Magnitude of Attention Deficit Hyper Kinetic Disorder among School Children of Mysore City

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Authors' contributions

This work was carried out in collaboration between all authors. Authors RM and MK designed the study and wrote the protocol. Author MK translated the study tool. Authors PK and BMS supervised the statistical analysis and reviewed the manuscript. Author SS preformed the statistical analysis, managed the literature search and wrote the first draft of the manuscript with supervision from authors PK and BMS. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Background: Attention Deficit Hyperkinetic Disorder (ADHD) is a highly prevalent disorder of Childhood and adolescence. There are only a few studies reporting the prevalence of this condition.
Methods: This cross-sectional study was conducted in three primary school; children aged 6-10 years of Mysore city, using Conner's 3 Parent short form. A total of thousand hundred and forty five children participated in the study.
Results: The overall prevalence of ADHD was 14.4%. The prevalence of ADHD Inattentive, Hyperactive and Combined type was 4.1, 3.4 and 6.9% respectively. The male female ratio was 1.8:1. Paternal alcohol consumption (OR 2.36) and lack of breast feeding (OR 2.43) were found to be predictors of ADHD. Aggression/Defiance and Learning Difficulties were observed in 63 and 58.2% respectively.
Conclusion: This study noticed a very high prevalence of ADHD. Increasing awareness among parents and teachers about the disorder can lead to early identification and management.

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ABBREVIATIONS

Attention Deficit Hyperactivity Disorder=ADHD; Conner's 3 Parent short form= C3P(S); Inattention= (IN); Hyperactivity/impulsivity= HY; Learning Problems= LP; Executive Functioning= EF; Aggression/Defiance= A/D; Peer Relations= PR; Attention Deficit Hyperactivity Disorder- Combined type= ADHD-C; Attention Deficit Hyperactivity Disorder- predominantly Inattentive type= ADHD-I; Attention Deficit Hyperactivity Disorder- predominantly Hyperactive/Impulsive type (ADHD-H).

1. INTRODUCTION

Children and adolescents constitute around 40% of Indian population. Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common neuropsychiatric conditions of childhood and adolescence. In India, the prevalence of ADHD in Child Guidance Clinics ranges between 8%-20% [1],[2],[3],[4]. This disorder persists into adolescents and adulthood causing secondary psychosocial problems such as early onset alcohol dependence, non-alcoholic substance abuse disorder and anti-social personality disorder [5],[6],[7],[8].

Children's hyperactivity can also be very stressful for the caregivers. Both teachers and parents can find it difficult to handle a hyperactive child, and their tolerance and ability to cope may determine whether it is presented as a problem. The disorder also increases parental stress [9],[10].

Disruptive behavioral disorders and learning disorders are the frequently associated co-morbid condition [11]. Children suffering ADHD are often labeled as naughty/ under-achiever and are not referred. With a steady rise in the juvenile delinquents and increase in crime rates, there is a necessity to emphasis on this particular age group.

This is cross-sectional study was undertaken to know the magnitude of ADHD and the various socio-demographic characteristics associated with it. Sharing the study result will also help in sensitizing the parents and teachers about the disorder.

2. MATERIALS AND METHODS

This cross-sectional study was conducted in Mysore city during January 2014- April 2014. Mysore has 557 schools out of which 390 schools were offering primary school education. The sample size calculation was made on the basis of a study conducted in Coimbatore, India [12] to determine the prevalence of ADHD among primary school children aged 6-11 years, which was found to be 11.33%; considering an absolute precision of 2% with 95% confidence interval, the sample size required for our study was found to be 968.

Two stage sampling was adopted to identify the study participants. The schools offering primary school education in Mysore city was the unit of sampling in first stage. Utilizing the school list as a sampling frame, schools were selected by simple random sampling which was done using random number table. In the second stage all eligible children in the schools were selected till the saturation was met. In this process, three were included for the study.

The tool used was Conner's 3 Parent short form C3P(S) [11]. The Conner's 3 is a focused assessment tool for ADHD and associated issues in children ages 6 to 18 years. Its content scales include inattention (IN), hyperactivity/impulsivity (HY), learning problems (LP), executive functioning (EF), aggression/Defiance (A/D) and peer relations (PR). The Cronbach's alpha for C3P(S) ranges from 0.85 to 0.92 [13]. The tool was validated and had the questions both in English and Kannada. Socio-demographic information was collected using a semi-structured questionnaire.

After acquiring a formal permission from the Principal of each selected schools, school children were briefed about the purpose of the study in their respective class and the study tool along with the parent consent form was distributed. For children who were not living their parents, their guardians were invited to rate the child's behavior. Completed forms were collected over a period of three days. Children of parents who give consent for participation were included in the study. Those children identified with disorder were offered consultation with psychiatrist at a tertiary care hospital.

The raw scores are added up for each content scale and converted to T scores (transformed scores). This transformation was based on the mean and standard deviation of raw scores of a normative sample of American children of the

same age and sex. Transformation was done using Conner's 3rd edition manual. The transformation formula is 50+10[(raw score of a domain – mean of that domain in normative sample)/ standard deviation of that domain in normative sample].

Transformed score of >65 in both inattentive & hyperactive/impulsive domain with elevated scores (>65) in any of the other domain was defined as Attention deficit hyperactivity disorder-combined type (ADHD-C). Elevated scores in only inattentive and any of the other domain was defined as Attention deficit hyperactivity disorder-predominantly inattentive type (ADHD-I) & elevated scores in only hyperactive/impulsive and any of the other domain was defined as Attention deficit hyperactivity disorder-predominantly hyperactive/impulsive type (ADHD-H).

3. RESULTS

The analysis included the data of 1145 primary school children from three schools of Mysore city. For analysis involving socio-economic status analysis, 992 subjects were included due to missing values.

3.1 Socio-demographic Characteristics

The proportion of 6 to 10 year old was 19.8, 20.3, 20.4, 19.5 & 19.9 respectively. There were 578 (50.5%) boys & 567 (49.5%) girls. Majority of the study subjects 1120 (97.6%) lived with their parents.

3.2 Prevalence

Out of 1145 children studied, 165 (14.4%) were found to have ADHD based on C3P(S). The prevalence of ADHD-C was 6.9% (95% CI 5.5, 8.5), ADHD-I 4.1% (95% CI 3.1. 5.3) and ADHD-H 3.4% (95% CI 2.4, 4.5). The prevalence was more in boys18.5% compared to girls10.2%. The male to female sex ratio was 1.8:1. The most common associated problem with ADHD was Aggression/Defiance (63%) followed by learning problem (58.2%).

3.3 Factors Associated with ADHD

The factors which were associated with ADHD are shown in Table 2. The Mean birth weight children with ADHD was 3.13±1.86 as compared to children without ADHD 3.01±0.55 (p value .075) All the variables which were significant in bivariate analysis (Chi-square & unpaired 't' test) were included in regression analysis. Multinomial Logistic regression was used with ADHD status as dependent variable. The reference was children who were classified as normal by the scale. The risk of ADHD-I, ADHD-C and ADHD-H were estimated. Factors which were tested for association were sex, father's and mother's education, type of family, Paternal alcohol consumption, breast feeding, family and sibling H/O similar behavior.

4. DISCUSSION

The prevalence of ADHD in the present study was found to be 14.4% (95% CI 12.33, 16.47)

Table 1. Socio-demographic characteristics of study participants (N=1145)

Socio-demographic characteristics	Number	Percentage
Type of family		
Nuclear family	744	65.0
Joint family	401	35.0
Father's education		
Degree/diploma	772	67.4
High school/PUC	166	14.5
Others	207	18.1
Mother's education		
Degree/diploma	592	51.7
High school/PUC	260	22.7
Others	293	25.6
Father's occupation		
Professional/semiprofessional	217	19.0
Business/agriculturist/clerical	718	62.7
Others	210	18.3
Mother's working status		
Working	239	20.9
Not working	906	79.1

with majority being ADHD-C (6.9%). The male to female sex ratio was 1.8:1. Table 4 compares the results of this study with those present in literature with samples greater than 100 & using standardized diagnostic instruments.

The result of this study was similar to most of the other studies except the studies conducted by Prem Lata Chawla [14], Manilal Gada [15] & Prahbhjot Malhi [3]. The reason for the difference in the first two studies may be due to the stringent diagnostic criteria used. The second study also did not report the prevalence of ADD. The 3rd study which was a hospital based study recorded a lower prevalence than our study. The reason may be due to different age group studied as many studies noticed higher prevalence in older age group [2],[12],[17].

Table 2. Univariate analysis of factors associated with ADHD [Mean±SD or n (%)] (N=1145)

Variable	ADHD-C	ADHD-I	ADHD-H	ADHD-any type	p value
Gender					
Male	54(9.3)	26(4.5)	27(4.7)	107(18.5)	.000
Female	25(4.4)	21(3.7)	12(2.1)	58(10.2)	
Family type					
Nuclear	60(8.1)*	29(3.9)	27(3.6)	116(15.6)	.114
Joint	19(4.7)	18(4.5)	12(3.0)	49(12.2)	
Birth order					
1sr born	45(6.5)	23(3.3)	25(3.60	93(13.4)	
2nd born	30(7.3)	19(4.6)	13(3.1)	62(15.0)	.080
3rd born	3(9.1)	5(15.2)	1(3.0)	9(27.3)	
4th born	1(33.3)	-	-	1(33.3)	
Socio-economic status					
Class I	28(5.7)	12(2.5)	17(3.5)	57(11.7)	
Class II	18(7.4)	8(3.3)	7(2.9)	33(13.6)	
Class III	21(11.7)	5(2.8)	8(4.4)	34(18.9)	.206
Class IV	1(1.5)	4(6.1)	5(7.6)	10(15.2)	
Class V	1(6.2)	2(12.5)	-	3(18.7)	
H/O Breast feeding					
Yes	66(6.2)	40(3.8)	35(33.3)	141(13.3)	.000
No	13(15.7)	7(8.40	4(4.8)	24(28.9)	
Mother working Status					
Working	63(7.0)	33(3.6)	32(3.5)	128(14.1)	.471
Homemakers	16(6.7)	14(5.9)	7(2.9)	37(15.5)	
Paternal alcohol consumption					
Yes	14(13.5)*	3(2.9)	2(1.9)	19(18.3)	.061
No	65(6.2)	44(4.2)	37(3.6)	146(14.0)	
Father's occupation					
Professional/Semi-professional	6(2.8)	1(0.4)	6(2.8)	13(6.0)	
Business/Agriculture/Clerical	52(7.2)	24(11.4)	12(5.7)	95(13.2)	.000
Others	21(10.0)	24(11.4)	12(5.7)	57(27.1)	
Family H/O similar behavior					
No	75(6.7)	40(3.6)	38(3.4)	153(13.7)	.000
Yes	4(15.4)	7(26.9)	1(3.8)	12(46.2)	

Significant difference observed when considered only for ADHD-C

Table 3. Predictors of ADHD

Diagnosis	Variable	Adjusted odds ratio	95% CI	p value
	Sex (male)	2.12	1.28, 3.54	0.004
	Not breastfed	2.43	1.2, 4.92	0.013
	Paternal alcohol consumption	2.36	1.22, 4.55	0.01
ADHD-C	Father being businessmen/clerical/agriculturist	3.18	1.29, 7.83	0.12
	Other occupations	3.39	1.17, 9.77	0.024
ADHD-I	Other occupations	14.18	1.17, 117.3	0.014
	Family H/O	7.56	1.96, 29.08	0.003
ADHD-H	Sex (male)	2.32	1.14, 4.7	0.02

*Nagelkerke pseudo R square= 0.16(16%); *- Father being professional/semi-professional was the referent group in occupation*

Table 4. Indian studies in literature regarding the prevalence of ADHD

Author	Year	Setting	Study population age (yr)	Sample	Instrument	Diagnostic criteria	Prevalence (%) 95% CI	M:F ratio
Prem Lata Chawla [14]	1982	CB	6-12	2160	Modified behavioral checklist	ICD	4.67 3.7, 5.7	4.7:1
Manilal Gada [15]	1987	CB	5-10	321	Modified Conner's Teacher scale	DSM-III[*] (ADDH)	8.10 5.1, 11.1	7.6:1
M.S. Bhatia [4]	1999	HB	3-12	362	Clinical interview	DSM-IV	17.7 13.7, 21.7	3:1
Prahbhjot Malhi [3]	2000	HB	3-12	245	Multimodal assessment	DSM-IV	8.1 4.6, 11.5	5:1
Maya Mukhopadhyay [2]	2003	HB	5-12	238	Clinical interview	DSM-IV	15.5 10.8, 20.2	6.4:1
Venkatesh C [1]	2004	HB	-	251	Multimodal assessment	DSM-IV	20.3 15.2, 25.3	6.3:1
BS Suvarna [16]	2009	CB	4-6	1250	Conner's Global Index	DSM-IV TR	12.2 10.6, 14.0	3.3:1
Venkata JA [12]	2013	CB	6-11	635	Conner's Abbreviated Rating Scale (CARS)	DSM-IV TR	11.33 8.8, 13.8	1.9:1
This study	2104	CB	6-10	1145	Conner's 3 Parent short form	DSM-IV TR	14.4 12.3,16.	1.8:1

CB- Community Based; HB- Hospital Based; ADDH- Attention Deficit Disorder with Hyperactivity
DSM-III classify; ed the disorder as ADDH, ADD (Attention Deficit Disorder without Hyperactivity) & Residual type (ADD-RT)

The prevalence was higher in males with male to female ratio ranging between 1.8:1 to 7.6:1. Higher male to female ratio was noticed in studies which measured the severe form (ADHD-C) & in hospital based studies. This may be due to the higher referral rate for boys & higher level of hyperactivity associated with boys. Present study found sex was an independent predictor for ADHD-C & ADHD-H.

Breastfeeding (not breast fed) was also found to be predictor for ADHD-C in this study, supported by other studies like, a case control study done by Aviva Mimouni-Bloch [18] in Israel on 6-12 yr old, using 2 control group of non-ADHD sibling & non-ADHD hospital control found that lack of breastfeeding at three months as a risk factor.(odds 95% CI 1.46-6.50). Similarly, a cross-sectional study conducted by Hamed JHA [19] in Saudi Arabia found that children who are not breastfed are at a higher risk of ADHD-I.

Contrary to the theory that ADHD has a strong genetic background, family history of similar behavior was able to predict only ADHD-I in our study. This can be attributed to reporting bias, as behavioral/mental disorders in the family are perceived as weakness. However Children with Inattentiveness, because of the commonly associated learning problem, are often labeled as underachiever and this is not considered by the parents as a behavioral disorder. Low socio-economic status showed no association with ADHD and/ or Hyperkinetic disorder in contrast to several studies [4],[12],[14]. This may be due to very less number of study participants in class V socio-economic status according to BG Prasad scale in our study (1.6%). However, father's occupation was significantly associated with ADHD-C & ADHD-I in our study.

5. CONCLUSION

A high prevalence of 14.4% of ADHD among children warrants for an active detection and intervention since, it can significantly affect a child scholastic performance, family and peer relation. It is clear that the prevalence of ADHD varies widely within and outside a country. The reasons for these differences are different diagnostic criteria, different diagnostic approach, different tools even if the approach is same, different study setting, cultural difference in tolerability of hyperactive behavior, rater's psyche. Although the condition is more common in boys in hospital settings, this difference is less at community level. With many independent predictors which are preventable such as breast

feeding and paternal alcohol consumption, addressing these issues would prevent the occurrence and influence the outcomes.

6. RECOMMENDATIONS

Focus on preventable causes such as by creating awareness and promoting breast feeding, awareness on the ill effects of alcohol consumption and its influence on ADHD would bring about substantial benefits in reducing the burden. A standardized tool for parent and teachers to detect ADHD would decrease the arduous task of the present scenario. At community level, a stepped care model proposed by NICE can be applied [20]. This consists of multiple assessments at tier 1 by teachers, parent & other healthcare professional, which in turn would sensitize them about this condition for the early diagnosis & timely referral. Future follow up studies of this cohort planned would reveal about the progress of the disorder.

7. STRENGTHS AND LIMITATIONS

The strength of the study include use of standardized tool, community based study, large sample size and generalizibility of result to the Mysore population. The findings of our study need to be considered alongside the following limitations. Reporting bias are a limiting factor in parents who want to mask the true status of their child. Another limitation was child's behaviour was assessed by only one individual rating, the simultaneous use of teacher's rating scale could have yielded more information. This being a cross-sectional study cannot confirm causality between factors.

INSTITUTIONAL ETHICS CLEARANCE AND CONSENT

The study was approved by the institutional Ethics Committee and formal written permission was obtained from the Heads of each school.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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