Effect of Ganga River Basin on Psychological Health of children: a Cross-sectional study

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Abstract

Introduction: River Ganga plays a pivotal role in the lives of Indians either due to its water or due to its spiritual and religious significance but is suffering from the same ravaging issue i.e. Water Pollution. This severely affects the physical health of children which in turn affects their mental and psychological development.

Aim: The aim was to study the effect of degrading water quality of river Ganga on mental and psychological wellbeing of children.

Methodology: The present cross-sectional study was conducted in schools of Meerut and included healthy children in age group 4 to 8 years. The children were divided into two groups (near Ganga river and away from river bed) on the basis of school location. The psychological effect of children were compared by using pre-validated Pediatric Symptoms Checklist. The scales are further grouped into 3 subscales: Attention, Externalizing and Internalizing.

Result: The study included 1426 children of 4 to 8 years. These include 715 children from villages near Ganga basin and 711 children from villages away from Ganga basin. The PCS score of 7.9% children residing in villages away Ganga was above cut-off score which was significantly greater than 36.51% children in villages near river Ganga was having PCS score above cut-off. The similar result was obtained for all the three subscales.

Conclusion: The water quality of rivers affected the children psychological health. Children living in villages near river Ganga had higher prevalence of mental health disorder in comparison to Children living away from river bed.

Introduction

Water is the magical potion of life, gifted by the nature to all living organisms present on earth. About 75% of our earth is covered by water and out of this, 97.5 % is present in oceans in form of saltwater and merely 2.5% is available as fresh water. Freshwater resources include ice sheets, icebergs, glaciers, lakes, ponds, rivers, and underground water. Rivers are one of the main resources of fresh water because of their deep penetration into far-flung areas, reaching millions of people.[1]

River water is used various purposes such as drinking, day-to-day household activities, irrigation, cultivation of aquatic flora and fauna for commercial purposes, generating hydroelectric power, and transportation.[2] water pollution often take place due to human activities. These activities include industrial, agricultural and domestic activity. Water pollution is defined as "the addition of any substance to water that changes physical, chemical, and biological properties of water and rendering it unfit for use." WHO estimated that about 829000 people die each year due to a single contaminated water disease, Diarrhoea, and out of this 297 000 are children under age of five years.[3]

In our country, river Ganga plays a pivotal role in the lives of Indians either due to its water or due to its spiritual and religious significance. River Ganga serves as a lifeline for millions of people as it has a large catchment area and world's densely populated river basin. Besides this, River Ganga is suffering from the same ravaging issue i.e. Water Pollution. The various factors are responsible for the pollution of the river and major reasons are the dumping of sewage and industrial chemical effluents without any treatment directly into the river. Various agricultural, religious and non-religious anthropogenic activities are also equally responsible for the river pollution.[4] Another daunting prospect of River Ganga's water pollution is serious illness such as cancer, cardiac problems, skin problems and others, occurring in humans due to exposure to pollutants present in river water. In India, over three in every 1000 children under five years old died due to water pollution.[5]

Methyl mercury poisoning resulted in neurological disorders in both adults and children (U.S. EPA, 1997). In utero exposure to methyl mercury lead to cerebral palsy like conditions in new-borns and later on, these children showed the signsof mental retardness and had problems like mood fluctuations and behavioral dysfunctions.[6]

Suk et al.,[7] showed Children show extreme sensitivity towards pollution . Children have no part to play in pollution, still, they are at higher risk of developing diseases due to water pollution and it has been found that even short–time exposure or low-dose exposure can result in life-threatening diseases in children.[8]

Water pollution severely affects the physical health of children which in turn affects their mental and psychological development and this had been established by various studies that children

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suffering from physical illness are more prone to develop social, mental, and psychological problems . [9-11]

Aim

The aim was to study the effect of degrading water quality of river Ganga on incidences of disease-morbidity in children and their mental and psychological wellbeing

Methodology

The present cross-sectional study was conducted in primary schools of Meerut after obtaining permission from institutional Ethical Committee of Meerut College. The study was funded under IMPRESS Scheme, Indian Council of Social Science Research, New Delhi

The study included children in age group 4 to 10 years without any history of chronic diseases. The study population included primary school children of Meerut District. The children were divided into two groups on the basis of location of schools. Children enrolled directly from the schools in the villages near the river stream that are exposed to the detrimental effects of river pollution. Further, children were enrolled from the schools more than 50 km away from the river beds with no expected exposure to river water pollution.

The study included children of age group 4 to 10 years of both genders who were attending the primary schools regularly. Children with chronic diseases like TB or Asthma, Children with known genetic problems and Children Absent on the day of examination were excluded from the study. The children were included in study after obtaining written informed consent from the parents

The survey was conducted in primary schools after obtaining approval from school authorities. The psychological effect of children were compared by using pre validated Pediatric Symptoms Checklist (PSC-17). It was developed by W Gardner and K Kelleher (1999). PSC is a 17-items based questionnaire that is used to screen cognitive, emotional and behavioural problems in children. All included 17-items are ranked and scored as never (0), Sometimes (1), and Often (2). Scores ≥15 indicate an increased likelihood of a behavioral health disorder being present.

The items are further grouped into 3 subscales: Attention, Externalizing and Internalizing. The Attention sub scale includes 5 questions (1, 3, 7, 13 & 17) i.e. Fidgety and unable to sit still, Daydreams too much, Has trouble concentrating, Acts as if driven by a motor and Distracted easily. Scores ≥7 indicate an increased likelihood condition like Attention deficit hyperactivity disorder (ADHD), Attention Deficit Disorder (ADD). The Externalizing sub scale includes 7 questions (4, 5, 8, 10, 12, 14 and 16) i.e. Does not understand other people's feelings, Refuses to share, Fights with other children, Blames others for his or her troubles, Does not listen to rules, Teases others and Takes things that do not belong to him or her. Scores ≥7 indicate an increased likelihood condition like Conduct disorder, Oppositional Defiant Disorder, adjustment disorder with disturbed conduct or mixed disturbed mood and conduct. The Internalizing sub scale includes 5 questions (2, 6, 9, 11 and 15) i.e. Feels sad, Feels hopeless, Is down on him or herself,

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Seems to be having less fun and Worries a lot. Scores ≥5 indicate an increased likelihood condition like anxiety or mood disorder.

Result:

The study included 1426 children of 4 to 8 years. These include 715 children (382 boys and 329 girls) from villages near Ganga basin and 711 children (360 boys and 355 girls) from villages away from Ganga basin. (Table 1)

PSC questionnaire was analyzed on Total score scale, Attention sub scale, internalizing sub scale and externalizing scale. The PCS score in 56 (7.9%) children residing in villages away Ganga was above cut-off score while 261 (36.51%) children in villages near river Ganga was having PCS score above cut-off. The result found significantly more percentage of children residing in villages near river Ganga had score more than cut-off. The similar result was also found among boys and girls. 33.6% (N=121) boys residing in villages near Ganga had PCS score greater than cut-off score which was significantly greater than 9.4% (N=36) in boys from villages away from Ganga. Similarly 39.4% (N=10) girls residing in villages near Ganga had PCS score greater than cut-off score which was significantly greater than 6.1% (N=20) in girls from villages away from Ganga. (Table 2)

The Attention sub scale score in 1.4% (N=10) children residing in villages away Ganga was above cut-off score while 9.3% (N= 59) children in villages near river Ganga was having Attention sub scale score above cut-off. The result found significantly more percentage of children residing in villages near river Ganga had score more than cut-off. The similar result was also found among boys and girls. 7.2% (N=26) boys residing in villages near Ganga had Attention sub scale score greater than cut-off score which was significantly greater than 1.6% (N=6) in boys from villages away from Ganga. Similarly 9.3% (N=33) girls residing in villages near Ganga had Attention sub scale score greater than cut-off score which was significantly greater than 1.2% (N=4) in girls from villages away from Ganga. (Table 3)

The Externalizing sub scale score in 24.61% (N=175) children residing in villages away Ganga was above cut-off score while 48.0% (N= 365) children in villages near river Ganga was having Externalizing sub scale score above cut-off. The result found significantly more percentage of children residing in villages near river Ganga had score more than cut-off. The similar result was also found among boys and girls. 54.7% (N=209) boys residing in villages near Ganga had Externalizing sub scale score greater than cut-off score which was significantly greater than 25.4% (N=97) in boys from villages away from Ganga. Similarly 43.9% (N=156) girls residing in villages near Externalizing sub scale score greater than cut-off score which was significantly greater than 23.7% (N=78) in girls from villages away from Ganga. (Table 4)

The Internalizing sub scale score in 9.3% (N=66) children residing in villages away Ganga was above cut-off score while 31.5% (N= 225) children in villages near river Ganga was having Internalizing sub scale score above cut-off. The result found significantly more percentage of children residing in villages near river Ganga had score more than cut-off. The similar result was also found among boys and girls. 30.3% (N=109) boys residing in villages near Ganga had Internalizing sub scale score greater than cut-off score which was significantly greater than 8.1% (N=31) in boys from villages away from Ganga. Similarly 32.7% (N=116) girls residing in villages near Internalizing sub scale score greater than cut-off score which was significantly greater than 10.6% (N=35) in girls from villages away from Ganga. (Table 5)

Table 1: Number of Samples collected according to Locality

ADDRESS	Gender	N	%
Away from Ganga	Boys	382	53.7
	Girls	329	46.3
	Total	**711**	**100.0**
Near Ganga	Boys	360	50.3
	Girls	355	49.7
	Total	**715**	**100.0**
TOTAL	Boys	742	52.0
	Girls	684	48.0
	Total	**1426**	**100.0**

TABLE 2: PSC score on Total Score Scale of both Locality and Gender wise

GENDER	SCORERANGE	Away from Ganga		Near Ganga		Chi square value	P Value
		N	%	N	%		
BOY	Below Cut-off	346	90.6	239	66.4	55.21	0.001*
	Above Cut-off	36	9.4	121	33.6		
GIRL	BelowCut-off	309	93.9	215	60.6	64.39	0.001*
	AboveCut-off	20	6.1	140	39.4		
Total	BelowCut-off	655	92.12	454	63.49	59.74	0.001*
	Above Cut-off	56	7.88	261	36.51		

TABLE 3: Comparison of Attention Subscale score both Locality and Gender wise

GENDER	SCORE RANGE	Away from Ganga		Near Ganga		Chi square value	P Value
		N	%	N	%		
Boy	Below cut-off	376	98.4	334	92.8	62.27	0.001*
	Above cut-off	6	1.6	26	7.2		
Girl	Below cut-off	325	98.8	322	90.7	87.55	0.001*
	Above cut-off	4	1.2	33	9.3		
Total	Below cut-off	701	98.6	656	91.7	81.69	0.001*
	Above Cut-0ff	10	1.4	59	9.3		

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TABLE 4: Comparison of Externalizing Subscale score both Locality and Gender wise

GENDER	SCORE RANGE	Away from Ganga		Near Ganga		Chi square value	P Value
		N	%	N	%		
Boy	**Below cut-off**	285	74.6	173	45.3	21.75	0.001*
	Above cut-off	97	25.4	209	54.7		
Girl	**Below cut-off**	251	76.3	199	56.1	17.92	0.001*
	Above cut-off	78	23.7	156	43.9		
Total	**Below cut-off**	536	75.38	372	52.0	18.66	0.001*
	Above Cut-off	175	24.61	365	48.0		

TABLE 4: Comparison of Internalizing Subscale score both Locality and Gender wise

GENDER	SCORE RANGE	Away from Ganga		Near Ganga		Chi square value	P Value
		N	%	N	%		
Boy	**Below cut-off**	351	91.9	251	69.7	51.49	0.001*
	Above cut-off	31	8.1	109	30.3		
Girl	**Below cut-off**	294	89.4	239	67.3	34.86	0.001*
	Above cut-off	35	10.6	116	32.7		
Total	**Below cut-off**	645	90.7	490	68.5	48.29	0.001*
	Above Cut-0ff	66	9.3	225	31.5		

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<u>Discussion</u>

The quality of the air we breathe and the water we drink has direct and indirect effects on our physical and mental health.[12,13] We are continuously putting our effort into vitiating the quality of both of these necessities of life. The detrimental effect of physical environment on physical and mental health of humans is well documented and children are more prone to it. There is strong direct relationship between physical health and mental health of peoples.[14,15]

Alone, Water pollution of fresh water bodies caused millions of deaths of children around the world.[5] River Ganga is immensely polluted and the consumption of polluted water of Ganga has adverse effect on human health.[4]

The most source of exposure to pollutants in water is drinking contaminated water. Inhalation exposure to volatile compounds during hot showers and skin exposure while bathing or using water for recreation are also potential routes of exposure to water pollutants.[2]

Significantly less percentage of children living in villages faraway from Ganga basin had score above cutoff on PSC scale in comparison to children living close to Ganga Basin. The reason might be unorganized industries are mushrooming in villages around Ganga are responsible for water pollution in these villages. In villages near Ganga, indiscriminate uses of chemicals, pesticides, and fertilizers by farmers is also deteriorating the quality of water.

The high concentration of pollutants like heavy metals in water, soil and crops, is imposing a strong threat on the health of the local residents. Continuous uptake of these pollutatnts has cumulative effects on the residents, especially for children, since there is not an efficient way for elimination of these pollutants in child bodies.

The study by **Bao QS et al.,**[16] was also in confirmation with the result of our study. They found that the high level of behaviour problem in children around sulphide mine. These problem increases with the pollution of heavy metals in water. **Kohlboeck G**[17] had also reported behavioral problems in children due to the presence of pollutants in drinking water.

No published estimates are available of the global burden of disease resulting from the overall effects of chemical pollutants in water. Acute exposure to contaminants in drinking water can cause irritation or inflammation of the eyes and nose, skin, and gastrointestinal system; however, the most important health effects are due to chronic exposure (for example, liver toxicity) to copper, arsenic, or chromium in drinking water. The effects on the developing nervous system can include impaired mental and psychomotor development, as well as cognitive impairment and behavior abnormalities.[18]

The ideal method to abate diffuse chemical pollution of river water is to minimize or avoid the use of chemicals for industrial, agricultural, and domestic purposes.[19] Adapting practices such as organic farming and integrated pest management could help protect waterways. Chemical contamination of river water from industrial emissions could be reduced by cleaner production processes.[20]

Conclusion

The water quality of rivers affected the children psychological health. Children living in villages near river Ganga had higher prevalence of mental health disorder in comparison to Children living in villages away from river bed. This information will be useful for river cleaning projects. The government agencies should take proper measures by digesting the various reasons that cause the pollution of the river so that the children get healthy environment and this can lead to proper mental development of children

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