



## **IMPACT OF PRENATAL MATERNAL STRESS ON INCIDENCE OF ADHD IN CHILDREN OF THIRUVANANTHAPURAM DISTRICT**

**Dr Nithya VinayaKumar**

*Research Associate, International Centre for Technological Innovations.*

### **ABSTRACT**

*ADHD is a common neurodevelopmental disorder, with a prevalence of around 7.2% in children. Studies suggest that women who experience high levels of stress during pregnancy are more likely to have children with behavioural disorders, like ADHD or conduct disorder. The primary objective of this study is (i) To identify the association between ADHD and Prenatal Maternal stress (PNMS). (ii) To compare the contribution of dependent and independent factors to the incidence of ADHD in children. Secondary objectives are (i) To identify the gender difference in the prevalence of ADHD. (ii) To determine the severity of ADHD in children whose mothers suffered stress during pregnancy. A retrospective study conducted at a Government Hospital during the year 2018-2019, where ADHD of children confirmed using DSM-IV, 1994 (Diagnostic and Statistical Manual of Mental Disorders) and PNMS (Prenatal maternal stress) of mother, scaled using LES (Life experience survey) questionnaire. Results shows a high prevalence of ADHD in children whose mothers' suffered stress during pregnancy. There arises an awareness of the family and private sector to lessen the stress and work load on the expected mothers.*

**KEY WORDS:** *ADHD (Attention Deficit Hyperactive Disorder), PNMS (Pre Natal Maternal Stress), DSM IV.*

### **INTRODUCTION**

Attention Deficit Hyperactivity Disorder (ADHD) is highly prevalent in children worldwide and its prevalence in adults is increasingly recognized (Faraone, 2003). ADHD is a common neurodevelopmental disorder, with a prevalence of around 7.2% in children (Thomas R., 2015). ADHD is a disorder that makes it difficult for a person to pay attention and control impulsive behaviours. He or she may also be restless and almost constantly active. ADHD is not just a childhood disorder. Although the symptoms of ADHD begin in childhood, ADHD can continue through adolescence and adulthood. Even though hyperactivity tends to improve as a child becomes a teen, problems with inattention, disorganization, and poor impulse control often continue through the teen years and into adulthood (NIMH, 2016). While the exact cause of ADHD is not clear, research efforts continue. Factors that may be involved in the development of ADHD include genetics, the environment or problems with the

central nervous system at key moments in development. Risk factors for ADHD may include: blood relatives, such as a parent or sibling, with ADHD or another mental health disorder, exposure to environmental toxins — such as lead, found mainly in paint and pipes in older buildings, maternal drug use, alcohol use or smoking during pregnancy, premature birth (MFMER, n.d.). A new study suggests that women who experience high levels of stress during pregnancy are more likely to have children with behavioural disorders, like ADHD or conduct disorder. Researchers conclude that helping mothers manage prenatal stress may help temper behavioural issues once their child is born. Stress during pregnancy can alter a fetus' brain development, researchers said — leading to changes that result in academic, social, and behavioural difficulties (Devon Frye, 2017).

Prenatal influences have received increasing attention as potential causes of ADHD (Latimer et.al,

2012), mainly due to the hypothesis that prenatal exposures predispose individuals to disorders such as ADHD through fetal programming. Fetal programming refers to a process where factors in the intrauterine environment are hypothesized to influence the normal development of the fetus. Prenatal exposures, such as maternal stress, might permanently influence the structure, physiology and metabolism, causing long-lasting changes that might predispose individuals to later disorders (Baker, 1998). Prenatal stress has been suggested to influence the child's neurodevelopment and later risk of developing ADHD through exposure to high levels of maternal glucocorticoids (stress hormones), through impaired intrauterine blood flow, or through DNA methylation (Baker, Walton & Cecil, 2018).

Maternal stress can be dependent and independent. Dependent events, that is, events that are likely the result of the individual's own behaviour (e.g. financial problems or divorce), are more heritable than independent events, that is, events that are probably unrelated to the individual's own

behaviour (e.g. death of a relative) (Kendler & Baker, 2007).

The exposure of an expectant mother to stressful situations can influence the cognitive, behavioural and physical development of the children. In addition it may result in an increased risk of other mental health disorders, such as autism and depression. Effect on cognition: Many recent human research findings have shown that acute prenatal stress affects children's cognition – or ability to think. Effect on behaviour: There is consistent evidence demonstrating that prenatal maternal stress affects the behaviour of children. Children exposed to this stress may show difficulties with paying attention, and have aggressive attitudes. Physical effects: Recent research findings have demonstrated that obstetrical complications, low birth weight, and delayed physical development may all be influenced by prenatal maternal stress. Effects on mental health: Prenatal exposure to stressful events is associated with an increased risk of autism, schizophrenia and depression of the child (DMHUI, 2013).

**SIGNS AND SYMPTOMS:** Symptoms include limited attention and Hyperactivity

SI No.	SIGNS AND	SYMPTOMS
1.	BEHAVIOURAL	Aggression, excitability, fidgeting, hyperactivity, impulsivity, irritability, lack of restraint, or persistent repetition of words or actions.
2.	COGNITIVE	Absent - mindedness, difficulty focusing, forgetfulness, problem paying attention, or short attention span.
3.	MOOD	Anger, anxiety, boredom, excitement, or mood swings.
4.	ALSO COMMON	Depression, or learning disability.

The available diagnostic tools for ADHD in children: (CHADD, n.d.)

SI No.	DIAGNOSTIC TOOL FOR ADHD IN CHILDREN	REVISED EDITIONS
1.	American Psychiatric Association's Diagnostic and Statistical Manual (DSM) (WebMD, n.d.).	<ul style="list-style-type: none"> <li>• DSM-I, 1952</li> <li>• DSM-II, 1968</li> <li>• DSM-III, 1980</li> <li>• DSM IV, 1994</li> <li>• DSM-IV-TR, 2000</li> </ul>
2.	Child Behaviour Checklist (CBCL/6-18)	
3.	Conner's Rating Scales	<ul style="list-style-type: none"> <li>• Conner's Parent Rating Scale-Revised for parents/caregivers,</li> <li>• Conner's Teacher Rating Scale-Revised for teachers,</li> <li>• Conner's-Well's Adolescent Self-Report Scale for teenage.</li> </ul>
4.	Vanderbilt ADHD Rating Scales	<ul style="list-style-type: none"> <li>• Vanderbilt ADHD Parent Rating Scale (VADPRS),</li> <li>• Teacher Rating Scale (VADTRS)</li> </ul>

### RESEARCH METHODOLOGY:

A retrospective cohort study was conducted at Sadgama (Paediatrics Department) Government Homoeopathic Medical Hospital, Thiruvananthapuram, for the collection of data from 2018 – 2019.

Those children who exhibited ADHD confirmed using DSM-IV (Diagnostic and Statistical Manual of Mental Disorders) (American Psychiatric Association, 1952), whose mothers willing to fill-up the Life experience Survey (LES) questionnaire and with no family history of mental disorders were included in the study. Children not genetically related to the mother (IVF) were excluded for better convenience.

The primary objectives of the study were (i) To identify the association between ADHD and Prenatal maternal stress (PNMS). (ii) To compare the contribution of dependent and independent factors to the incidence of ADHD in children. Secondary objectives are (i) To identify the gender difference in the prevalence of ADHD. (ii) To

determine the severity of ADHD in children whose mothers suffered stress during pregnancy.

PNMS can be dependent and independent. Dependent events, that is, events that are likely the result of the individual's own behaviour (e.g. financial problems or divorce), are more heritable than independent events, that is, events that are probably unrelated to the individual's own behaviour (e.g. death of a relative).

### STUDY TOOL:

A small size sample of sixty cases (2018-2019) were selected at random, with children showing positive signs of ADHD confirmed through DSM-IV, 1994, (Diagnostic and Statistical Manual of Mental Disorders) (American Psychiatric Association, 1952). We contacted the mothers of these children to confirm the incidence of Prenatal maternal stress. Those willing to complete the LES (Life experience Survey) questionnaire were short listed to 50 cases.

<b>MODIFIED LIFE EXPERIENCE SURVEY QUESTIONNAIRE</b>						
<b>SI No.</b>	<b>QUESTION</b>	<b>NOT TOO BAD</b>	<b>PAINFUL</b>	<b>VERY PAINFUL</b>	<b>DID NOT EXPERIENCE THE EVENT</b>	<b>TIME OF EXPOSURE</b>
1.	Change of Residence					
2.	Being fired from job					
3.	Changed work situation (different work responsibility, major change in working conditions, working hours etc.)					
4.	New job					
5.	Sexual difficulties					
6.	Trouble with employer (in danger of losing job, being suspended, demoted etc.)					
7.	Major change in sleeping habits (much more or less sleep)					
8.	Major change in eating habits (much more or less food intake)					
9.	Marital separation from mate					
10.	Major change in number of arguments with spouse (a lot more or a lot less arguments)					
11.	Divorce					
12.	Separation from spouse (due to work, travel etc.)					
13.	Death of spouse					
14.	Death of a close family member- Mother, Father, Brother, Sister, Grandmother, Grandfather, Other					
15.	Financial problem /loan					
16.	Detention in a jail or comparable institution					
17.	Death of a close friend					
18.	Serious illness of a close family member- mother, father, brother, sister, grandmother, grandfather, other.					
19.	Problems with in-laws					
20.	Major change in financial status					
21.	Major change in closeness of family friend.					

22.	Major personal illness or injury					
23.	Major change in living conditions of family					
24.	Major change in social activities (participation in marriages, parties, worship)					
25.	Other experiences which have had an impact on your life. List and Rate.					

**RESULTS AND ANALYSIS:**

Chart 1 depicts the association between incidences of ADHD depending on the factors causing Prenatal Maternal Stress (PNMS). Dependent factors affects 53.84% of the total concerned cases, whereas independent factors 26% and 18% had no maternal stress during pregnancy. It can be inferred that

maternal stress during pregnancy i.e. depending factors contributes more to the development of ADHD in children.

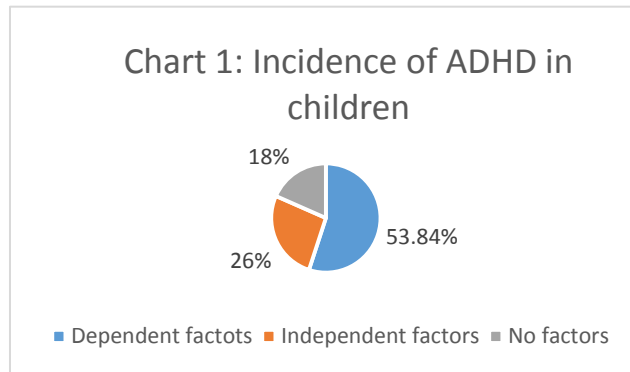


Chart 2: This double bar-graph compares the severity of ADHD scores and the factors responsible for maternal stress. Those children who exhibited severe ADHD belong to mothers who suffered from

depending factors during pregnancy. Whereas when other two factors are taken into concern, children exhibited only moderate level of ADHD.

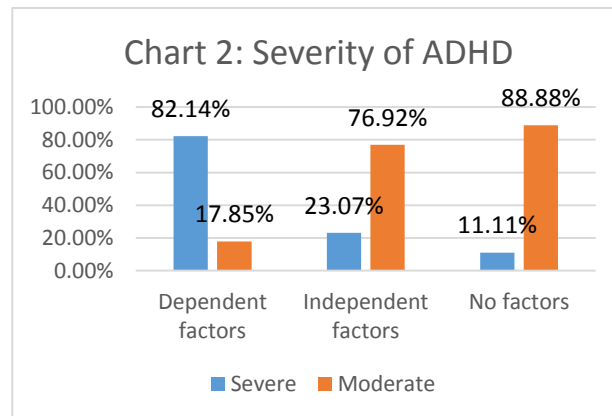
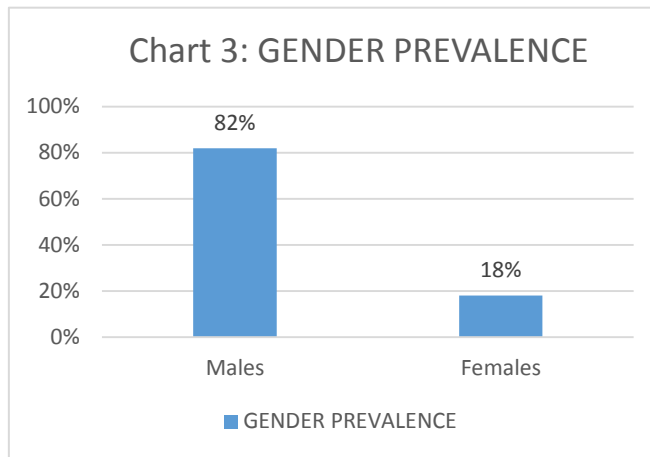


CHART 3: This simple bar graph is a comparative study of the gender prevalence of ADHD. This clearly reveals that male population is at a higher risk of developing developmental disorders than female children.

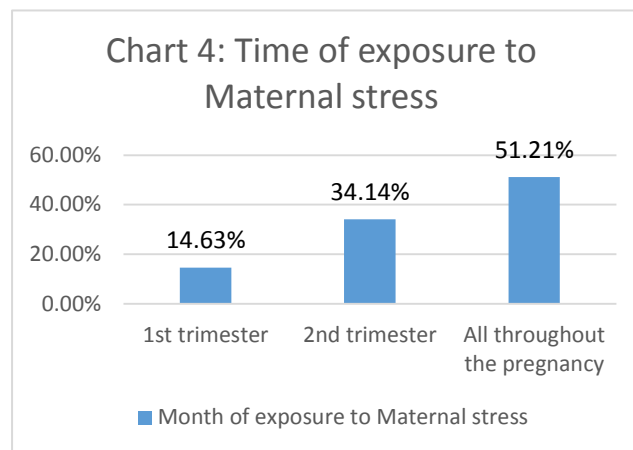
Independent t-test revealed that males had significant higher scores on the ADHD scale than females.



	Mean (M)	SD	Range	P value
Male	5.97	2.72	0-12	p=0.01
Female	5.6	2.7	0-12	

**CHART 4:** This bar graph shows that severity of ADHD is directly proportional to the duration of exposure to PNMS. Second trimester is when most of the developments take place in a fetus. Severity of

ADHD increases if exposed to mental stress during 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> months. This further complicates if the duration of exposure is all through-out the pregnancy.



Independent t-test revealed that all life events were associated with higher ADHD scores, with the strongest effect observed for separated/divorced

(mean difference in ADHD score 0.11, 95% CI: 0.06, 0.1

**CONCLUSION AND RECOMMENDATIONS:**

The aim of this study was to explore the association of ADHD with PNMS. PNMS was significantly associated with ADHD in both the genders, especially boys. Boys exhibited a severe level of ADHD. Incidence of ADHD is related to the month of exposure to maternal stress during pregnancy. The dependent factors gains importance, as exposure to them leads to developmental anomalies.

environment or it may be the time taken to commute.

Family issues were the most rated questions which affect the mothers in the Life Experience Survey. The second rating by mothers was the occupational stress. Work load, working

Inorder to tackle this problem, it is necessary for a family counselling when a woman get pregnant. Awareness for the family of the developmental anomalies that a child may develop, if exposed to stressful situations during fetal life. Private sector and co-operative sectors are to be warned of the global malice that they create, on work demand from expected mothers. Special regards and concessions to be rewarded to the expected mothers for a better world.

A crisis intervention can be made to remove the anxiety and provide a sense of control to the

pregnant women, by creating relaxing environments. It also include therapy, problem solving advice, a sense of safety, a calming influence and helping them to involve in selfless services.

Counselling, Yoga and meditation would help the expected mother to a greater extent.

According to Ayurveda, maternal stress can be regulated by:

- Exercise for thirty minutes daily.
- Eat healthy-avoid hot and spicy, non-veg food.

## REFERENCE

1. Faraone SV, Sergeant J, Gillberg C, Biederman J, 2003, *The worldwide prevalence of ADHD: is it an American condition?*, *World Psychiatry, PubMed* 2(2):104-13.
2. Rae Thomas, Sharon Sanders, Jenny Doust, Elaine Beller, Paul Glasziou, 2015, *Prevalence of Attention-Deficit/Hyperactivity Disorder: A Systematic Review and Meta-analysis*, *Pediatrics*.
3. National Institute of Mental Health, 2016, viewed on 21<sup>st</sup> October 2019, Available from <https://www.nimh.nih.gov/health/publications/attention-deficit-hyperactivity-disorder-adhd-the-basics/index.shtml>
4. Mayo Foundation for Medical Education and Research, n.d, viewed on 21<sup>st</sup> October 2019, Available from <https://www.mayoclinic.org/diseases-conditions/adhd/symptoms-causes/syc-20350889>
5. Devon Frye, 2017, *Stop stressing – especially during pregnancy, Additude inside the ADHD mind*, <https://www.additudemag.com/prenatal-stress-may-increase-risk-of-behavioral-disorders/>
6. K. Latimer, P. Wilson, J. Kemp, L. Thompson, F. Sim, C. Gillberg, C. Puckering, H. Minnis, 2012, *Disruptive behaviour disorders: a systematic review of environmental antenatal and early years risk factors*, *Child: care, Health and Development*.
7. Baker, D.J.P. (1998). *In utero programming of chronic disease. Clinical Science*
8. Baker, E.D., Walton, E., & Cecil, C.A.M. (2018). *Annual Research Review: DNA methylation as a mediator in the association between risk exposure and child and adolescent psychopathology. Journal of Child Psychology and Psychiatry and Allied Disciplines*.
9. Kendler, K.S., & Baker, J.H. (2007). *Genetic influences on measures of the environment: A systemic review. Psychological Medicine, 37, 615-626.*
10. Douglas Mental Health University Institute, 2013, viewed on 7 October 2019, Available from <http://www.douglas.qc.ca/info/prenatal-stress>
11. Google.com, n.d, viewed on 21<sup>st</sup> October, Available from [https://www.google.com/search?authuser=1&source=hp&ei=mESHXfrnAo-f9QPUhY\\_wBg&q=signs+and+symptoms+of+ADHD&oq=signs+and+symptoms+of+ADHD&gs\\_l=psy-ab..0l10.6842.15558..16669...0.0..1.818.7720.2-21j3j2j0j1.....0....1..gws-wiz.....0..0i131j0i10.yLG8tqf5Wvc&ved=0ahUKEwj6k6SziOTkAhWPT30KHdTC124Q4dUDCA Y&uact=5](https://www.google.com/search?authuser=1&source=hp&ei=mESHXfrnAo-f9QPUhY_wBg&q=signs+and+symptoms+of+ADHD&oq=signs+and+symptoms+of+ADHD&gs_l=psy-ab..0l10.6842.15558..16669...0.0..1.818.7720.2-21j3j2j0j1.....0....1..gws-wiz.....0..0i131j0i10.yLG8tqf5Wvc&ved=0ahUKEwj6k6SziOTkAhWPT30KHdTC124Q4dUDCA Y&uact=5)
12. WebMD LLC, n.d., viewed on 21<sup>st</sup> October, Available from <https://www.webmd.com/add-adhd/childhood-adhd/diagnosing-adhd#1>
13. Children and Adults with Attention-Deficit/Hyperactivity Disorder, n.d./, viewed on 21<sup>st</sup> October 2019, Available from <https://chadd.org/for-professionals/clinical-practice-tools/>
14. Nathalie MacKinnon, Mila Kingsbury, Liam Mahedy, Jonathan Evans, Ian Colman, 2018, *The Association Between Prenatal Stress and Externalizing Symptoms in Childhood: Evidence From the Avon Longitudinal Study of Parents and Children, Biological Psychiatry, A journal of Psychiatric Neuroscience and Therapeutics*.
15. *Diagnostic and Statistical Manual of Mental Disorders, 1952, American Psychiatric Association.*