



# Primary School Children with Developmental Coordination Disorder and Anxiety: A Case Control Study

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## Abstract

**Background:** The severity of DCD and association of anxiety among school children in Bengaluru is unknown. **Objective:** To find the prevalence of DCD and the association between DCD and anxiety. **Method:** After getting the clearance from ethical committee, 300 school children were interviewed, out of which 208 were included for the study based on the inclusion criteria by using convenience sampling technique. The DCD questionnaire was used to find the probability of DCD and the SCAS assessed symptoms of anxiety among school children correspondingly. Descriptive Statistics, Chi-Square and Odd ratio was used to find the significance of the study using SPSS software. **Results:** out of 208 students 115 were in case group, and 93 in control group. The prevalence of DCD was 55%. A significant difference between the DCD case and control groups was identified using the chi square test score with  $\chi^2 = 208.00$ , ( $p < 0.05$ ), and the difference between the case and control group of anxiety score with  $\chi^2 = 208.00$ , ( $p < 0.05$ ). The relative risk for the DCD group is  $0.87/0.84 = 1.03$ , showing that children exposed to DCD have a 13% higher risk of developing DCD than students who are not exposed. The relative risk for anxiety group is therefore  $0.95/0.9 = 1.04$ , showing that anxiety is around 5% more probable to affect individuals who have experienced it. **Conclusion:** From the survey it is found that children in Bangalore are susceptible to anxiousness. The presence of developmental coordination is impacted by higher frequency of anxiety symptoms reported in school children 8 to 11 years than children who are growing normally.

**Keywords:** Anxiety, DCD, SCAS, School Children

## 1. Introduction

DCD is a defect in development and use of kinetic abilities, making them sluggish or wrong<sup>1</sup>. This exhibits issues with executive function with considerable obstructions to the performance of daily tasks and academic pursuits.

Activities like drawing, writing, or cutting, pulling, donning, and pressing buttons, tying shoelaces riding, exercising,<sup>2,3</sup> and playing<sup>2</sup> as well as skating and climbing are compromised.

The issue of developmental coordination is most diagnosed in children between 6 to 12 years old and this appears to be a widespread problem childhood disorder<sup>4</sup>. Dyspraxia is characterized as “The inability to use voluntary motor talents successfully in parts of life ranging from play to scheduled skilled work” and a breakdown of praxis” [action]<sup>1,2,5</sup>. These activities may cause teachers to feel irritated and seek help from therapists. A youngster who exhibits these qualities could have

a sensory processing disorder that causes proprioception to be compromised. “Proprioception” is described as the sense of the location and movement of the limbs and body in space<sup>1,3</sup>. Such youth are much more inclined to succeed if early intervention developers are accustomed to enhance these kids’ motor skills and coordination skills which are greater likelihood of maintained as a result.

Given the variety of symptoms, determining the origin of DCD there has been challenging. According to several theories, the onset of developmental coordination issues is a symptom of cerebral palsy and may result from birth, perinatal, or neonatal trauma, cellular neuronal injury or malfunction of the neurotransmitter or receptor systems<sup>4</sup>.

In contrast to depression, which has a negative impact on one’s thinking and behaviour and can result depression or a decline of enthusiasm in previously enjoyed activities that one once found enjoyable. Anxiety is a mental disease that

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frequently results in tightness in the muscles and fear of what will happen in the future (American Psychiatric Association, 2013)<sup>29</sup>. To find out how common developmental coordination disorder is among primary school children and to evaluate the relationship between anxiety and developmental coordination disorder were the main objectives of the study.

## 2. Material and Method

Ethical clearance from Krupanidhi College of physiotherapy ethical committee (EC- MPT/21/PHY/005) was obtained for the case control study. A convenience sampling method was used to collect the samples from the subjects.

Subjects were included for the study after satisfying the inclusion criteria as follows.

Kids of age between 8-11 years, from grades third to fifth, both the genders, who had no further related motor abnormalities, screened developmental coordination disorder children were included. Children with neurological or orthopedic issues, severe coordination issues, or visual deficits were excluded. Third to fifth grade schools in Bangalore city were contacted to participate in the study. Formal informed consent was obtained. The questionnaires were distributed among the students and explanation for it was provided. Using the SCAS questionnaire the participants' anxiety levels were further considered because of the population's prevalence of DCD.

Developmental coordination deficits in children and the normal youngsters were divided into a case group and a control group. The Spence Children's Anxiety Scale (SCAS) was utilized to determine the anxiety level and determine whether developmental coordination deficit and anxiety are related.

The (DCDQ), a 15-item assessment this is relevant to youngsters' replies, was utilized to look for warning indicators of DCD 8 to 15-year-olds children at DCD Questionnaire 15-55 points are the age groups for which this instrument is evaluated.

For the signs of depression and anxiety we used the (SCAS), accompanied with a self-reported reaction, to measure the presence of anxiety symptoms among adolescents and teens aged 8 to 15 years. The SCAS has six subscales and 44 closed items, 38 of which are about specific anxiety symptoms. It also has one open question. Obsessive-compulsive disorder, social phobia, and generalized anxiety, issues with separation anxiety, panic attacks and agoraphobia, and fear of bodily harm. To lessen the likelihood of receiving negative answers, six of the 44 closed questions make mention to the child's abilities.

Four options are available: never (zero points), sporadically (1 point), regularly (2 points), and always (3 points). When the t score and overall score are both below 60, it indicates that the kid has severe anxiety symptoms. The connection between these subscales and the child's gender and age was investigated.

### 2.1 Statistical Analysis

For Windows, SPSS (version 29.0) had been used to analyses the data. For the demographic and outcome variables descriptive statistics was performed. Pearson chi square test was carried to find out the significant association between the variables such as DCD and the Spence Children Anxiety scale for anxiety. Relative risk and the odd's ratio have been applied to find out the risk between the variables.

### 2.2 Hypothesis

#### 2.2.1 Null Hypothesis (H0)

There will be no significant association between Developmental Coordination Disorder and anxiety among primary school children.

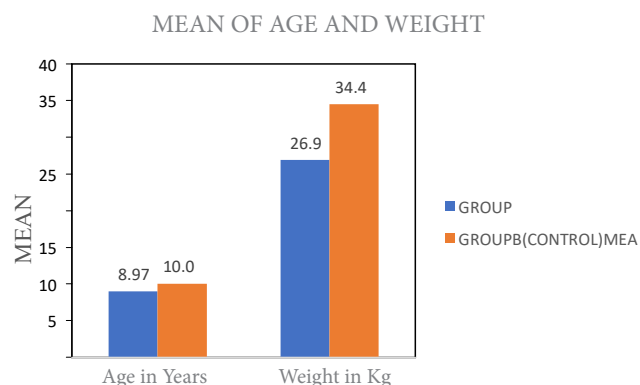
#### 2.2.2 Alternate Hypothesis (H1)

There will be significant association between Developmental Coordinatin Disorder and anxiety among primary school children.

## 3. Results

**Table 1.** Mean of Demographic data - Descriptive statistics

Group		Age (Years)	Weight
Group a (Case)	Mean	8.97	26.90
Group b (Control)	Mean	10.05	34.47

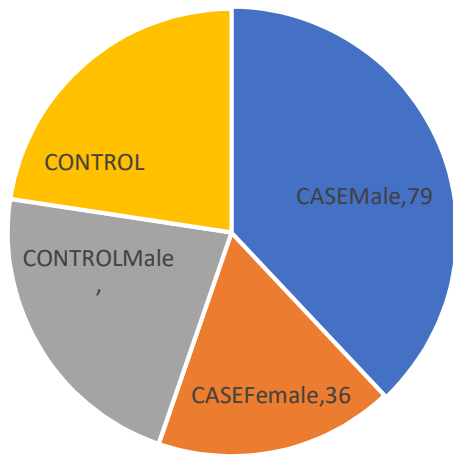


**Graph 1.** Mean of age and weight.

In Table 1 based on the inclusion criteria the age group of 8-11 years students were included for the study. The case group's mean age is 8.97 years, while the control group's average age is 10.0 years. The average age for both the group is having a slight difference in DCD students. The mean weight of group A was 26.90 Kg and the mean weight of group B was 34.47 Kg. The average weight of case group is having a difference when compared to control group students.

**Table 1(a).** Frequency distribution of gender

Gender		Frequency	Percent
Case	Male	79	68.7
	Female	36	31.3
Control	Male	46	49.5
	Female	47	50.5



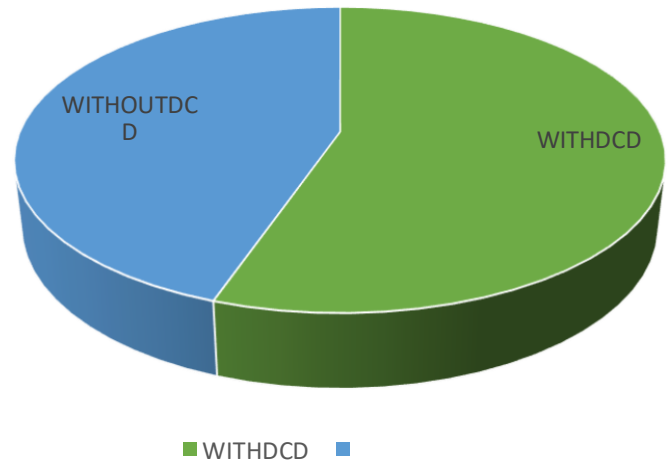
**Graph 1(a).** Frequency distribution of gender.

It is inferred from (Table 1(a) and Graph 1(a)) that out of 208 students 79 were males and 36 were females in case group, the maximum respondents in case group were male when compared to female. In control group 47 were female and 46 were male and the maximum respondents in control group were almost equal.

**Table 2.** Prevalence of DCD

DCD	Prevalance
With DCD	55%
Without DCD	45%

PREVALENCE



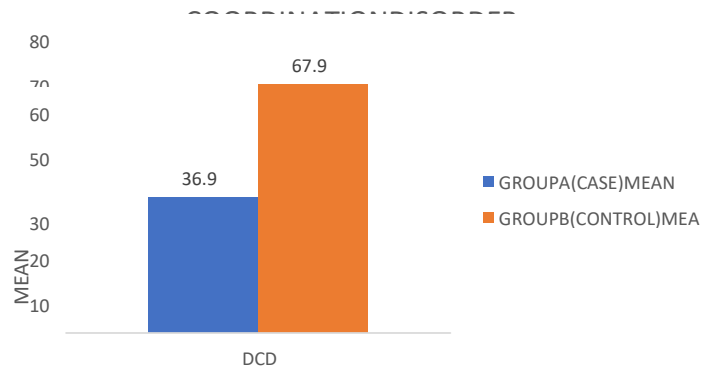
**Graph 2.** Prevalence of DCD.

Out of 208 participants, 55% had Developmental Coordination Disorder whereas 45% were unaffected by it (Table 2 and Graph 2).

**Table 3.** Means of DCD for developmental coordination disorder

Group	Mean	DCD
Group a (Case)	Mean	36.92
Group b(Control)	Mean	67.91

MEAN OF DCD FOR DEVELOPMENTAL

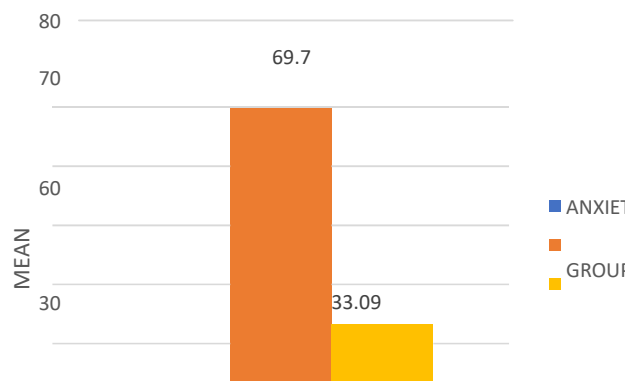


**Graph 3.** Mean of DCD for developmental coordination disorder.

Based on the DCD questionnaire, the students were considered for the study (Table 3 and Graph 3). The normal score for DCD questionnaire is 56-75, the subjects in the case group were scored between 15-55 with mean of 36.92 which indicates positive for DCD with and the subjects in control group were scored between 56-75 with mean DCD score of 67.91.

**Table 4.** Mean of anxiety

Group	Mean	Anxiety
Group a (Case)	Mean	69.71
Group b(Control)	Mean	33.09

**Graph 4.** Mean of anxiety.

Students' anxiety level was calculated based on Spence Children Anxiety scale (Table 4 and Graph 4), the normal score for anxiety is more than 60, the subjects in the case group were scored more than 60 with mean of 69.71 which indicates positive for anxiety for students and the subjects in control group were scored below 60 with mean anxiety score of 33.09 which means the students were not affected with anxiety.

**Table 5.** Chi-Square test for case and control group of DCD and anxiety group Chi Square Tests

Association of DCD and Anxiety		
	VALUE	P
Pearson Chi-Square	208.000	0.001
Pearson Chi-Square	208.000	0.001

The above table 5, show significant difference between the case and control group of DCD score with  $\chi^2 = 208.00$ , ( $p < 0.05$ ),  $P = 0.001$ . The above table show significant difference between the case and control group of anxiety score with  $\chi^2 = 208.00$ , ( $p < 0.05$ ),  $P = 0.001$

This indicates that there is an association between the case and control group of variables between DCD and anxiety score by the obtained results, therefore null hypotheses are rejected and the alternative hypotheses is accepted.

**Table 6.** Relative risk and odds ratio for DCD and anxiety group

	Groups	With Outcome	Without Outcome	Total	Risk	Odds	Relative Risk	Odds Ratio
DCD	Case	100	15	115	0.87	6.67	1.03	1.26
	Control	74	14	93	0.84	5.29		
ANXIETY	Case	110	5	115	0.95	22	1.04	2.07
	Control	85	8	93	0.91	10.6		

The Odds Ratio (OR), which also compares odds, and the Relative Risk (RR), which is commonly referred to as the "Risk Ratio", compare the risks of exposed and unexposed participants (Table 6). A value less than one implies a protective effect, whereas a value larger than one indicates a risk that is harmful. When exposed, a person's risk of contracting a disease increases by 13% (1.10) and by 30% (1.3). The probability of illness is 30% higher in exposed individuals ( $OR = 1.3$ ).

Subjects at variable DCD ('exposed' subjects) the risk is  $100/115 = 0.87$  against an "unexposed" risk of  $74/14 = 0.84$ . Consequently, the relative risk is  $0.87/0.84 = 1.03$ , showing that students exposed to DCD are about 13% more likely to develop DCD than of unexposed group. Using odds, a comparable analysis generates an odds ratio of 1.26, higher than the RR. It shows that the variable is significant, indicating p value less than 0.05. Therefore, for the variable DCD, the alternative hypothesis is accepted and the null hypothesis is rejected.

Similarly for the subjects at variable anxiety ('exposed' subjects) the risk is  $110/115 = 0.95$ , compared to an 'unexposed' risk of  $85/93 = 0.91$ . The relative risk is therefore  $0.95/0.91=1.04$ , indicating that students exposed to anxiety are about 5% more likely to be affected by anxiety than students of unexposed group. A similar calculation with odds gives an odds ratio of 2.07 times, higher than the RR. It shows that the variable is significant, indicating p value less than 0.05 ( $P < 0.05$ ). Therefore, the null hypothesis is rejected and alternate hypothesis is accepted for the variable anxiety.

**Table 7.** Mann Whitney test

Group		Mean Rank	Mann-Whitney U	Z	P
Age in years	Group A (case group)	80.65	2604.5	-6.602	0.000
	Group B (control group)	133.99			
Table 7(a)					
DCD	Group A (case group)	58.11	13	-12.366	0.000
	Group B (control group)	161.86			
Table 7(b)					
ANXIETY	Group A (case group)	151	0	-12.403	0.000
	Group B (control group)	47			

Mann Whitney test is a non-parametric test, it is done to know whether data is equally distributed. In the above Table 7(a), results of the test for age in years were in the expected direction and significant difference,  $Z = -6.602$ ,  $p < 0.05$ . Age in years with case group had mean risk of 80.65 while age in years with control group had mean rank 133.99. In the Table 7(b), the

results of the test for DCD score were significant,  $Z = -12.366$ , ( $p < 0.05$ ). DCD score in case group had mean rank of 58.11, while in control group mean rank of 161.86. In the Table 7(c), anxiety was also significant  $Z = -12.403$ ,  $p < 0.05$ . Anxiety score in case group had mean rank of 151 while in control group mean.

## 4. Discussion

Although what causes DCD is mostly unknown Nervous system issues could be at play. The term “Minimal Brain Dysfunction” several symptoms that reflect learning, attention, and motor coordination deficiencies are characterized by MBD was initially used to describe DCD. Then, MBD was modified to complicated “Minimal Neuro Logical Dysfunction” (MND), which, according to the ICF framework, shows “a different form of perinatally acquired brain dysfunction, which is likely associated with a structural deficit of the brain,” such as bodily functions and structure. There are suggestions that stress causes of premature birth causes MND. Adolescents who deliver prematurely are 6-8 times more prone to acquire DCD and have it been consistent with motor impairments (12.5-50%).

Evaluation of the probability of developmental coordination deficit in primary school students was the aim of the current investigation and the connection between that disorder and anxiety. The study’s outcomes show with that group DCD tend to be less durable than those without it had a much higher prevalence the circumstance and a greater degree of anxiety.

The age range for this study’s findings was 8 to 11 years. Of these age ranges, children under 8 exhibited a higher rate of risk, at 43.5 percent, compared to children in the other age ranges.

The results shows that mean DCD score was  $36.92 \pm 9.820$  for case group and the mean DCD score in control group was  $67.91 \pm 4.706$ . The results of the test for DCD score were significant,  $Z = -12.366$ ,  $p < 0.05$ . DCD score in case group had mean rank of 58.11, while in control group mean rank of 161.86, anxiety was also significant  $Z = -12.403$ ,  $p < 0.05$ . Anxiety score in case group had mean rank of 151 while in control group mean rank of 47. As event rate increases the two ratios diverge and no longer be used interchangeably. In general, anxiety levels were shown to be more typical in young people with DCD.

The relative risk for participants with variable DCD is 1.03, meaning that students exposed to DCD had a 13 percent higher risk of developing DCD in comparison to control group. The odds ratio is greater than the RR and is 1.26. The importance of the variable is demonstrated by the  $p$  value being less than 0.05 (P0.05). The proportional risk for individuals with

varied anxiety (referred to as “exposed” subjects) is also 1.04, meaning that students exposed to anxiety are around 5% more likely to have anxiety than students in the control group. The odds ratio acquired from a comparable calculation using odds is 2.07 times, which is greater than the RR. The relevance of the variable is as shown by the  $p$  value being less than 0.05 (P0.05). As a result, the alternative theory is accepted and the null hypothesis is refuted.

Michelle L. Pratt a, *et al.*, suggested that many kids with DCD have poor emotional wellness has been put out. It is also the initial investigation into the characteristics of anxiety that parents report additionally to documenting stated levels of anxiety on a group and individual level. In order to comprehend why certain children with DCD and adults do relatively well while others experience much worse long-term outcomes regarding their quality of life, the investigation of individual patterns and the specific forms they adopt offers a real opportunity to advance the field<sup>1</sup>.

Hsiu-Fen Chen, *et al.*, suggested that that DCD frequently results in reduced social participation in children, which makes them feel lonely, anxious, and influences their emotional health and that of their families. This essay analyses research that examined how children think with DCD participated in events at school, at home, and in the neighborhood<sup>26</sup>.

According to Deborah Dewey, *et al.*, learning, attention, and psychosocial adjustment issues in children who lack coordination as they develop were investigated (DCD). 78 comparison kids without motor difficulties on standardized motor function tests, 51 children suspected of having DCD, and 45 children with DCD participated. Results showed that teenagers with DCD is suspected to exist performed significantly lower on tests of attention and learning in contrast to comparison kids (reading, writing, and spelling). Parents’ According to reports, children who have DCD and those who may have it also had social problems and somatic complaints at a somewhat high level. These data demonstrate that every child with mobility difficulties is vulnerable<sup>27</sup>.

It is easy to see how experiencing a motor difficulty could result in higher-than-normal anxiety levels from the perspective of daily life. DCD in both children and adults struggle to navigate an extremely complex world because of their challenges. Although noteworthy is the fact that the exact method via which any correlation between motor challenges and anxiety is still unknown, as reported by Piek, Barrett, Smith, Rigoli, and Glasson (2010), suggests that early motor skills may be a good predictor of later anxiety and depressive symptoms in school-aged children.

The source of the problem is that motor impairment and mental health are not recognized as being associated, and DCD is solely recognized as a developmental impairment disorder is owing to a lack of knowledge that mental health

and motor disability are associated, making mental health screening crucial in the DCD population. If the frontal lobes do develop atypically in patients with DCD, this atypical brain disease may result in being present of additional underlying and more subtle problems, including a portion of the group exhibiting heightened obsessive-compulsive behaviour. Alternately, it is possible that this portion of the group is exhibiting anxiety symptoms based on obsessive-compulsive disorder to take action to influence their environment as opposed to for neurological reasons. Numerous individuals having a diagnosis of DCD might believe that their skill set is no more in control. Certain of these children may exhibit signs of obsessive-compulsive anxiety since they believe they already control over an activity when they repeat a specific action or a pattern of comparable conduct that they are worthy of. A hatred of regular change may also be connected to symptoms of obsessive-compulsive anxiety, which would again provide a sense of control.

#### Limitations

- A longer duration study would provide better results.
- The daily activities of subject were not monitored and could have influenced the study.
- Treatment for DCD and anxiety is not included.
- Another drawback is that we only used questionnaires that children responded to check for signs of anxiety and despair. It is recommended that parents and teachers be included as secondary informants to help further the knowledge of the symptomatology examined here both in adolescents having DCD also without.

## 5. Conclusion

The study concludes that the students diagnosed with DCD had more risk of anxiety. These outcomes give rise to questions about intervention, long-term effects, and the characteristics of condition itself by indicating that anxiety is a significant issue for certain students with DCD.

## 6. Acknowledgements

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