininks-Oseretsky Test of Motor Proficiency, second edition[9-11.] (BOT-2nd). The test-retest reliability and internal consistency of the total scale were excellent, with an Intraclass correlation Coefficient ICC of 0.99 (95% confidence interval) and alpha of 0.92 The BOT-2 can be used to evaluate a wide variety of fine and gross motor skills for children, teenagers and young adults 4-21 years of age. This is a test that can also be used by Physiotherapist , psychologists, adaptive physical education teachers, special education teachers and educational diagnosticians[9-13]The prevalence of DCD in India is found to be 1.37%. The prevalence of DCD in other countries is estimated to be (5-8%) usa, (1.8%) uk, (5.7%) greek, (5-9%) canada, (1.7%) belgium and 6% worldwide[13-17]. Considering the importance of timely diagnosis of DCD and the child's performance on the BOT-2 will allow the physical therapist to identify areas of strength and areas of need in regards to the child's gross motor functioning, and can therefore help to guide treatment.The early diagnosis of DCD can be helpful to prevent the future secondary complications. Aim of the study is to find out Point score of all subtest motor component, Descriptive category of Composite & Total Motor Composite component by using BOT_2nd in school going children Among Genders& according age group

MATERIALS & METHODOLOGY

The Cross Sectional analytical study was conducted in Pimpri C hinchwad area of age group 5 to 15 years. Total samples 516 were studied. The Subjects were divided according to age groups. Age Group 1 includes 5.0-7.11,age group 2 includes 8.0-9.11,age group3 includes 10.0-11.11,age group 4 includes 12.0-13.11 and age group 5 includes 14.0-15.11.Inclusion criteria were normal healthy school going children. Exclusion criteria were neurological trauma like spinal fractures, any visul problem, or any congenital deficit. BOT™-2nd kit used for assessment.

PROCEDURE

Institutional Ethical committee approval (reference No; DYPCPT/324/2016) was taken to conduct the study. .516 subjects were selected who fulfilling the inclusion criteria. After explaining the purpose of the study to the subject/parent, they were informed that they can withdraw any time during the course of the study without giving reason for doing so.Subjects were selected on the basis of multistage sampling method. In the first stage, 3 English & 3 Marathi schools were selected randomly out of total schools in Area. In 2nd stage, from each standard, any onedivision was selected Randomly . In 3rdstage, from every division, boys and girls of same age were selected by random sampling method. A written informed consent was obtained from the subjects/parents one day prior to the assessment. Proper precautions was taken so that there was no harm to the child.Total children were divided into 5 age groups according to their chronological age. These age groups were divided for sampling convenience and for obtaining proper results. BOT-2nd was used to assess children's motor proficiency. The BOT-2(53 items, 8 subtests and 4 four motor-area composites; score range = 0–320 points) fine manual control (FMC), manual coordination (MC), body coordination (BC) and strength and agility (SA).Subjects were assessed for these tasks and these raw score were converted to a numerical point score. Descriptive analysis done by using manual , they are categorized in to WAA-Well above average , AA- Above Average, A – Average, BA- Below Average , WBA- Well Below Average . Data from all subjects was entered in to computer database & analyzed with SPSS statistical Package (version14.0). Data analyzed by using percentage, mean & standard deviation from total number of sample.

RESULTS & OBSERVATION

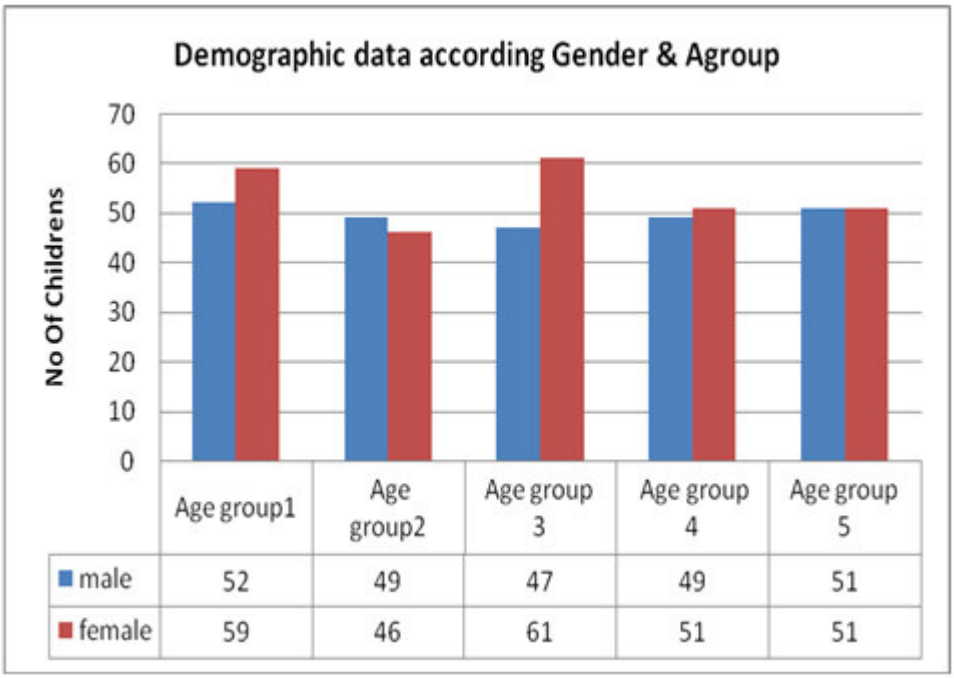


Figure 1
Demographic Data according Gender & Age Group

Table 1
Mean and standard deviation of subtest point score by Age group and Gender

Age Group.	Sex	N	FMP		FMI		MD		ULC		BLC		B		RSA		S	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1 (Age 5,6&7)	COM	111	24.47	5.89	24.97	7.53	19.19	5.73	16.91	9.08	17.35	3.66	31.00	4.94	24.25	4.46	24.04	4.95
	M	59	25.44	5.95	24.76	7.24	19.19	6.08	19.68	9.09	32.81	7.37	30.59	5.99	24.44	4.76	24.15	4.95
	F	48	23.37	5.66	25.21	7.91	19.19	5.36	13.77	8.05	30.67	6.97	31.46	3.38	24.04	4.12	23.90	4.98
2 (Age8&9)	COM	95	30.56	6.40	30.61	6.72	25.08	4.56	27.47	8.32	19.60	6.62	33.43	2.57	29.94	4.39	24.61	4.75
	M	46	30.24	6.21	31.33	6.45	24.59	5.13	30.89	7.25	29.96	5.72	33.33	2.46	31.04	4.81	25.85	3.31
	F	49	30.86	6.63	29.94	6.97	25.55	3.94	24.27	8.04	27.57	7.12	33.53	2.69	28.90	3.71	23.45	5.57
3 (Age 10&11)	COM	108	32.08	5.82	33.06	5.04	29.16	4.51	32.23	6.04	20.95	3.20	33.20	4.17	33.99	4.93	26.52	4.92
	M	61	31.92	6.63	33.61	5.51	29.64	3.91	34.90	3.99	30.97	7.55	33.62	4.60	35.00	4.76	27.46	4.77
	F	47	32.30	4.62	32.36	4.32	28.53	5.16	28.77	6.50	25.72	11.59	32.66	3.52	32.68	4.89	25.30	4.90
4 (Age 12&13)	COM	100	35.33	5.79	34.10	5.71	32.62	4.50	34.02	4.25	22.04	3.28	33.43	2.21	34.67	4.49	27.38	5.54
	M	51	34.78	5.04	35.55	4.34	33.63	4.25	35.63	2.75	28.90	6.14	33.59	2.03	36.51	3.56	28.57	5.24
	F	49	35.90	6.48	32.59	6.57	31.57	4.56	32.35	4.88	28.41	6.53	33.27	2.39	32.76	4.59	26.14	5.63
5 (Age 14&15)	COM	101	36.36	5.45	35.24	4.88	33.78	4.05	35.39	3.82	21.88	3.05	34.20	2.32	34.81	4.55	28.44	3.73
	M	51	37.51	4.96	34.92	5.18	33.49	4.80	36.41	3.47	29.57	6.17	34.41	2.18	36.84	3.96	29.25	3.42
	F	51	35.22	5.71	35.55	4.59	34.08	3.15	34.37	3.92	27.98	8.73	33.98	2.45	32.78	4.22	27.63	3.88

Abbreviation : COM: Combine (Male & female) , N= Total number of sample , SD: Standard Deviation , FMP : Fine Motor Precision , FMI: Fine Motor Integration , MD: Manual Dexterity , ULC: Upper Limp Coordination , BLC : Bilateral Coordination , B: Balance , RSA : Running Speed And Agility

Table2
Mean and standard deviation of Composite& Total Motor composite standard score by Age group and Gender

Age Group.	Sex	n	FMC		MC		BC		S&A		TMC	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1 (Age 5,6&7)	COM	111	25.46	7.90	25.94	8.83	31.81	7.23	34.58	6.83	49.17	9.45
	M	59	27.25	7.92	28.27	7.15	32.81	7.37	35.24	5.71	51.88	9.68
	F	48	23.42	7.45	23.29	9.83	30.67	6.97	33.83	7.90	46.10	8.24
2 (Age 8&9)	COM	95	23.65	9.75	25.91	8.55	28.73	6.55	30.09	5.62	45.06	9.10
	M	46	25.46	9.28	28.96	8.88	29.96	5.72	31.83	5.47	48.39	8.87
	F	49	21.96	9.96	23.04	7.21	27.57	7.12	28.47	5.32	41.94	8.24
3 (Age 10&11)	COM	108	21.05	8.54	27.95	21.09	28.69	9.83	30.31	5.67	42.87	9.04
	M	61	22.97	9.28	29.41	8.65	30.97	7.55	31.49	6.05	46.54	9.42
	F	47	18.55	6.78	26.06	30.51	25.72	11.59	28.77	4.77	38.11	5.78
4 (Age 12&13)	COM	100	23.08	8.81	27.71	7.53	28.66	6.31	28.77	4.84	43.55	8.40
	M	51	23.92	8.24	30.63	7.22	28.90	6.14	30.22	4.22	45.69	7.33
	F	49	22.20	9.37	24.67	6.65	28.41	6.53	27.27	5.02	41.33	8.92
5 (Age 14&15)	COM	101	23.40	9.24	28.05	7.49	28.77	7.56	27.15	4.19	44.94	9.17
	M	51	24.16	9.07	29.84	8.08	29.57	6.17	27.25	4.68	45.45	7.47
	F	51	22.65	9.44	26.25	6.43	27.98	8.73	27.04	3.69	44.43	10.65

Abbreviation: FMC: Fine Manual Control, MC: Manual Coordination, BC: Body Coordination, S& A: Strength and Agility and TMC: Total Motor Composite

Table 3
Prevalence of Developmental coordination Disorder DCD (Motor Deficit)

Motor Deficit		Present	Absent
N=516	%	1.16	98.64

Figure 2
Prevalence of Developmental coordination Disorder DCD (Motor Deficit)

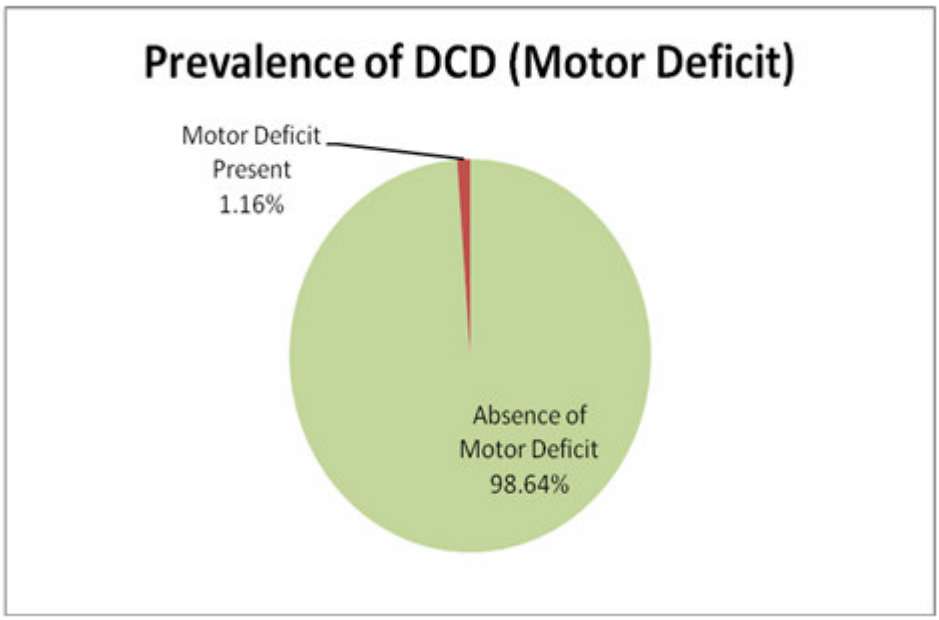
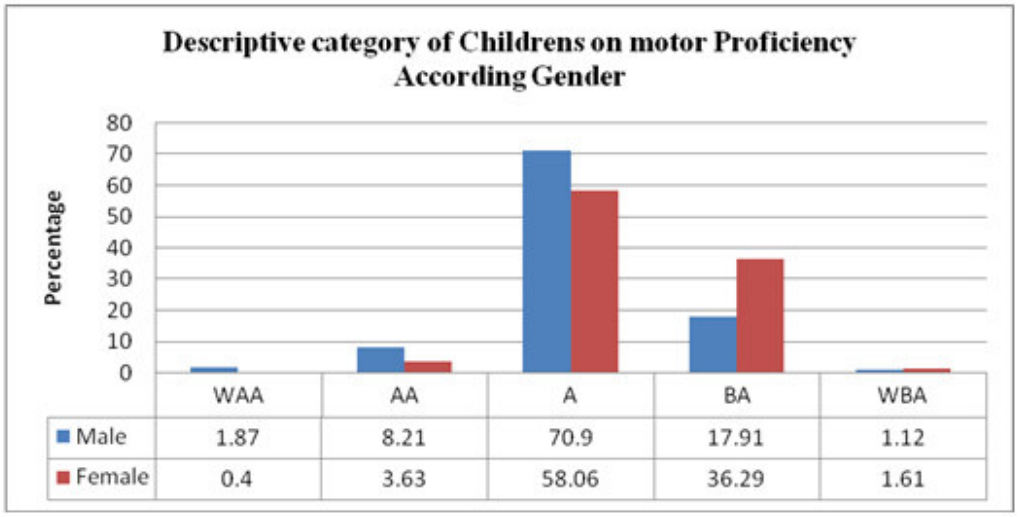


Figure 3
Descriptive category ofChildren on motor Proficiency According Gender



	WAA	AA	A	BA	WBA
Male	1.87	8.21	70.9	17.91	1.12
Female	0.4	3.63	58.06	36.29	1.61

Figure 4
Prevalence of DCD among Male And Female

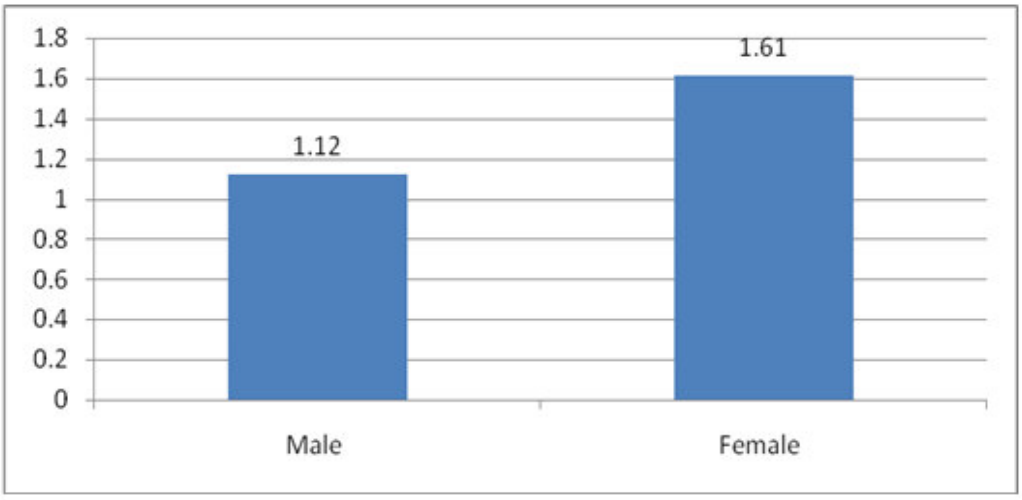
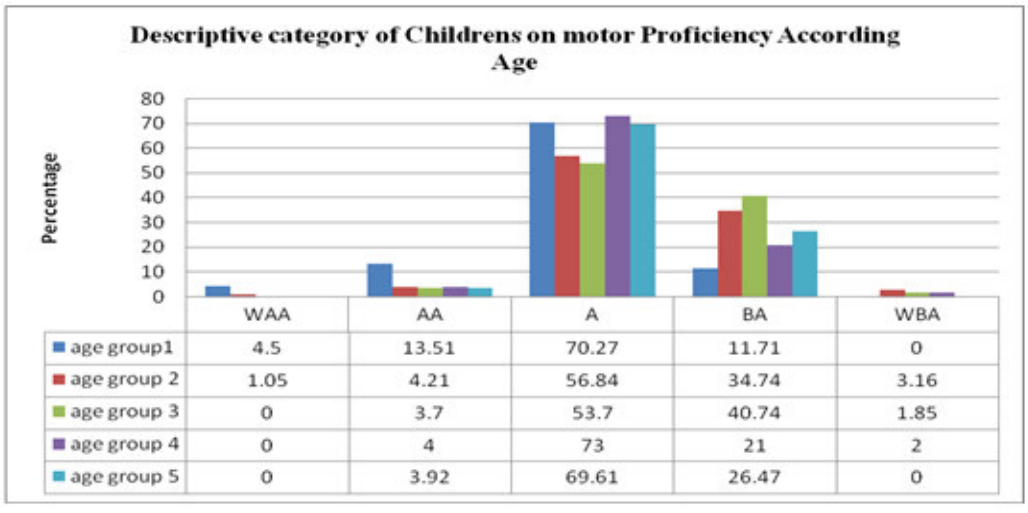
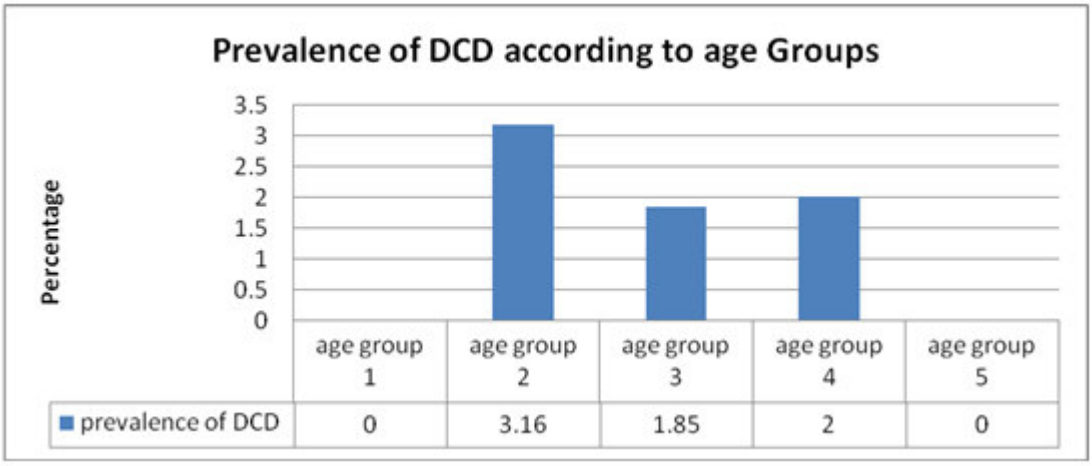


Figure 5
Descriptive category of Children on motor Proficiency According Age Group



	WAA	AA	A	BA	WBA
age group1	4.5	13.51	70.27	11.71	0
age group 2	1.05	4.21	56.84	34.74	3.16
age group 3	0	3.7	53.7	40.74	1.85
age group 4	0	4	73	21	2
age group 5	0	3.92	69.61	26.47	0

Figure 6
Prevalence of DCD among Age Groups



DISCUSSION

The present study was carried out with the aim 1) To find out point score & Descriptive category of all subtest motor component by using BOT-2nded. 2) To find out the prevalence of Developmental coordination disorder by using BOT-2nded in 5 to 15 yr of school going children, and 3) To find out prevalence of developmental coordination disorder according age group and gender. 1stgraph showed Five hundred & sixteen children (Mean age =10.67 years, SD = 3.03) participated in this study among that 248 & 268 were male & female respectively. Table 2 showed linear pattern subtest point score of Motor proficiency according to age group. The use of subtest point score will result in more precise measurement of function, because gain or deterioration will be related to specific area of motor control [18].Barnekow-Bergkvist et al. (1998) found that performance in physical tests; height, weight and physical activity at the age of 13 contributed best of explain adult physical performance and physical activity. Therefore, it may be concluded that so farwhen all thesubtest point score was concerned age factor was responsible for the higher mean value. Age group 4 & 5 having higher age, they had significantly performed better in comparison to Age group 1,2&3 boys & girls. Motor performance is related to lean body mass, general musculature, aerobic capacity and certain psychological state of mind (willingness to accept pain) and development of all of which are influenced by advancement of age. Therefore, it is obvious that Age group 1,2&3 will have less motor quality than that of Age group 4 & 5 because of structural and functional differences with the higher age groups [19]Magalhaes et al., (1989), in their study on the development of bilateral coordination on certain jumping tasks observed improvement in the performance with age in their sample of 5 to 9 years of typical children[20]. Moreover, the motor performance is related to bodystature, body weight, growth spurt, body composition, cardiovascular fitness and muscle strength [22]hence as age increases point score of motor proficiency also get increases. Standard score , Descriptive category of all compositecomponent & total motor composite did not showed any linear pattern of motor development with age growth becauseBrendaN.wilson concluded Standard Score & Descriptive category that have undergone statistically transformation will be less exact in their ability to detect real changes that occurred. Because these standard score are age adjusted , progress will not be reflected in the score unless the progress is faster than typical maturation (which is not likely to occur with children who have motor problem). Therapist should consider using the subtest point score as a accurate measure of change.[18] In this study, we found Prevalence of DCD by Using BOT-2nded. was 1.16% (95% CI 0.43% to 2.51%) from 516 children as they fall under Well below average descriptive category i.e motor deficit. This result showed the similar findings of the study done by Girish, Srilatha et al who showed prevalence of DCD in children between ages of 6-15 years attending mainstream schools in a school district in southern India using criteria of Diagnostic and Statistical Manual of Mental Disorder, Fifth Edition (DSM-5) was 0.8% in Southern India[22]. Another study conducted by Sankar U et.al.found out the prevalence rate of Developmental Coordination Disorder (DCD) at Kattankulathur among 5 - 10 years of age group by using The DevelopmentalCoordination Disorder Questionnaire (DCDQ) was 1.37%[15]. Another study conducted by Georgia D. Tsiotra et.al.investigated whether lifestyle differences between Canadian and Greek children are mirrored in DCD screening results. As compared with their Canadian peers (8%), Greek children exceeded expected DCD prevalence rates (19%) for pediatric populations[16,23]. Greek children demonstrated greater prevalence rates as they were relatively inactive compared with their peers from other countries[24-25]. Limited physical activity may result in a decline in selected fitness-related parameters and deterioration in motor skills acquisition[27]. Present study also showed that females are having more prevalence of DCD than males , however this difference is not statically significant as P=0.915 by Fisher's Exact test. These performance differences in males and females can be due to the nutritional status, as the dietary intake of boys is more than that of girls.(satabdighosh et al 2013)[27].Nutritional status appear to be significant predictor for both fine and gross motor development[27].Similar observations have been reported by other research workers in children of different countries (Bobbio et al., 2007; Chowdhury,Wrotniak, &Ghosh, 2010; Pollitt et al., 1994;)[28-30]. Nutritional status

may alter the learning process by influencing brain development and physical growth and accordingly modify the movement proficiency of the children by adjusting the strength, power, coordination and perception[26] Our study result are in accordance with Girish, SrilathaRaja et.al as in their study prevalence of DCD with girls (1.1%) affected more than boys (0.5%) at confidence interval of 95%. Girls were twice affected than boys[22]. Some researchers stated that girls with low socioeconomic status were less competent in locomotors skills compared with their high socioeconomic status peers (Hardy et al., 2012; Mészáros et al., 2008)[31]. However difference among gender in present study was not statistically significant. It is difficult to make exact comparisons between countries because the estimated prevalence is highly influenced by the means of assessment and the type of sample recruited Developmental coordination disorder in various age group did not show statically significant difference as P=0.219. However Age 8 &9 yrsshowed highest prevalence of DCD (3.16%) fallowed by Age 12 & 13yr (2%). The Indian children under-performed in the bilateral coordination subtest across all age group 7, 8 and 9 as compared to the USA normative sample.This observed developmental variation in the bilateral coordination patterns between Indian children and USA normative sample which may be attributed to the cultural and environmental (school) variations[32] In Bilateral Coordination component no children were found in well Above Average category (WAA) because scale score was not given for this category even though they scored maximum in Bilateral coordination point score. . So need to establish normative data for Indian population is suggested. Limitation of the present study was socioeconomic status, Cardiorespiratory Fitness& Body Mass Index were not considered while finding out the prevalence of DCD. Further studies can be conducted to investigate Motor proficiency of school going children whowere underweight at time of birth and preterm.

CONCLUSION

Prevalence of DCD by Using BOT-2nded. was 1.16% (95% CI 0.43% to 2.51%), where asfemale showed more prevalence of Developmental coordination disorder than Male .

FUNDING ACKNOWLEDGEMENT

The Authors gratefully acknowledge the resources and financial support for the study was provided by, Dr. D.Y.Patil Vidyapeeth, Pune, INDIA. (Grant Number - DPU/21/2016) . The generous support for carrying out the study at Dr. D.Y.Patil college of Physiotherapy , Pimpri, Pune , is also acknowledged.

CONFLICT OF INTEREST

Conflict of interest declared none.

REFERENCES

1. Ghai OP, Gupta P, Paul VK. Ghai essential pediatrics. Diseases of Gastrointestinal System and Liver. 2004 May.
2. Magalhaes L, Missiuna C, Wong S. Revisiting an international consensus 10 years later: Terminology used in reporting research with children with developmental coordination disorder. Dev Med **Child** Neurol Suppl. 2006;48:937-41.
3. World Health Organization. The ICD-10 classification of mental and behavioural disorders: clinical descriptions and diagnostic guidelines. Geneva: World Health Organization; 1992.
4. DSM-IV-TR AP. Diagnostic and Statistical Manual of Mental Disorders.(Rev.) Washington. DC: American Psychiatric Association. 2000.
5. Lingam R, Hunt L, Golding J, Jongmans M, Emond A. Prevalence of developmental coordination disorder using the DSM-IV at 7 years of age: A UK population–based study. Int. Pediatr.. 2009 Apr 1;123(4):e693-700.
6. Prado M, Magalhães LC, Wilson BN. Cross-cultural adaptation of the Developmental Coordination Disorder Questionnaire for Brazilian children. Braz J Phys Ther. 2009 Jun;13(3):236-43.
7. Folio MR, Fewell RR. Peabody developmental motor scales: Examiner's manual. Pro-ed; 2000.
8. Darrah J, Piper M, Watt MJ. Assessment of gross motor skills of at-risk infants: predictive validity of the Alberta Infant Motor Scale. Dev Med Child Neurol. 1998 Jul 1;40(7):485-91.
9. Bruininks RH, Bruininks BD. Bruininks-Oseretsky test of motor proficiency. AGS Publishing; 2005.
10. Laszlo JI. Child perceptuo-motor development: Normal and abnormal development of skilled behaviour. Adv Cogn Psychol. 1990 Dec 31;64:273-308.
11. Burton AW, Miller DE. Movement skill assessment. Human Kinetics; 1998.
12. Wuang YP, Su CY. Reliability and responsiveness of the Bruininks–Oseretsky Test of Motor Proficiency-in children with intellectual disability. Dev Disabil Res Re. 2009 Oct 31;30(5):847-55.
13. Physiotherapy For Children. 1sted. New York: Elsevier Health Sciences; 2007. Chapter no 9. Pg. no.123.
14. Barnhart RC, Davenport MJ, Epps SB, Nordquist VM. Developmental coordination disorder. Phys Ther. 2003 Aug 1;83(8):722.
15. Ganapathy Sankar U, Saritha S. A study of prevalence of Developmental Coordination Disorder (DCD) at Kattankulathur, Chennai. PLoS One . 2011 Jan;5(1).

16. Tsiotra GD, Flouris AD, Koutedakis Y, Faught BE, Nevill AM, Lane AM, Skenteris N. A comparison of developmental coordination disorder prevalence rates in Canadian and Greek children. J Adolesc **Health**. 2006 Jul 31;39(1):125-7.
17. Valentini NC, Coutinho MT, Pansera SM, Santos VA, Vieira JL, Ramalho MH, Oliveira MA. Prevalence of motor deficits and developmental coordination disorders in children from South Brazil. Rev Paul Pediatr. 2012 Sep;30(3):377-84.
18. Wilson BN, Polatajko HJ, Kaplan BJ, Faris P. Use of the Bruininks-Oseretsky test of motor proficiency in occupational therapy. Am J Occup Ther. 1995 Jan 1;49(1):8-17.
19. Paul PK. Comparative Study on Balance and Coordination of 12 and 13 Years BoysInt Multidiscip Res J,2014 jul;,3 (4):138-142
20. Magalhaes LC, Koomar JA, Cermak SA. Bilateral motor coordination in 5-to 9-year-old children: A pilot study. Am J Occup Ther. 1989 Jul 1;43(7):437-43.
21. Liao HF. Relations between balance function and gross motor ability in children developing typically. 物理治療. 2002 Oct 1;27(5):221-30.
22. Girish S, Raja K, Kamath A. Prevalence of developmental coordination disorder among mainstream school children in India. J Pediatr Rehabil Med. 2016 Jan 1;9(2):107-16.
23. Kessler RC, Chiu WT, Demler O, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. AMA Arch Gen Psychiatry. 2005 Jun 1;62(6):617-27.
24. Bouziotas C, Koutedakis Y, Nevill A, Ageli E, Tsigilis N, Nikolaou A, Nakou A. Greek adolescents, fitness, fatness, fat intake, activity, and coronary heart disease risk. Arch Dis Child. 2004 Jan 1;89(1):41-4.
25. Katzmarzyk PT, Malina RM, Bouchard C. Physical activity, physical fitness, and coronary heart disease risk factors in youth: the Quebec Family Study. Tap Chi Y Hoc Du Phong. 1999 Dec 1;29(6):555-62.
26. Koutedakis Y, Bouziotas C. National physical education curriculum: motor and cardiovascular health related fitness in Greek adolescents. Br J Sports Med. 2003 Aug 1;37(4):311-4.
27. Ghosh S, Chowdhury SD, Chandra AM, Ghosh T. A study on the influence of occupation on development of motor activities in children. Int J Adolesc Youth. 2013 Mar 1;18(1):23-31.
28. Bobbio TG, Morcillo AM, Filho AD, Gonçalves VM. Factors associated with inadequate fine motor skills in Brazilian students of different socioeconomic status. Percept Mot Skills. 2007 Dec;105(3_suppl):1187-95.
29. Chowdhury SD, Wrotniak BH, Ghosh T. Nutritional and socioeconomic factors in motor development of Santal children of the Purulia district, IndiaEarly Hum Dev. 2010 Dec 31;86(12):779-84.
30. Pollitt E, Husaini MA, Harahap H, Halati S, Nugraheni A, Sherlock AO. Stunting and delayed motor development in rural West Java. Am J Hum Biol. 1994 Jan 1;6(5):627-35.
31. Hardy LL, Reinten-Reynolds T, Espinel P, Zask A, Okely AD. Prevalence and correlates of low fundamental movement skill competency in children. Hosp Pediatr. 2012 Jul 1:peds-2012.
32. Balakrishnan T, Rao CS. Interrater reliability of bilateral coordination of Bruininks Oseretsky Test of Motor Proficiency (BOTMP) & Performance of Indian Children compared with USA norms.'Indian J Physiother Occup Ther. 2007 Mar 6;38(3):55-60.

Reviewers of this article

Prof Snehal A Ghoder M.Ph.T

Prof Cum Principal,MAEER'S Physiotherapy College ,Talegeon ,Dabhade,Pune ,India

Prof.Dr.Prapurna Chandra Rao

Assistant Proffessor, KLE University, Belgaum, Karnataka

Prof.Dr.K.Suriaprabha

Asst. Editor , International Journal of Pharma and Bio sciences.

Prof.P.Muthuprasanna

Managing Editor , International Journal of Pharma and Bio sciences.

We sincerely thank the above reviewers for peer reviewing the manuscript