

## Endemic Fluorosis and Cognitive Dysfunction in School Going Children: Any Link?

Dear Editor,

We read with great interest the recently published article titled “Effect of Endemic Fluorosis on Cognitive Function of School Children in Alappuzha District, Kerala: A Cross-Sectional Study” by Prabhakar *et al.*<sup>[1]</sup> The authors have concluded that fluorosis is associated with impaired cognition in children. However, we wish to add certain points.

The authors have mentioned that there was a strong positive correlation between the severity of dental fluorosis and Raven’s SPM grades (Spearman’s correlation coefficient = 0.740), but in the corresponding Table 4 of the article, the Spearman’s correlation coefficient has been mentioned as 0.452, suggestive only moderate positive correlation. Furthermore, many columns in the table for correlation analysis have zero participants, thereby compromising the reliability of the correlation coefficient estimated.<sup>[2]</sup> Secondly, the authors have not measured the correlation between forward or backward digit span score and the degree of fluorosis, without which the conclusion by authors that there is a positive correlation between the severity of dental fluorosis and the grade of cognitive impairment seems overenthusiastic and more extrapolated rather than truly estimated. Similarly, for comparing the Raven’s SPM grades between children with and without fluorosis, the authors have used Chi-square test, but Chi-square test is reliable only when all expected cell frequencies are equal to or greater than 5, which is not the case as reported in Table 2 of the article.<sup>[3]</sup> In such a case, the authors should have used Fisher’s exact test and if still they wanted to use Chi-square test, they should have used it with Yate’s correction for continuity.

The authors have only used the digit span test among the battery of 11 sub-tests in MISIC. It would have been better and would have provided more information regarding the verbal, non-verbal, and full-scale intelligence quotient of the participants. The authors have only mentioned the raw scores in forward and backward digit span tests but did not convert them into test quotients, which are better indicators of performance as compared to the general population. Thus, it would have provided how much proportions of participants have impaired cognition as measured by the forward and backward digit span test. The authors have also not mentioned whether any participant had features of compressive myelopathy, radiculopathy, or even ADHD/specific learning disability (recently have been reported to be associated with increased serum and urine fluoride levels).<sup>[4,5]</sup>

The authors have mentioned that in the study by Arora *et al.*, cognitive impairment was found in 3.1% of the population, while in the study controls, around 15% performed below average on the Raven’s SPM and had evidence of cognitive impairment. This is significantly higher than the general population and thus the controls selected by the authors might not be completely healthy, typically developing controls. It could have confounded the study results. Intelligence quotient depends on many social and environmental factors, apart from exposure to increased fluoride in drinking water. Thus, while performing intragroup correlation analysis; the authors should have included socioeconomic status (SES) as a covariate, as children coming from families with low SES are likely to have lower IQ.<sup>[6]</sup>

Lastly, the authors have not mentioned whether the person performing these psychometric assessments was blinded to which group (fluorosis or control group), the participant belonged to and what was Dean’s fluorosis index in the participants. In such a case, it could have introduced some degree of observer bias in the study results.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

**Prateek Kumar Panda, Vetoni Moirangthem, Indar Kumar Sharawat**

Department of Pediatrics, Pediatric Neurology Division, All India Institute of Medical Sciences, Rishikesh, Uttarakhand, India

**Address for correspondence:** Dr. Indar Kumar Sharawat, Department of Pediatrics, Pediatric Neurology Division, All India Institute of Medical Sciences, Rishikesh, Uttarakhand, India.  
E-mail: [sherawatdrindar@gmail.com](mailto:sherawatdrindar@gmail.com)

## REFERENCES

1. Prabhakar A, Abdulkhayarkutty K, Cheruvallil SV, Sudhakaran P. Effect of endemic fluorosis on cognitive function of school children in Alappuzha District, Kerala: A cross sectional study. *Ann Indian Acad Neurol* 2020. doi: 10.4103/aian.AIAN\_850\_20.
2. Winters R, Winters A, Amedee RG. Statistics: A brief overview. *Ochsner J* 2010;10:213-6.
3. Wong KC. Chi squared test versus Fisher’s exact test. *Hong Kong Med J* 2011;17:427.
4. Reddy DR. Neurology of endemic skeletal fluorosis. *Neurol India* 2009;57:7.
5. Barberio AM, Quiñonez C, Hosein FS, McLaren L. Fluoride exposure and reported learning disability diagnosis among Canadian children: Implications for community water fluoridation. *Can J Public Health Rev Can Sante Publique* 2017;108:e229-39.

Letter to the Editor

- Hanscombe KB, Trzaskowski M, Haworth CMA, Davis OSP, Dale PS, Plomin R. Socioeconomic status (SES) and children's intelligence (IQ): In a UK-representative sample SES moderates the environmental, not genetic, effect on IQ. PLoS One 2012;7:e30320.

**Submitted:** 09-Dec-2020    **Accepted:** 10-Dec-2020

**Published:** 04-Feb-2021

---

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**DOI:** 10.4103/aian.AIAN\_1197\_20