

Vitamin D deficiency in children and adolescents with Autism and ADHD - a retrospective study

Dr. Rachita Kalra¹, *Dr. Darpan Kaur², Dr. Rishab Verma³,
Dr. Rakesh Ghildiyal⁴

ABSTRACT

Background: There is sparse research on Vitamin D levels in children and adolescents with autism and ADHD from India, hence the need for this study. **Aims and objectives:** To assess the profile of Serum Vitamin Levels from retrospective records of children and adolescents diagnosed with autism and ADHD. **Methodology:** This was a retrospective study of children and adolescents who were diagnosed with autism and ADHD and were attending the child and adolescent psychiatry outpatient clinic at the Department of Psychiatry, MGM Medical College and Hospital, Navi Mumbai over the past one year. The Records of Child and Adolescent Psychiatry Clinic were referred for the past 1 year for the demographic details and Diagnostic Profile of the sample. The Biochemistry Department Records were referred for the Serum Vitamin D levels of the children and adolescents with autism and ADHD. Results were tabulated in excel sheet and analysed. Institutional Ethics Clearance was obtained. **Results:** We found that 142 children and adolescents were diagnosed with Autism and ADHD over the past one year. Out of the 142, Serum Vitamin D level records were available for n=70. The sample size n=70 was analyzed further. The mean age was found to be 11.84 years and maximum (80%) were from urban areas. The sex profile of the sample comprised of 41.43% boys and 58.57% girls. As per the Psychiatric Diagnostic Profile, 40% had ADHD, 55.72% had Autism, while 4.28% had both Autism and ADHD. Serum Vitamin D Levels Profile of the entire sample were Normal Vitamin D levels (14.29%), Insufficient Vitamin D Levels (18.57%), Severe Vitamin D deficient levels (37.14%), and very Severe Vitamin D Deficient Levels were seen in 30% of the sample. **Conclusion:** Our study has further research and clinical Implications in this domain of Vitamin D deficiency and children and adolescents with autism and ADHD.

¹PG Resident, Department of Psychiatry, Mahatma Gandhi Missions Medical College and Hospital, Kamothe, Navi Mumbai, India

²Associate Professor, Child and Adolescent Psychiatry Clinic In-charge, Department of Psychiatry, Mahatma Gandhi Missions Medical College and Hospital, Kamothe, Navi Mumbai, India

³PG Resident, Department of Psychiatry, Mahatma Gandhi Missions Medical College and Hospital, Kamothe, Navi Mumbai, India

⁴Professor and HOD, Department of Psychiatry, Mahatma Gandhi Missions Medical College and Hospital, Kamothe, Navi Mumbai, India

*Corresponding Author:

Received: January 8, 2020; Revision Received: February 13, 2020; Accepted: March 3, 2020

Keywords: *Vitamin D Deficiency, Autism, ADHD, Children, Adolescents*

Vitamin D is postulated to have a role in the modulation of the biosynthesis of neurotransmitters and neurotrophic factors.^[1] It may have a role in autism spectrum disorder and many ASD-associated medical conditions.^[2] Background literature highlights the putative role of Vitamin D in regulating signaling processes that maintain the phenotypic stability of both Ca²⁺ and redox signaling pathways across neurodevelopmental disorders.^[3] Certain animal model based studies suggest that transient prenatal vitamin D deficiency is associated with altered brain development.^[4] It is important to appraise study designs considering varied methodological challenges, e.g., hypovitaminosis D at baseline, appropriate supplementation doses, sufficient intervention periods, an adequate power, clinically validated diagnostic instruments, and homogenous, well-defined risk groups.^[5] Literature highlights that Vitamin D could have an important role in children with Attention-deficit/hyperactivity disorder (ADHD). Vitamin D has an important protective effect against inflammation, oxidative stress and certain neurotrophic factors and neurotransmitter, as well as facilitating dopaminergic and serotonergic functions. Certain literature highlights Vitamin D levels in children with ADHD are lower as compared to healthy children.^[6] Existing research shows that patients with ADHD may have reduced levels of vitamin D, zinc, ferritin, and magnesium which have important roles in neurologic function, including involvement in neurotransmitter synthesis, however there is limited evidence for supplementation based studies.^[7] Whether hypovitaminosis-D is a potential causative factor for the development or activity in these conditions or hypovitaminosis-D may be due to increased vitamin-D consumption by an activated immune system (reverse causation) is the focus of intense research.^[8] There is sparse research on Vitamin D levels in children and adolescents with autism and ADHD from India, hence the need for this study.

Aims and Objectives of The Study

- To assess the profile of Serum Vitamin D Levels in children and adolescents diagnosed with Autism and ADHD from retrospective records. To explore demographic factors, psychiatric diagnostic profile and Profile of Serum Vitamin D deficiency in children and adolescents with Autism and ADHD.

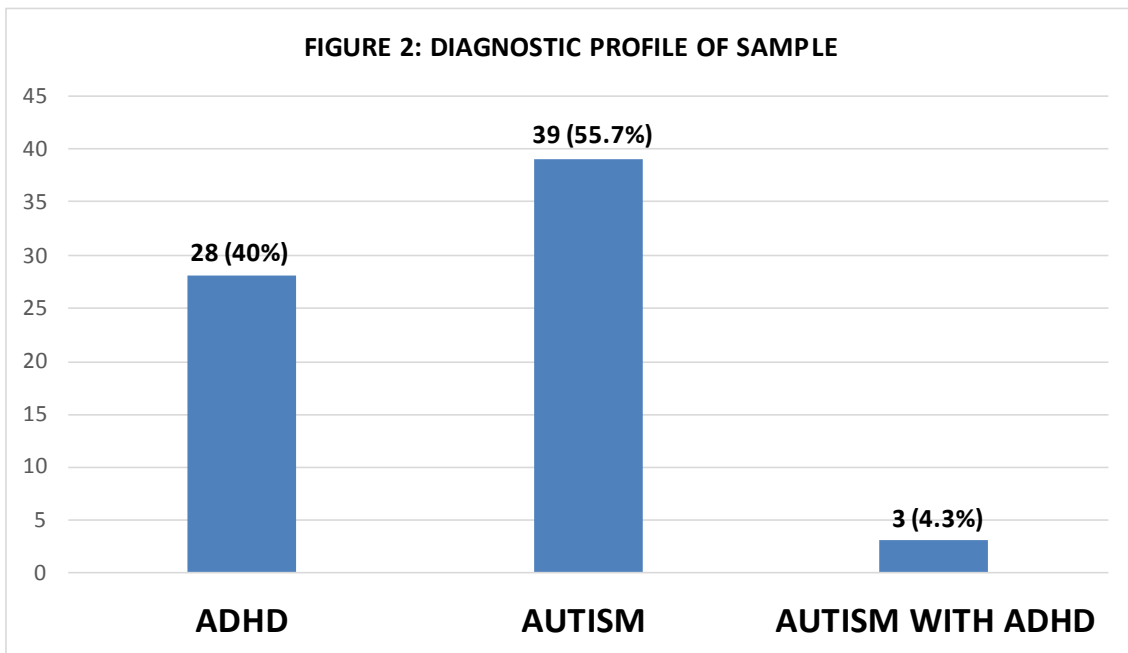
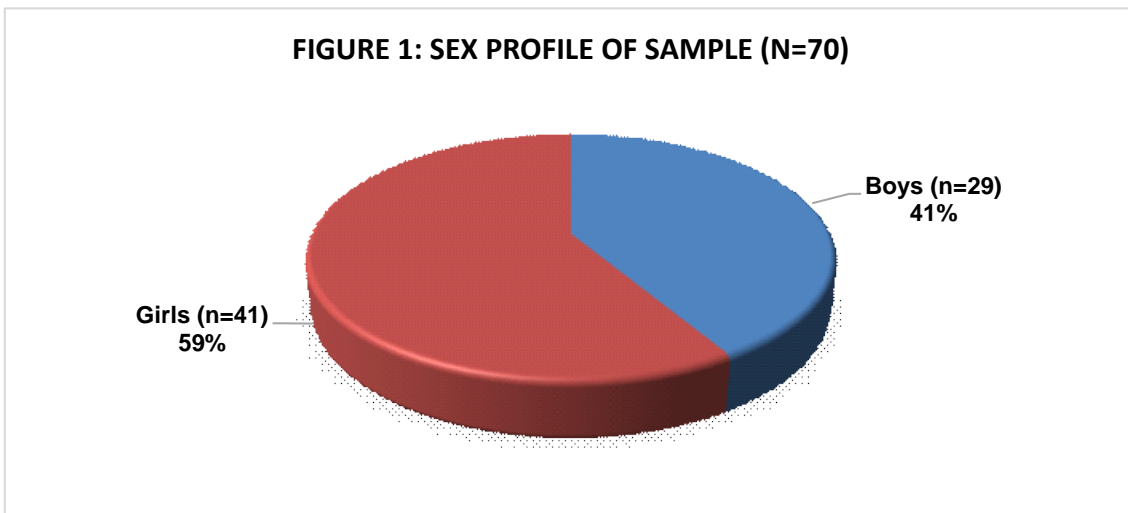
METHODOLOGY

This was a retrospective study of children and adolescents who were clinically diagnosed with autism and ADHD and had attended the Child and Adolescent Psychiatry Outpatient Clinic, Department of Psychiatry, MGM Medical College and Hospital, Navi Mumbai over the past one year for clinical consultation. Institutional Ethics clearance was obtained. The sample comprised of the records of varied referral profile of patients with caregivers who were referred at the Child and Adolescent Psychiatry Clinic from Pediatric specialists, Allied Mental Health Professions, Family Physicians, NGOs, schools or self-referred. Inclusion criteria comprised of records of children and adolescents with Autism or ADHD or both. The Records of Child and Adolescent Psychiatry Clinic were referred for the past 1 year for the demographic details and Diagnostic Profile of the sample. The Biochemistry Department Records were referred for the Serum Vitamin D levels of the children and adolescents with autism and ADHD or both. This was a retrospective record-based study and only available records of Serum Vitamin D levels which were advised by varied specialists as part of routine clinical care on a case to case basis such as General Pediatrics, Pediatric Neurologists, Psychiatrists apriori over the past 1 year were noted. Results were tabulated in excel sheet and analysed with appropriate software.

RESULTS

We found that 142 children and adolescents were diagnosed with Autism and ADHD or both over the past one year. Out of the 142, Serum Vitamin D level records were available for n=70. This sample size of n=70 was analyzed further for results. The age profile of the sample revealed that the minimum age was 4 years and the maximum age was found to be 17 years and the mean age was around 11.84 years. The demographic profile of the sample found n=14 (20%) were from rural areas and n= 56 (80%) were from urban areas.

The sex profile of the sample comprised of boys (41.43%) and girls (58.57%). As per the Psychiatric Diagnostic Profile, 40% had ADHD, 55.72% had Autism, while 4.28% had both Autism with comorbid ADHD.



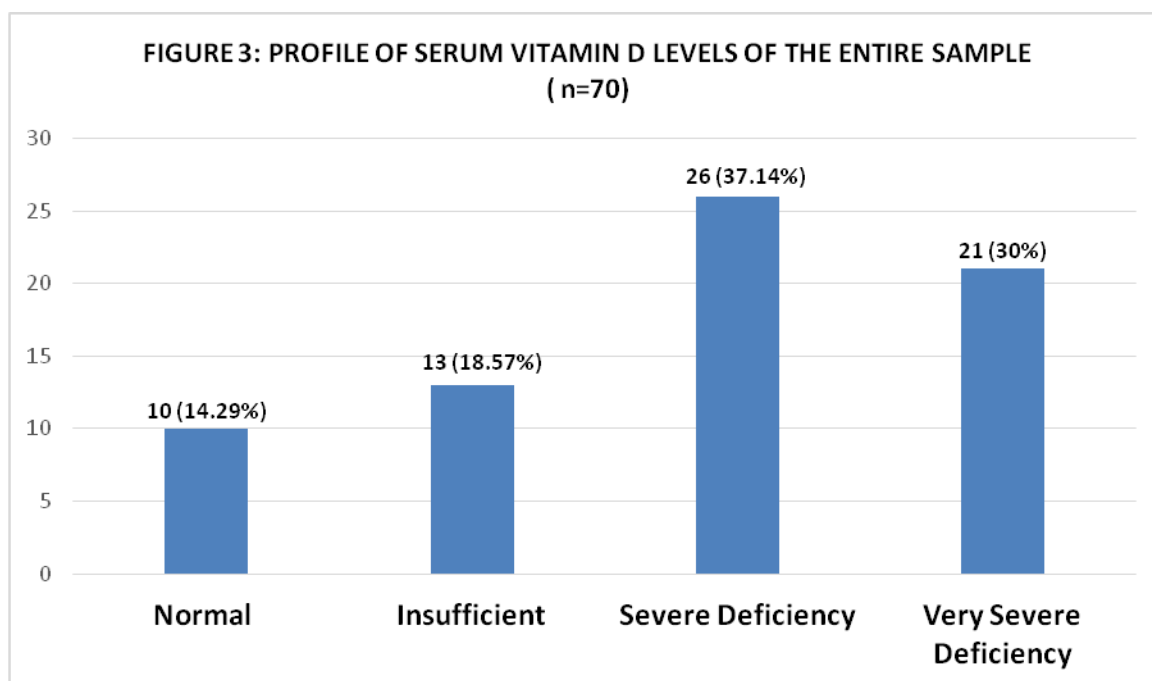


Table 1: Profile of Serum Vitamin D level across ADHD and Autism.

| Profile Of Psychiatric Diagnosis | Profile of Serum Vitamin D Levels | | | |
|----------------------------------|-----------------------------------|---------------------------|---------------------------------|-----------------------------------|
| | Normal (>30 ng/ml) | Insufficient (20-30ng/ml) | Severe Deficiency (10-20 ng/ml) | Very severe deficiency (<10ng/ml) |
| ADHD | 5 (17.86%) | 5 (17.86%) | 12 (42.86%) | 6 (21.43%) |
| Autism | 5 (12.82%) | 7 (17.95%) | 13 (33.33%) | 14 (35.90%) |
| Autism with ADHD | 0 (0%) | 1 (33.33%) | 1 (33.33%) | 1 (33.33%) |

The Profile of serum Vitamin D Levels of the entire sample were Normal Vitamin D levels (14.29%), Insufficient Vitamin D Levels (18.57%), Severe Vitamin D deficient levels (37.14%), and very Severe Vitamin D Deficient Levels (30%). The Biochemistry Laboratory ranges of the Vitamin D levels were as follows: >30 (ng/ml) = Normal, 20-30 (ng/ml) = Insufficient, 10-20 (ng/ml) = Severe deficiency, <10ng/ml = Very Severe deficiency. Majority of the Serum Vitamin D levels in the records were observed to be advised by Pediatricians (90%), followed by Psychiatrists (8.57%) and (1.43%) by Pediatric neurologists on case to case basis as part of clinical care and evaluation.

It was further found that amongst the n=28 (40%) cases of ADHD, 17.86% had Normal Vitamin D Levels, 17.86% had Insufficient Vitamin D levels, 42.86% had Severe deficiency of Vitamin D levels, 21.43% had Very Severe Deficiency of Vitamin D levels. Similarly, amongst the n=39 (55.72%) cases of Autism, 12.82% had Normal Vitamin D Levels, 17.95% had Insufficient levels of Vitamin D, 33.33% had Severe deficiency of Vitamin D levels and 35.90% had Very Severe Deficiency of Vitamin D levels. Finally, amongst the n=3 (4.28%) who had features of both Autism with ADHD, 33.33% had Insufficient Vitamin D levels, 33.33% had Severe deficiency of Vitamin D levels and 33.33% had Very Severe Deficiency of Vitamin D levels.

DISCUSSION

Saad K et al found that the mean 25-OHD levels in patients with severe autism were significantly lower than those in patients with mild/moderate autism.^[9] Bener A et al found that Vitamin D deficiency was considerably more common among autistic children (18.79 ± 8.35 ng/mL) as compared to healthy children (22.18 ± 9.00 ng/mL).^[10] Goksugur SB et al concluded that there is an association between lower 25-OH-vitamin D concentration and ADHD in childhood and adolescence.^[11] Another study by Elshorbagy HH et al showed diagnosis of vitamin D deficiency was significantly greater in children with ADHD compared with the control group.^[12] Avcil S et al found that Vitamin D deficiency, hypocalcemia, and hypophosphatemia were observed in children with ADHD.^[13] A Systematic review and meta analysis done by Khoshbakht Y et al found that children with ADHD have lower serum concentrations of 25-hydroxyvitamin D than healthy children and lower vitamin D status was significantly associated with the likelihood of ADHD.^[14] Another study by Sahin N et al found Serum vitamin D and vitamin D receptor levels were found to be significantly lower in children with ADHD compared to healthy controls. However, no significant differences were found among the ADHD subtypes in terms of serum vitamin D, vitamin D receptor, calcium, phosphorus and alkaline phosphatase levels.^[15] Kotsi E et al found that eight trials reported significantly lower serum concentrations of 25(OH)D in patients diagnosed with ADHD compared to healthy controls.^[16] Kamal M et al found that the mean values of vitamin D (ng/mL) were significantly lower in ADHD children (16.6 ± 7.8) than in healthy children (23.5 ± 9.0) ($P < 0.001$).^[17] Shang-Guan LL et al found that serum levels of 25-hydroxyvitamin D in children with ADHD were lower as compared to healthy children, suggesting that Vitamin D level might be related to ADHD.^[18] Arastoo AA et al found that in children with ASD, the average serum 25-hydroxyvitamin D level was 9.03 ± 4.14 ng/mg. Among children with ASD, 96.8% (30 subjects) had vitamin D deficiency whereas in healthy children group, average serum 25-hydroxyvitamin D level was 15.25 ± 7.89 ng/mg.^[19] Garipardic M et al found that in the ASD and ADHD groups, the levels of vitamins B12 and D were significantly lower than those in the control group.^[20] Sharif MR et al study indicated that the proportion of children with vitamin D deficiency in ADHD group was significantly larger than that of the normal children.^[21] Chauhan N et al found lower mean Vitamin D level for neurodevelopmental disorders (intellectual disability, pervasive developmental disorder, and disturbance of activity and attention).^[22]

CONCLUSION

We conclude that Serum Vitamin D levels have been found to be deficient in our sample of children and adolescents with autism and ADHD in our study. Among the entire sample profile, we found that most common was severe deficiency of serum Vitamin D. It was found that in cases of ADHD, Vitamin D levels of severe deficiency were the most common type and in cases of Autism, it was found that the most common was very severe deficiency of Serum Vitamin D levels. The strengths of the study were that it was conducted at the Child and Adolescent Psychiatry Clinic at the Department of Psychiatry at a tertiary Care Institute with Ethics Committee Approval and appropriate protocol. The limitations of the study were that it was a hospital sample, a record-based study, retrospective in design, relatively small sample size, lack of comparative normative sample, Laboratory based reference cut offs and limited generalization of the findings. The study did not correlate the Vitamin D levels with severity of autism and ADHD using any severity assessment tools or scales. The authors highlight that the current study did not explore any correlations, associations, causations nor therapeutics related to Vitamin D and its role in autism or ADHD. The authors recommend that future researchers may consider using prospective study designs with larger community samples with comparative normative data for further exploring the role of Vitamin D in child

and adolescent psychiatric disorders. Further multi-disciplinary neuroscience based research exploring the role of Vitamin D in autism and ADHD is recommended.

REFERENCES

1. Máčová L, Bičíková M, Ostatníková D, Hill M, Stárka L. Vitamin D, neurosteroids and autism. *Physiol Res*. 2017 Sep 26;66(Supplementum 3):S333-S340.
2. Mazahery H, Camargo CA Jr, Conlon C, Beck KL, Kruger MC, von Hurst PR. Vitamin D and Autism Spectrum Disorder: A Literature Review. *Nutrients*. 2016 Apr 21;8(4):236.
3. Berridge MJ. Vitamin D deficiency: infertility and neurodevelopmental diseases (attention deficit hyperactivity disorder, autism, and schizophrenia). *Am J Physiol Cell Physiol*. 2018 Feb 1;314(2):C135-C151.
4. Ali A, Cui X, Eyles D. Developmental vitamin D deficiency and autism: Putative pathogenic mechanisms. *J Steroid Biochem Mol Biol*. 2018 Jan;175:108-118
5. Föcker M, Antel J, Ring S, Hahn D, Kanal Ö, Öztürk D, Hebebrand J, Libuda L. Vitamin D and mental health in children and adolescents. *Eur Child Adolesc Psychiatry*. 2017 Sep;26(9):1043-1066.
6. Saedisomeolia A, Samadi M, Gholami F, Seyedi M, Effatpanah M, Hashemi R, Abdolahi M, Honarvar NM. Vitamin D's Molecular Action Mechanism inattention-Deficit/Hyperactivity Disorder: A Review of Evidence. *CNS NeurolDisord Drug Targets*. 2018;17(4):280-290.
7. Villagomez A, Ramtekkar U. Iron, Magnesium, Vitamin D, and Zinc Deficiencies in Children Presenting with Symptoms of Attention-Deficit/Hyperactivity Disorder. *Children (Basel)*. 2014 Sep 29;1(3):261-79.
8. Kočovská E, Gaughran F, Krivoy A, Meier UC. Vitamin-D Deficiency As a Potential Environmental Risk Factor in Multiple Sclerosis, Schizophrenia, and Autism. *Front Psychiatry*. 2017 Mar 27;8:47.
9. Saad K, Abdel-Rahman AA, Elserogy YM, Al-Atram AA, Cannell JJ, Bjørklund G, Abdel-Reheim MK, Othman HA, El-Houfey AA, Abd El-Aziz NH, Abd El-Baseer KA, Ahmed AE, Ali AM. Vitamin D status in autism spectrum disorders and the efficacy of vitamin D supplementation in autistic children. *NutrNeurosci*. 2016 Oct;19(8):346-351.
10. Bener A, Khattab AO, Bhugra D, Hoffmann GF. Iron and vitamin D levels among autism spectrum disorders children. *Ann Afr Med*. 2017 Oct-Dec;16(4):186-191.
11. Goksugur SB, Tufan AE, Semiz M, Gunes C, Bekdas M, Tosun M, Demircioglu F. Vitamin D status in children with attention-deficit-hyperactivity disorder. *Pediatr Int*. 2014 Aug;56(4):515-9.
12. Elshorbagy HH, Barseem NF, Abdelghani WE, Suliman HAI, Al-Shokary AH, Abdulsamea SE, Elsadek AE, Abdel Maksoud YH, Nour El Din DMAE. Impact of Vitamin D Supplementation on Attention-Deficit Hyperactivity Disorder in Children. *Ann Pharmacother*. 2018 Jul;52(7):623-631.
13. Avcil S, Uysal P, Yilmaz M, Erge D, Demirkaya SK, Eren E. Vitamin D Deficiency and a Blunted Parathyroid Hormone Response in Children with Attention-Deficit/Hyperactivity Disorder. *Clin Lab*. 2017 Mar 1; 63(3):435-443.
14. Khoshbakht Y, Bidaki R, Salehi-Abargouei A. Vitamin D Status and Attention Deficit Hyperactivity Disorder: A Systematic Review and Meta-Analysis of Observational Studies. *Adv Nutr*. 2018 Jan 1;9(1):9-20.
15. Sahin N, Altun H, Kurutas EB, Balkan D. Vitamin D and vitamin D receptor levels in children with attention-deficit/hyperactivity disorder. *Neuropsychiatr Dis Treat*. 2018 Feb 19;14:581-585.

Vitamin D Deficiency in Children and Adolescents with Autism and ADHD - A Retrospective Study

16. Kotsi E, Kotsi E, Perrea DN. Vitamin D levels in children and adolescents with attention-deficit hyperactivity disorder (ADHD): a meta-analysis. *Atten DeficHyperactDisord*. 2019 Sep;11(3):221-232
17. Kamal M, Bener A, Ehlayel MS. Is high prevalence of vitamin D deficiency a correlate for attention deficit hyperactivity disorder? *Atten DeficHyperactDisord*. 2014 Jun;6(2):73-8
18. Shang-Guan LL, Zhao YR. [Serum levels of 25-hydroxyvitamin D in children with attention deficit hyperactivity disorder]. *Zhongguo Dang Dai ErKe Za Zhi*. 2015 Aug;17(8):837-40.
19. Arastoo AA, Khojastehkia H, Rahimi Z, Khafaie MA, Hosseini SA, Mansouri MT, Yosefshad S, Abshirini M, Karimimalekabadi N, Cheraghi M. Evaluation of serum 25-Hydroxy vitamin D levels in children with autism Spectrum disorder. *Ital J Pediatr*. 2018 Dec 17;44(1):150.
20. Garipardic M, Doğan M, Bala KA, Mutluer T, Kaba S, Aslan O, ÜstyolL. Association of Attention Deficit Hyperactivity Disorder and Autism Spectrum Disorders with Mean Platelet Volume and Vitamin D. *Med Sci Monit*. 2017 Mar 20;23:1378-1384.
21. Sharif MR, Madani M, Tabatabaei F, Tabatabaee Z. The Relationship between Serum Vitamin D Level and Attention Deficit Hyperactivity Disorder. *Iran J Child Neurol*. 2015 Fall;9(4):48-53.
22. Chauhan N, Padhy SK, Shah R, Malhotra S. Vitamin D Deficiency in Children with Psychiatric Illness in a Tertiary Care Hospital in North India. *J Neurosci Rural Pract*. 2019;10(1):16–20.

Acknowledgements

The primary author Dr Rachita Kalra is grateful to the MGM IEC Institutional Ethics Committee for approving the project. The primary author Dr Rachita Kalra is grateful to Dr Darpan Kaur for her guidance and support as the guide for the project and invaluable support in writing the manuscript. The author also wishes to thank Dr Rakesh Ghildiyal for overall support and guidance, Dr Parineeta Samant for support from the Biochemistry Department and Dr Rishab Verma for his contribution in drafting the manuscript.

Conflict of Interest

The author declared no conflict of interests.

How to cite this article: R Kalra, D Kaur, R Verma & R Ghildiyal (2020). Vitamin D deficiency in children and adolescents with Autism and ADHD - a retrospective study. *International Journal of Indian Psychology*, 8(1), 342-348. DIP:18.01.043/20200801, DOI:10.25215/0801.043