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A study of the distribution and determinants of attention deficit hyperactivity disorder in children aged between 6 to 11 years attending a tertiary care hospital in Chennai

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ABSTRACT:-

Background:
Attention Deficit Hyperactivity Disorder (ADHD) is the most prevalent neurobehavioral disorder in children, often leading to negative outcomes such as academic struggles and low self-esteem. Despite its prevalence, a significant percentage of cases remain undiagnosed.

Aims & Objectives:
This study aims to identify the distribution and determinants of ADHD among children aged 6 to 11 years attending a tertiary care hospital in Chennai.

Materials and Methods:
A cross-sectional study was conducted over 12 months (July 2022 - August 2023) at Sree Balaji Medical College and Hospital. A sample size of 430 children was determined based on a prevalence rate of 11.32%. Data were collected using a Personal Information Questionnaire and Conner's Abbreviated Rating Scale. Ethical approval was obtained, and informed consent was secured from parents.

Results:-
In this study, we screened 430 children aged 6 to 11 years at the Pediatric Outpatient Department of Sree Balaji Medical College and Hospital. The distribution of ADHD risk categories, as assessed by the Conner's Abbreviated Rating Scale, revealed that 60% of the participants were classified as low risk, 25% as medium risk, and 15% as high risk. Co-existing conditions were frequently observed in those diagnosed with ADHD, with oppositional defiant disorder (ODD) and anxiety disorders being the most prevalent. Statistical analysis indicated significant associations between ADHD and variables such as family psychiatric history and socio-economic status, with a p-value of less than 0.05.

Discussion:-
The findings of this study align with existing literature that highlights the high prevalence of ADHD among school-aged children. With 15% of the sample falling

into the high-risk category, this underscores the critical need for early screening and intervention in pediatric settings. The identified co-morbidities, particularly ODD and anxiety, reflect the complexity of ADHD as a disorder that often impacts multiple facets of a child's life. Additionally, the significant associations with socio- economic factors suggest that children from disadvantaged backgrounds may be at a heightened risk, necessitating targeted interventions. Given the global prevalence rates of ADHD, which range from 5.3% to 9.2%, our findings provide important local data that can guide healthcare strategies and resource allocation. Ultimately, this study emphasizes the urgency for increased awareness, screening, and therapeutic approaches for ADHD within pediatric healthcare frameworks, as early detection and intervention are vital for improving educational and psychosocial outcomes for affected children.

INTRODUCTION:-

Attention Deficit Hyperactivity Disorder (ADHD) is the most prevalent neurobehavioral disorder in children [1]. Children with ADHD often experience negative outcomes such as family conflicts, injuries, academic struggles, and low self-esteem [2]. Despite this, 60-80% of childhood ADHD cases go undiagnosed, often persisting into adolescence and adulthood, where they are linked to substance abuse, unemployment, and difficulties in social and work environments [3]. This is particularly concerning given that early detection and treatment of ADHD can significantly improve a child's educational and psychosocial development [4]. Polanczyket al. estimated a global prevalence of ADHD at 5.3% (95% CI; 5.01-5.56) [5], while studies conducted in Kinshasa reported prevalence rates of 6% and 8%, respectively [6,7]. The Kinshasa study also found that ADHD was associated with poor academic performance and family health issues [6]. Additionally, Atwolietal. observed a prevalence rate of 9.2% among university students in Kenya [8].

ADHD is often accompanied by co-existing conditions, such as oppositional defiant disorder (ODD) in 35.2% of cases, conduct disorders (26%), anxiety disorders (26%), and depression (18%) [9]. Theseco-morbidities, particularly ODD, can lead to more severe clinical presentations and poorer outcomes. In some instances, ADHD is linked with antisocial behavior, and when combined with other disorders, it is associated with worse neurocognitive outcomes [10].

Childhood behavioral disorders like ADHD are also predictive of lower academic achievement and early school dropout. Breslau et al. found that attention problems were the strongest predictor of poor academic performance in a study of 700 children, as students with inattention are inefficient learners, limiting their ability to acquire essential skills for higher education [11].

Moreover, ADHD has been linked to a higher risk of unintentional injuries, astraits such as impulsivity, inattention, and risk-taking behavior make children more prone to accidents [12,13]. Injuries such as head trauma or burns before the age of two may indicate the presence of ADHD-related behavioral traits [14]. Merrill et al. discovered that children with ADHD were more likely to experience injuries like sprains, open wounds, and fractures.
Severe injuries, such as skull fractures and spinal cord injuries, were three times more common in children with ADHD [15].
Our study aims to identify the distribution and determinants of attention deficit hyperactivity disorder in children aged between 6 to 11 years attending a tertiary care hospital in Chennai

AIMS AND OBJECTIVES:-

AIM:-

To study the distribution and "determinants of ADHD among children aged 6 years to 11 years

OBJECTIVES:-
Primary Objective:

To identify the distribution of Attention Deficit Hyperactivity Disorder among children aged 6 years to 11 years attending a Tertiary" care hospital in Chennai.

MATERIALS AND METHODS:

Secondary Objective:

To identify the various determinants of ADHD

The preset study is a Cross-sectional study conducted in the Department of Paediatrics, Sree Balaji Medical College and Hospital in Children aged between 6 years - 11 years attending Paediatric OPD.

The study was conducted for a period of 12 months from July" 2022 – August 2023. The sampling method that was followed was Purposive sampling

The sample size was calculated considering the prevalence of ADHD in children aged 6 to 11 years in Tamil Nadu as 11.32% based on a study by Venkata JA etal[36] and with a precision of 3%. The sample size calculated was 430

N = Z2 x P x Q /L2

Z2 - 95% two-tailed probability with a 1.96 confidence

intervalP (%) - Prevalence

L (%) - Precision

N = 1.96 x 1.96 x 11.3 x 88.7 / 9

N = 427.83

Consequently, 428 was the total sample size needed for the investigation. We used 430 samples as our minimum sample size.

ELIGIBILITY CRITERIA:-

INCLUSION CRITERIA:-

Children aged 6 years to11 years of age attending Paediatric OPD atSree Balaji Medical College and Hospital

EXCLUSION CRITERIA:-

Children with severe physical disabilities

Children with very low IQs less than 70

Children with other Psychiatric Disorders like Autism

Data Collection Tools and Methods:
Data collection utilized a Personal Information Questionnaire and Conner's Abbreviated Rating Scale. The questionnaire captured demographic information, including the child's name, age, gender, place of residence, family structure, birth details (gestational age, mode of delivery, birth weight), consanguinity, mother's educational level, socio-economic status (based on BG Prasad classification, Jan 2021), family psychiatric history, feeding practices, birth order, and history of birth asphyxia.

Study Participants and Screening Process: A total of 430 children, aged 6 to 11 years,

were screened based on inclusion and exclusion criteria. Informed consent was obtained from their parents. The screening process, which took approximately 15-20 minutes per child, included parents completing the Conner's Rating Scale to assess ADHD risk. Based on the T score system, children were classified into low (<60), medium (60-70), and high (>70) risk categories. Those in the medium to high-risk range were referred for further diagnosis using the DSM-5 criteria.

Ethical Approval and Data Collection: The study received approval from the Institutional Human Ethics Committee of Sree Balaji Medical College and Hospital (Reference No. SBMC/IHEC/2022/1730). Written informed consent was obtained from parents or guardians, and data were collected using a semi-structured questionnaire.

Statistical Analysis: Data analysis was conducted using SPSS Version 29. Categorical variables were summarized as frequencies and percentages, with graphical displays. The odds ratio and Chi-square test were used to analyze associations between variables, with statistical significance set at $p < 0.05$.

RESULTS:-

Table 1: Socio-demographic details of the participants

Socio-Demographic Details	FREQUENCY (N=430)	PERCENTAGE (%)
Age (years)		
6-7	135	31.40
8-9	159	36.98
10-11	136	31.63
Gender		
Male	248	57.67
Female	182	42.33
Socio-Economic Class		
Class – I	21	4.88
Class – II	69	16.05
Class – III	173	40.23
Class – IV	125	29.07
Class – V	42	9.77
Educational Of The Mother		
Illiterate	43	10.00

School	267	62.09
Graduate and above	120	27.91
Mode of delivery		
LSCS	196	45.58
NVD	234	54.42
Type Of Feeding		
Bottle feeding	34	7.91
Breastfeeding	396	92.09

Table 1 represents the Socio-demographic details of the participants .Out of the 430 children, 159(36.98%) were in the 8–9 age range, 248 (57.67%) were males 173(40.23%) children belong to class III socio-economic status.Ten percent (43) of the mothers of the children were illiterate, compared to 267(62.09%) and 120(27.91%) of the mothers of the children. 234(54.42%) of the children were born via normal vaginal delivery and 396(92.09%) of the children were breastfed.

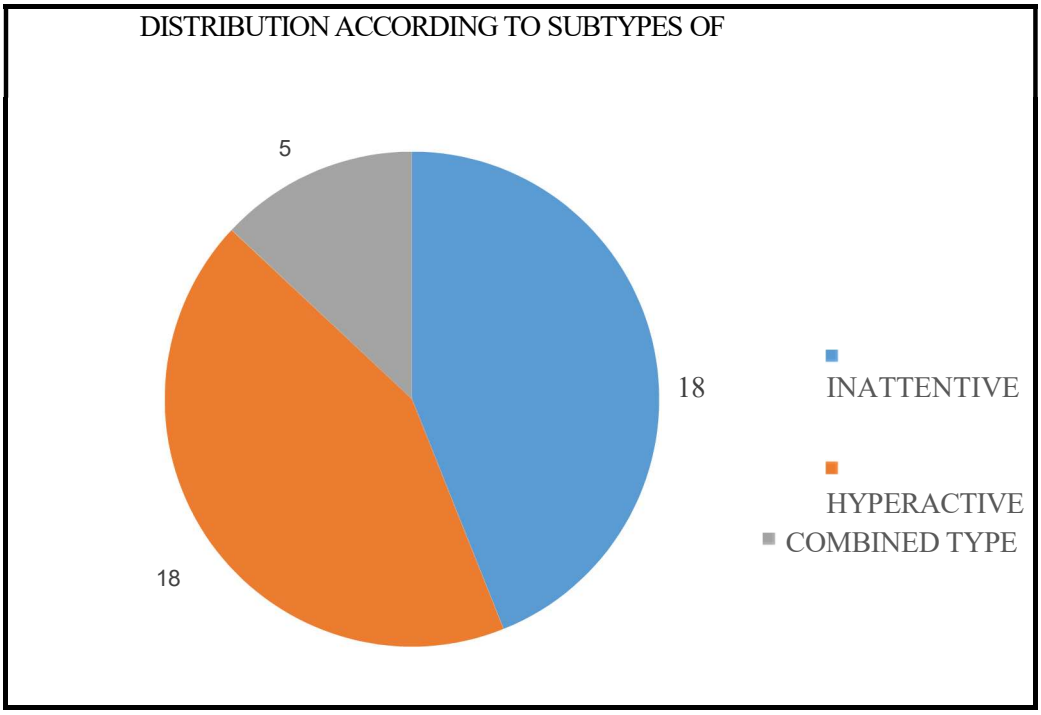

Fig 1 : Distribution According to Subtypes of ADHD

Table 2 : Association of socio-demographic variables with ADHD

socio-demographic variables		ADHD		ODDS RATIO	95% CI	P-VALUE
		YES N=41(%)	NO N=389(%)			
Age	6-8	9(6.67)	126(93.33)	-	-	0.003*
	8-9	25(15.72)	134(84.28)			
	10-11	7(5.15)	129(94.85)			
Gender	Male	31(12.5)	217(87.5)	2.46	1.17-5.15	0.02*
	Female	10(5.5)	172(94.5)			
Socioeconomic status	Class I -III	19 (46.3)	244 (62.7)	0.51	0.27-0.98	0.040*
	Class IV & V	22 (53.7)	145 (37.3)			
Educational status	Illiterate	4(9.7)	39(10)	0.97	0.33-2.87	0.956
	Literate	37 (90.3)	350 (90)			
Consanguinity	Consanguinous	9(20)	36(80)	2.76	1.22-6.23	0.01*
	Non-consanguinous	32(8.3)	353(91.7)			
Family H/O ADHD/psychtric disorders	Yes	14(15.1)	79(84.9)	2.04	1.02-4.06	0.04*
	No	27(8)	310(92)			
Type of family	Nuclear	31(9.5)	294(90.5)	1.01	0.47-2.12	0.99
	Joint	10(9.6)	95(90.4)			
Type of delivery	C-section	26(13.3)	170(86.3)	2.23	1.15-4.35	0.02*
	Nvd	15(6.4)	219(93.6)			
Gestation	Preterm	6(24)	19(76)	3.34	1.25-8.91	0.01*
	Term	35(8.6)	370(91.4)			

Type of feeding	Bottle feeding	10(29.41)	24(70.59)	4.91	2.15-11.18	0.002*
	Breastfeeding	31(7.83)	365(92.17)			
Birth order	1-2	30 (73.2)	298 (76.6)	0.83	0.4-1.73	0.622
	>/=3	11 (26.8)	91 (23.4)			
Birth weight	LBW	15(16.3)	77(83.7)	2.34	1.18-4.63	0.01*
	Normal	26(7.7)	312(92.3)			
Birth asphyxia	Yes	9(9.9)	82(90.1)	1.05	0.48-2.29	0.9*
	No	32(9.4)	307(90.6)			

P value <0.05- statistically significant

Table 2 illustrates the association between socio-demographic factors and ADHD. In children aged 6-7 years, 9 (6.67%) had ADHD, while 126 (93.33%) did not. Among 8-9-year-olds, 25 (15.72%) had ADHD, compared to 134 (84.28%) without ADHD. For those aged 10-11 years, 7 (5.15%) had ADHD, and 129 (94.85%) did not. A significant relationship between age and ADHD was observed ($X^2 = 11.38$, $p = 0.003$). ADHD was more prevalent in males (12.5%) than females (5.5%), with males being 2.46 times more likely to develop ADHD (OR = 2.46, 95% CI [1.17 - 5.15], p = 0.02).

In terms of socioeconomic status, 11 (26.19%) of children from class V had ADHD, while lower percentages were reported in higher classes. A significant link between socioeconomic status and ADHD was found ($X^2 = 16.44$, $p = 0.003$). Consanguinity was also significantly associated with ADHD (OR = 2.76, p = 0.01).

Children with a family history of psychiatric disorders were more likely to develop ADHD (p = 0.04; OR = 2.04), whereas maternal education, family structure, and birth asphyxia were not statistically significant. ADHD was more common in children born via C-section (13.3%) compared to vaginal delivery (6.4%) (p = 0.02), and in preterm births (24%) versus full-term (8.6%) (p = 0.01). ADHD prevalence was higher among bottle-fed children (29.41%) than breastfed ones (7.83%) (p = 0.0002). Low birth weight was also significantly related to ADHD (OR = 2.34, p = 0.01). No significant association was found between ADHD and birth order.

DISCUSSION:-

In the present study, the prevalence of ADHD was determined to be 9.54%, aligning closely with the findings of Venkata JA etal[16]., who reported a prevalence of 11.32% among elementary school students. Another study conducted by Sharma P etal[17]. found a lower prevalence of 6.34%, which did not match the current study's results. The disparity in prevalence rates among different studies may stem from variations in diagnostic criteria, sample populations, and regional factors. These differences highlight the complex nature

of ADHD diagnosis and prevalence across different demographics.

In the current study, children aged 8 to 9 were found to be significantly more likely to have ADHD compared to children aged 10 to 11 and 6 to 7. A statistically significant correlation between age and ADHD was established ($X^2 = 8.4$, $p=0.02$). Supporting this, Wamulugwa J et al. reported that 82% of children with ADHD were under the age often and were four times more likely to have ADHD compared to older children. Similarly, Venkata JA etal[16]. noted the highest ADHD prevalence in children aged 9 and 10 years. The consistency of these findings across multiple studies suggests a peak in ADHD prevalence in middle childhood, which may be linked to developmental and cognitive factors specific to this age group.

Gender also played a substantial role in ADHD prevalence in the current study, with males showing a higher association with ADHD. This finding was supported by a study by Jennifer L. et al., which identified male gender as a significant risk factor for ADHD. Wamulugwa J et al[18]. also reported that male participants had a three-fold higher likelihood of having ADHD compared to females. Similar trends were observed in research by Sharma P etal. and Venkata JA etal[16]., which both found a higher occurrence of ADHD in males. Conversely, Catherine et al. reported no significant gender-based differences in ADHD prevalence, underscoring the variability in findings across different populations and studies. Overall, male gender appears to be a consistent risk factor in many studies, though the strength of this association can vary.

Children from lower socioeconomic class (V) were significantly more likely to have ADHD in the current study ($p=0.001$). This aligns with the study by Larsson H etal[19]., which found that children from lower-income families had a higher likelihood of developing ADHD. Similarly, Venkatesh C et al. identified a correlation between lower socioeconomic status and ADHD, noting that many children with ADHD were first-borns and belonged to middle or lower socioeconomic classes. These findings reinforce the broader understanding that socioeconomic factors, including access to healthcare and educational resources, play a critical role in the development and diagnosis of ADHD. Families from lower socioeconomic backgrounds may experience heightened stress and reduced access to interventions, potentially exacerbating the symptoms of ADHD.

Regarding maternal education, the current study found no significant correlation between the mother's educational status and ADHD ($p=0$). However, this finding contrasts with research by Jennifer L. et al[20]., which indicated that children whose parents had lower levels of education were at a higher risk for ADHD. Wamulugwa J et al. similarly found that children with caregivers who had no formal education were three times more likely to

have ADHD. Gurevitz M etal. also reported that lower maternal education was substantially associated with ADHD, while Spencer NJ etal[21]. observed a protective effect of high maternal education. These divergent findings may be influenced by cultural, social, and economic differences in the populations studied, suggesting that while maternal education can be a factor in ADHD, its significance may vary depending on context.

In the present study, consanguinity was found to be significantly associated with ADHD ($p=0.01$), with children born to consanguineous parents being 2.76 times more likely to develop the disorder. This finding is in contrast to the study by Ayyoub Maleket al., which did not find a significant association between consanguinity and ADHD. Similarly, Javad Golmirzaeiet al. reported a significant correlation between ADHD and children born to non-consanguineous parents. The genetic complexity of ADHD, combined with cultural practices of consanguineous marriages in certain regions, may explain the conflicting results across these studies. Consanguinity could influence genetic predisposition, but this effect may be more pronounced in specific populations.

The family history of psychiatric disorders or ADHD was another factor significantly associated with ADHD in the current study ($p=0.04$). Children with a family history of ADHD or psychiatric conditions were 2.04 times more likely to have ADHD compared to those without such a history. These findings are consistent with studies by Amiri S et al. and Gurevitz M etal., both of which identified a significant link between family psychiatric history and ADHD. Van Dyk L et al[22]. and Hoang HH etal. also reported a similar correlation, emphasizing that genetic and familial factors play a crucial role in the etiology of ADHD. The consistent association between ADHD and family history across studies underscores the importance of genetics and shared environmental factors in the development of the disorder.

In contrast, the type of family (joint or nuclear) was not significantly associated with ADHD in the present study. However, Pawan Sharma et al. found a significant correlation between ADHD and joint families, while Venkatesh C et al. identified a strong link between ADHD and nuclear families. These varying results may reflect differences in family dynamics, social structures, and cultural practices, suggesting that while family type may influence ADHD, it is not a universal determinant.

The current study also found a significant association between ADHD and C-section deliveries ($p=0.02$), with children born via C-section being 2.23 times more likely to have ADHD. This finding aligns with studies by Amiri S et al. and Fahimeh Soheilipour et al[23]., which both found a significant relationship between cesarean deliveries and ADHD. However, Jamal H etal. reported no significant association, indicating that while C-sections may be a risk factor, further research is needed to fully understand the nature of

this relationship. -

Premature birth was another significant factor in the present study, with preterm children being 3.34 times more likely to have ADHD (p=0.01). This result is supported by studies from Sucksdorff M etal[25]. and Lindstrδm K et al., both of which found that preterm births increased the risk of ADHD. Preterm delivery can lead to neurodevelopmental challenges, which may contribute to the higher prevalence of ADHD in this population. However, Jamal H etal. did not find a significant link between preterm birth and ADHD, further highlighting the complexity of this relationship.

In conclusion, the present study identifies several factors significantly associated with ADHD, including age, gender, socioeconomic status, family history, mode of delivery, and prematurity. These findings are largely consistent with existing literature, though some discrepancies exist, particularly regarding maternal education and consanguinity. This highlights the multifactorial nature of ADHD, with both genetic and environmental factors playing key roles in its development. Further research is needed to clarify the relationships between these variables and to develop targeted interventions for children at risk.

SUMMARY:

The present study identified a prevalence of 9.54% for ADHD in children aged 6 to 11 years. Statistically significant associations were observed between ADHD and several factors, including male gender, lower socioeconomic status, consanguinity, a family history of psychiatric disorders or ADHD, C-section deliveries, preterm births, bottle feeding, and low birth weight. Conversely, no significant associations were detected with birth order, type of family, or birth asphyxia. These results highlight the importance of sociodemographic and familial influences in the onset of ADHD. In response, it is recommended to implement parent training programs, improve school health services for timely identification, and encourage effective behavior management strategies in both home and school settings.

LIMITATIONS:-

- Due to the relatively small sample size, the study was unable to assess the impact of several potential confounding factors that may have influenced the causation of ADHD in the study population.
- Another major limitation of this study is the insufficient research on the etiology of ADHD in children aged 6 to 11.
- As a single-center investigation, the findings of this study cannot be generalized to a wider population.

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