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LETTER TO THE EDITOR

IQ OF 9–12-YEAR-OLD CHILDREN IN HIGH- AND LOW-DRINKING WATER FLUORIDE AREAS IN WEST AZERBAIJAN PROVINCE, IRAN: FURTHER INFORMATION ON THE TWO VILLAGES IN THE STUDY AND THE CONFOUNDING FACTORS CONSIDERED

In a critique of our study[1] on the IQ of 9–12-year-old children in high- and low-drinking water fluoride (F) areas in West Azerbaijan province, Iran, Dr Ken Perrott questioned whether possible confounding factors in the two villages, such as the rural status and parental educational levels, were adequately considered.[2]

Perrott's comments on the rural status and the parental educational levels of the villages: Perrott noted that the only data presented were for F concentration and IQ and that no data were given to support two reassuring statements given by the authors: "The two rural areas studied had very similar populations, educational, economic, social, cultural, and general demographic characteristics but differed in the concentration of F in drinking water. Questionnaires were completed by the parents to measure potential confounding factors involving educational, economic, social cultural, and general demographic characteristics." Perrott considered, despite these statements, that there was "absolutely no consideration of any other factors known to influence IQ" such as population size and parental educational levels.

Perrott stated that in the low-F area of Piranshahr (county), according to Wikipedia, Piranshahr city, Iran, "is one of the fastest-growing cities in Iran. The government's mid-year estimate for 2013 puts Piranshahr's population at 270,138 compared with the 2012 figure of 220,000. The city is forecast to have a population of approximately 320,000 by 2014 and 350,000 by 2015. Piranshahr has an educated population and its literacy rate is very high: of Piranshahr's population over 28.60% (vs. a national average of 24%) hold a bachelor's degree or higher; 945 (vs. 82% nationally) have a high school diploma or equivalent. In fact, Piranshahr has the highest percentage of college graduates of any city in the entire country."

For the high-F region of Poldasht, Perrott observed that Poldasht city, Iran, was the capital of Poldasht county, West Azerbaijan province, Iran, and that at the 2006 census its population was 8,584, in 2,205 families. He commented that the city was smaller than Piranshahr and was situated "pretty much in the middle of nowhere" on the Iran/Armenian border. He recorded that he could not find any information on educational levels in Poldasht, pointed out that it was a small remote place, and thought that it was safe to infer that it was culturally and educationally less developed than Piranshahr.

Perrott quoted Dr Jonathan Broadbent as commenting that these towns (Piranshahr city and Poldasht city) were not comparable. Perrott stated that consequently neither would the satellite villages be comparable and that it appeared that the authors may have indulged in a bit of confirmation bias through sample selection.

Our response to Dr Perrott's critique: We note that despite the guidelines for authors for *Fluoride* stating that manuscripts need to be written as concisely as

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possible, it would have been helpful if we had provided more data in our initial paper and we apologize for this omission. However we do not accept Dr Perrott's assessment that there was "absolutely no consideration of any other factors known to influence IQ" such as population size and parental educational levels. We now provide further information on the assessment of possible confounding factors in the two villages.

Further information on the positions and population sizes of the two villages: The high-F village of Bahloul Abad, at 39º13'50.0"N 44º59'46.0"E, in Poldasht county, is situated 16.1 km, 15 min by car, from the county capital city of Poldasht. Similarly, the low-F village of Pasve, at 36º47'53"N 45º19'48"E, in Piranshahr county, is situated 25.3 km, 29 min by car, from the county capital city of Piranshahr. Because the two villages were situated 16–25 km from the respective county capital cities, we considered, as stated in the article, that Bahloul Abad was not more urban that Pasve and the villages were rural rather than urban (Figures 1 and 2).

Figure 1. The situation of the high-fluoride village of Bahloul Abad, 16.1 km, from the county capital city of Poldasht, in Poldasht county.
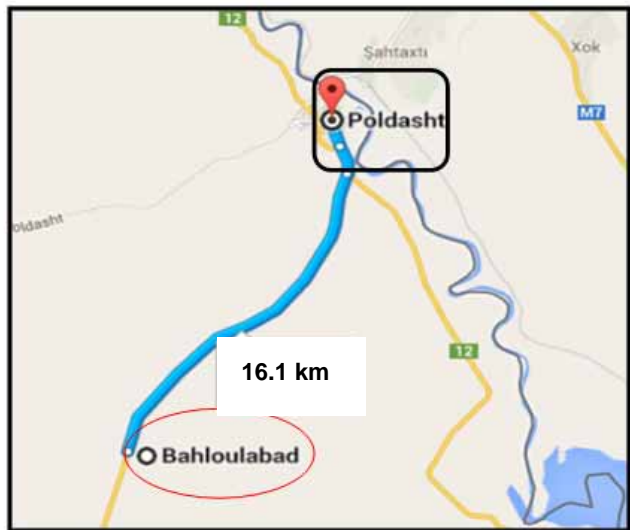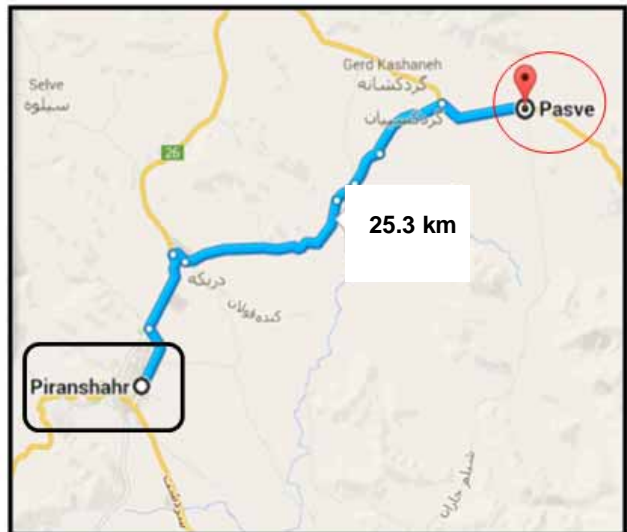

Figure 2. The situation of the low-fluoride village of Pasve, 25.3 km, from the county capital city of Piranshahr, in Prinanshahr county.

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For population size, the 2011 census from the Statistical Center of Iran (SCI). showed the total rural and urban populations for Poldasht county were 12,724 and 29,347, respectively, while those for Piranshahr county were 52,917 and 70,722 respectively.[3] However, the 2011 census did not list the populations of the villages we studied and the population sizes for them were obtained from the Health Deputy of West Azerbaijan province. In 2013, the population of Bahloul Abad was 1,400 while that for Pasve was 3,200.
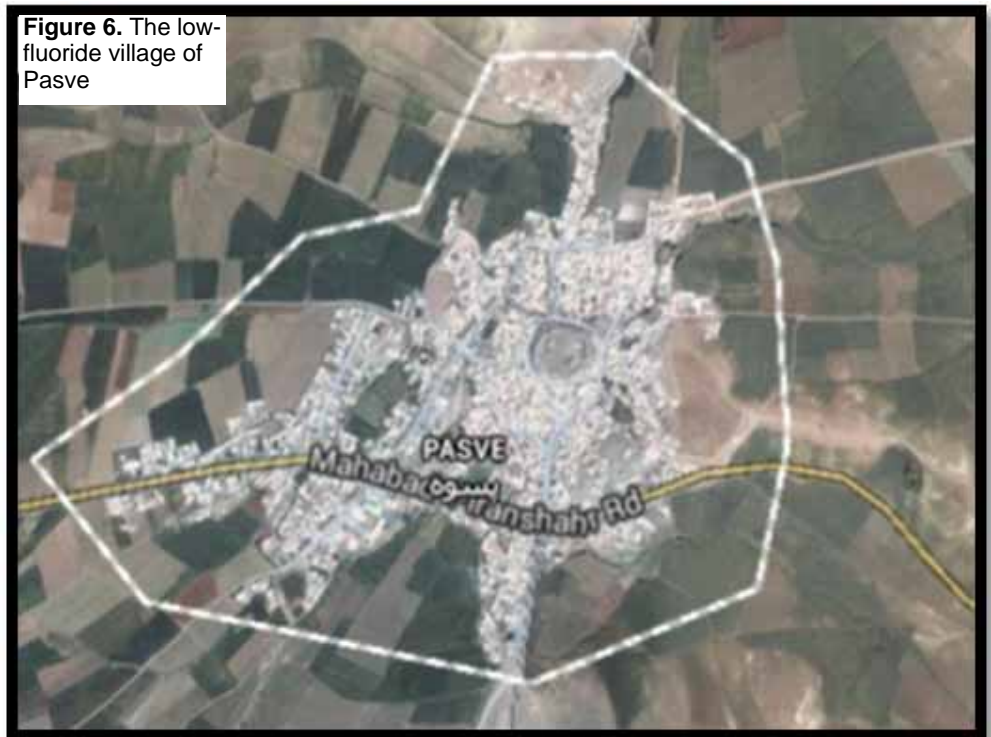
In Iran, especially in West Azerbaijan, villages such as Bahloul Abad and Pasve, are not only completely separate from the county capital cities but also differ, from the capitals, in their environments and culture (Figures 3–6).

Figure 3. The high-fluoride village of Bahloul Abad in Poldasht county.

Figure 4. The low-fluoride village of Pasve in Prinanshahr county.

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Figure 5. The high-fluoride village of Bahloul Abad.

Figure 6. The low-fluoride village of Pasve

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Further information on the assessment of possible confounding factors: In low-F Pasve, only one of two schools was willing for the IQ questionnaire to be distributed to their students and all 24 of the 9–12-yr-old children from that school participated. Twenty-one 9–12-yr-old children were chosen randomly from high-F Bahloul Abad. The mothers or fathers of the children were interviewed and they also completed a questionnaire on possible confounding factors: parental educational level, smoking during pregnancy, breastfeeding, parental income, socioeconomic status, life-long residence in the village, and history of illness.

Table. Confounding factors assessed by questionnaire in low-F Pasve and high-F Bahloul Abad

Factor	Low-F Pasve (n=24)	High-F Bahloul Abad (n=21)
Age	10.89 yr (mean)	10.47 yr (mean)
Parental educational level		
Illiterate	0	0
Primary or elementary school	21	21
Junior high school		
Senior high school		
Diploma	1*	3*
College or university degree		
Maternal smoking during pregnancy	0	0
Occurrence of breast feeding	24	21
Parental income per month		
<6,000,000 Rial (< US$2500	0	0
6,000,000–10,000,000 Rial (US$250–416)	24	21
10,000,000–15,000,000 Rial (US$416–625)		
>15,000,000 Rial (>US$625)	0	0
Unknown	0	0
Socioeconomic status		
High	0	0
Medium	24	21
Low	0	0
Life-long residence of the village since birth	24	21
History of illness (congenital or acquired neurological disorder, mental retardation)	1*	1*
Maternal smoking and tea consumption	Similar in both villages	
Final number of children included after exclusions	20	19

*Excluded from the study

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Six children were excluded (4 from low-F Pasve and 2 from high-F Bahloul Abad) because of the presence of confounding factors (a history of neurological disease or the parents having an educational diploma or degree) leaving study groups of 20 and 19 in Pasve and Bahloul Abad respectively. Ecologically, the study sites were very similar, with the residents of the two villages sharing in common social, economic, cultural, and educational habits and lifestyles. No statistically significant differences were present between two villages in the demographic, socioeconomic, and breastfeeding data.

In conclusion, we do not accept the claim of Dr Perrott that, in our study, there was "absolutely no consideration of any other factors known to influence IQ" such as population size and parental educational levels and that in choosing the villages we "indulged in a bit of confirmation bias through sample selection." We chose the two study villages because they were very similar socially, economically, culturally, and educationally, with the drinking water F levels, 0.25 mg F/l in low-F Pasve and 3.94 mg F/L in high-F Bahloul Abad, being the main point of difference. Our finding of a significantly lower mean IQ (p=0.0004) in the children in high-F Bahloul Abad (81.21±16.17) than in low-F Pasve (104.25±20.73) is likely to reflect the adverse effect that F can have on brain development rather than Bahloul Abad being "culturally and educationally less developed" than Pasve as suggested by Perrott. We excluded the children of parents with diplomas and degrees (two in Pasve and one in Bahloul Abad) so that all the children had parents with a primary or high school education. Similarly, all the parents had an monthly income in the range 6,000,000–15,000,000 Rial (US$250–625). All the children were breast-fed. To attribute the IQ differences to confounding factors, such as population size and parental education, while overlooking of the effects of F, would be a failure to recognize the presence of a remedial toxic factor, high drinking water F levels, and result in ongoing morbidity to children living in Pasve and similar high-F areas. We thus stand by our conclusion and do not accept the criticisms of Dr Perrott and Dr Broadbent as being valid.

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