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Effect of covid-19 lockdown on the water quality index of Sone River in Shahdol district (M.P.) with potential hazards of Faecal-oral transmission

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Abstract: **Water is a scarce and valuable resource for the survival of mankind. But manmade activities has changed the morphology of the areas, the river regimes causing problems of water pollution. Through the bodies like state Pollution Control Board try to tackle the problem of pollution. But the net result indicates that no any remarkable improvement has been made.**

But sometimes nature takes care of itself. The Covid-19 lockdown has been reported as a ventilator for the reinstatement of natural resources entire the world. Present study is an attempt to evaluate the effect of covid-19 lockdown on water quality of Sone river across its stretch through the assessment of water quality index (WQI). This study also highlights the potential risk of faecal-oral transmission of Covid-19 through intake of river water facing the issue of direct discharge of domestic sewage .A deterioration in the water quality has been witnessed at 16 sampling locations during Pre-lockdown period, lockdown period and post lockdown period.

Interestingly none of the sample during Pre-lockdown, lockdown and post lockdown period across the whole stretch belonged to the satisfactory level (WQI ⩽ 25).The DO levels across 69% and 88% of all the sites during the lockdown and post lockdown periods. Moreover, there was increase in BOD5 levels across 69% and 75% of all the sites during lockdown and post lockdown periods.

Index Terms: **Sone River. Water quality index. BOD5. DO. Faecal-Oral transmission. Covid-19 lockdown. River Water Pollution.**

INTRODUCTION

WHO reported the first human covid-19 case by an official at Wuhan City of China in December 2019.Environmental samples taken from Wuhan city market in December 2019 tested positive for (SARS)-Cov-2. Market was closed on 1st January 2020. WHO hasutilised international network of expert laboratories to provide support in detection of covid-19 virus globally. An outbreak of Nobel coronavirus-19 starts in wuhan China and describes diagnosis clinical course of cases including patients initial and mild symptoms at presentation with progression to pneumonia on day 9th of illness. The initial case has been exposed in a seafood market in Wuhan. Upto 27th January 2020, 81 death cases had been reported by Chinese authorities. The disease spread across the word at a very rapid pace (Yunus et al.1; 2020) and was announced as a pandemic by WHO. First case of COVID-19 infection reported in Kerala,India. On January 27, 2020, a 20 yr old female presented to the Emergency Department in General Hospital, Thrissur, Kerala, with a one-day history of dry cough and sore throat. There was no history of fever, rhinitis or shortness of breath and spread all over the country within 2 months.A lockdown had declared in India on 24th March 2020 and extended in different phases is till may 2020 to control the outbreak of covid-19 amongst 1.38 billion population (Worldometer 2-4; 2020.) of India as illustrated in the Fig. 1.

Metro closed, trains closed, airways closed, buses closed, even people coming out of their homes were completely banned. Shops, small and big factories were closed, people became disheartened and sad but nature started smiling. The air quality began to improve as the smoke emanating from the chimneys of motor vehicles, factoriesstopped. The wastewater from industries, restaurants, shopping malls almost stopped getting into the rivers and the water of the rivers shone.

Pollution of the environment including air and water pollution in rivershas witnessed substantial determination of pollutants especially during our study period. In river water PM10 and PM2.5, NO_2, NH_3 concentrations have shown significant declining trends.

The lockdown period has reportedly witnessed the fact that our environment has the potential competency to reinstate into its antiquated form.

Datta et al5 (2020) reports about the positive impact of lockdown on imposing the quality of the various environmental resources. This report stated that the national river Ganga witnessed a remarkable improvement in the water quality index during the lockdown period. According to this study, the water quality index of river Ganga at Haridwar has been declared "fit for drinking purposes", i.e, "class A", designated notably, 20 years after since the formation of Uttarakhand as a state in 2000.

Thus, results from various studies and reports make this study necessary and important for accessing the actual impact of covid-19 lockdown on river Sone. The SARS-CoV-2 virus utilizes angiotensin-converting enzyme (ACE-2) as a receptor for its passage into human body cells. This (ACE-2) RNA messenger is majorly conveyed in the gastro-intestinal system (Heller et al6 2020).

It has been highlighted in various studies (Wu et al 7 2020), (Wang et al 8 2020),(Ahmed et al 9 .2020) that potential SARS-CoV-2 has detected in the stools of covid-19 patients as well as release of virus in human faeces after disappearance of other respiratory symptoms. Medema et al10 (2020), reveals the detection of this virus in sewage water during low prevalence of covid-19 and immediate necessity of sewage water surveillance for monitoring of virus circulation.

Transmission of this Virus through potential faecal-oral transmission among unaffected population makes the sewage surveillance a vital easy warning tool for the possible increased circulation in the winter season.Thus in Sone river the potential risk of faecal-oral transmission cannot be ignored, since the use of this river water for drinking purpose in many habitations along its stretch and issue of direct release of domestic sewage in the river.

River "Sone" originated from SonmudaAmarkantak district, Anuppur (Longitud- 23.49' 23.6, Latitude: 80.24'29.3) then it flows underground and becomes a surface river at village Cholna, Anuppur district. Then it flows to the forest area towards town Chachai of Anuppur, further moves to industrial Town Amlai, where the intake well point of Orient paper Mill (OPM) exists. Then it follows towards village Navalpur, Chaka, Jarwahi, Lalpur, Diyapipar, Kshirsagar(a Picnic spot), Maseera, Deolond (Bansagar Dam).

The total length of Sone River from its origin to Deolond (Bansagar Dam), district Shahdol is nearly 209 km. From Deolond River Sone crosses the jurisdiction of regional office Shahdol and enters into jurisdiction of regional office Rewa. (Source- Regional office MP pollution control board, Regional office Shahdol MP).

River Sone is also a primary source of drinking water supply in many villages, towns and cities, especially Shahdol City along its Course. The excessive discharge of domestic sewage and industrial effluents from local and small industries etc has deteriorated the water quality index of river Sone significantly in the Shahdol district of Madhya Pradesh with a total population of 1.1 million.

Hence study emphasizes in assessing the lockdown effect on water quality of river Sone. This study also aims at the need of a comprehensive analysis considering the Perseverance of viral infection in rever Sone. A comparative assessment of the water quality has been carried out for samples drawn during pre covid-19 lockdown, lockdown duration and post lockdown (July 2020). Efforts have also been made to identify major probable contributing factors affecting the water quality.

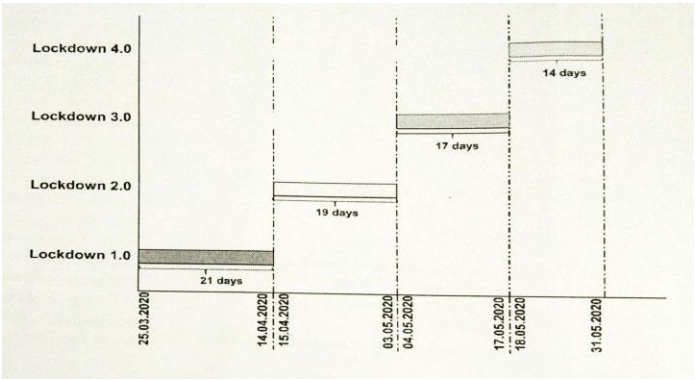

Fig. 1.Lockdown Phases in India

Fig. 2.Sone River locations

EXPERIMENTAL

Study Area

The origin of river Sone is located between 23.49'-23.6 Longitude and 80.24'-29.3 Latitude called Sonmuda (R-1) Amarkantak district Anuppur. Near to its origin it flows underground and becomes a surface river at village-Cholna (R-2) of Anuppur district. A dam is constructed by MB Power limited. Jaitahari at village Koytar and Dhurvasin(R-3).Then river flows towards town Chachai(R-4) of Anuppur and enters to Shahdol district through village Amlai (R-5) then it follows to Saboo(R-6), Bhaturaghat(R-7), Nawalpur(R-8),Chaka(R-9),Jarwahi(R-10)Lalpur(R-11),Diyapipar(R-12), kshirsagar(R-13, junction point with Murna river),Dashrathghat(R-14),Maseera(R-15) and Devlond (R-16,Bansagar Dam).

The total length of Sone River from village Cholna district Anuppur to Devlond district Shahdol is about 209 kms. There are six small rivers named Kewai,Tipan,Surfa, Murna,Juhila,Chandas joined to Sone river in a stretch from its origin in Sonmuda district Anuppur to Devlond (Bansagar Dam). Some locations are shown in Fig. 2.

Other 5 Nallas-Ghattan,Nargada, Gaibuda,Bagaiha, and Takinalla of Shahdol City fall into river Murna which joins the river Sone at kshirsagar, at a distance of approximately 22 kms (Source-Report, M.P. Pollution Control Board, Regional Office Shahdol, M.P.).

Methodology

Data Collection

A comparative analysis of the variations in water quality indexes of river Sone has been attempted for the prior period during and after the covid-19 lockdown-I i.e, January-February 2020. May- June 2020 and Aug-Sep 2020.

The dataon dissolved oxygen(DO), biological Oxygen Demand (BOD5) and other coliform parameters available on MP Pollution control board used.

Due to the lockdown all over the country sampling was not possible in May-June 2020, hense secondary data are collected through internet sources, journals, Research articles, different government reports. To maintain coherence in our competitive assessment secondary data for the month of January February 2020 and August September 2020 (Pre and post covid-19 lockdown) has been used.

Water Quality Index (WQI) Data treatment

The water quality index explains the biological, physical, and chemical characteristics of water.

Various water quality indices(WQI) has been developed for the monitoring and analysis of freshwater quality for utilisation of human beings.

WQI has been used as a defined and comprehensive technique to express the quality of surface water through a single number of aggregation of the values of physicochemical parameters (Shukla et al.11 2020, Mishra et al.12 2020).

The variation in the different water quality parameters including BOD5 ,DO and total coliform at different sites was estimated and presented through graphical illustration.

WQI has been computed using parameters DO, BOD5 and total coliform.

WQI has been computed by using weighted arithmetic index (WAI) method and by using following equations (Goyal et al13 2018; Selvam et al14 2020; Shukla et al15 2020 a,c).

$$Qn = 100(Vn-Vs)/Vs-Vi) \quad \text{-------- (a)}$$

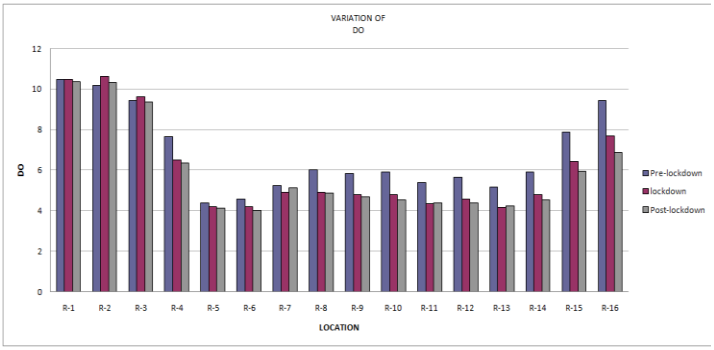

Fig. 3.DO level variation across selected locations in pre-lockdown, lockdown & post-lockdown phases

$$Wn = K/Sn \quad \text{---------- (b)}$$
$$K = \Sigma(1/Sn) \quad \text{-------- (c)}$$
$$And\ WQI = \Sigma QnWn/Wn \quad \text{------ (d)}$$

Where- Vs=standard values
Vi= Ideal values
Wn= Unit weight for the nth parameter
Sn= Standard permissible value for the nth parameter
K = Proportionality Constant
WQI= Suitability values for utilization are as follows-
(0-25) - Excellent
(26-50) - Good
(51-75) - Poor
(76- 100) - Very poor and >100- Unfit

I. RESULTS AND DISCUSSION

Variation in BOD_5, DO, and total coliform levels

The subsistence of aquatic flora mainly depends upon BOD5 and DO levels in the surface water source. The variation of BOD5 and DO levels appears with reference to several factors such as Temperature, PH value, Stagnation or flow of water, Presence of inorganic and organic waste etc.

The relevance of affecting factors has been considered to study their impact on the variation of BOD5 and DO levels. An overall average DO value decreased by 18.2% during the lockdown as compared to Pre-Lockdown phase at all sampling sites. Fig. 3.

Such depletion in DO levels had been observed in the majority of midstream and downstream sites. The significant effect of domestic sewage discharge on DO levels was explicit,

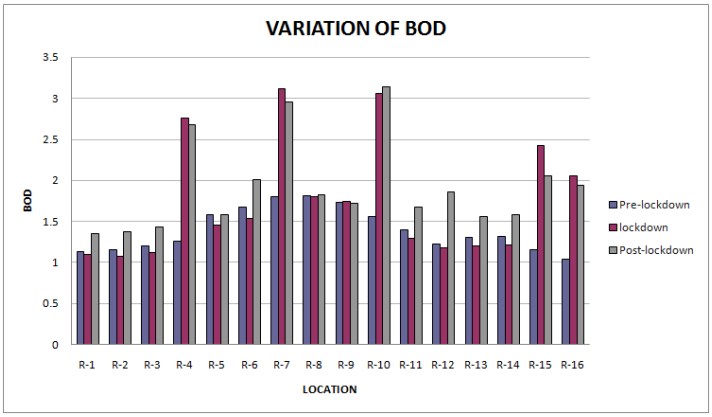

Fig. 4. BOD_5 level variation across selected locations in pre-lockdown,lockdown & post-lockdown phases

considering that total lockdown period had no effect on sewage discharge.

A further 18.1% decrease observed in DO level in post-lockdown phase. The impact of the unlocking of various activities by commercial activities, industrial discharge effluent and other small-scale enterprises emerged as a major cause of this depletion in the post lockdown phase.

An improved DO level witnessed during lockdown phase at upstream sites is probably due to their upstream location (R-1, R-2, R-3).

Release of industrial effluents by local small scale manufacturing units during lockdown phase is also a possible

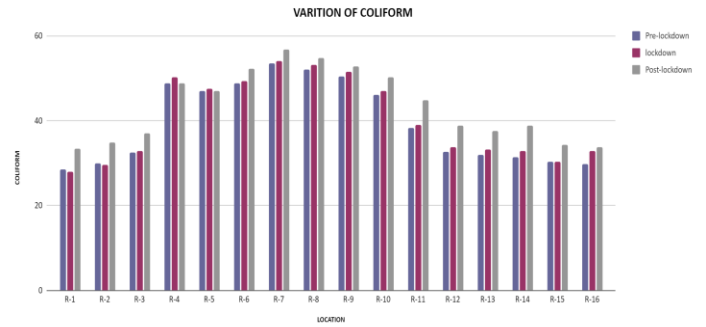

Fig. 5. Total coliform level variation across selected locations in pre-lockdown, lockdown& post-lockdown phases

cause behind the increased DO level.

An overall average increase of 7.09 % during the lockdown phase indicates the influence of domestic sewage load on BOD5 levels.

Again an increase of 19.4 % was observed in BOD5 values during the post lockdown phase confirming the potential influences of anthropogenic activities.

BOD5 levels at sites R-4 to R-7, R-10, R-15 and R-16 increased during lockdown and post lockdown phases Fig. 4.

The impact of anthropogenic activities and domestic sewage discharge at these sites might be the primary source of water pollution, indicating the issue of direct discharge of sewage into river water without any treatment. The BOD5 level at R-8 and R-9 remained constant during the lockdown phase and increased in the post lockdown phase. The BOD_5 levels at R-12 dipped slightly during lockdown and increased during the post lockdown phase.

The three upstream sites R-1, R-2, and R-3 and one downstream site R-15 of the river Sone, constant levels of total coliform during the lockdown period Fig. 5.

This pattern indicates the dominance of domestic sewage discharge as compared with the industrial discharge on these sites.

Variation in water quality index (WQI) levels

The WQI had computed by using total coliform bacteria counts and by using values of BOD5 and DO. These three parameters are very crucial for water quality of any freshwater riverine ecosystem. During this study higher WQI values were obtained. The Increased average WQI values by 0.24 % and 21.36 % during the lockdown and post lock down phases respectively, represents a deterioration of water quality of the river Sone.

During lockdown the water quality depleted at 69% of the sites but also improved at 31% sites.

A significant depletion has been observed at five sites indicating the effect of urban sprawl and closely located sites. River Sone is a groundwater fed river not a glacial fed river like Ganga; this river might have a possible influence on the self healing/cleaning capability or ability to recover its water quality. In this study the development of current lack of evidence on the importance of Faecal-oral transmission Corona-virus/ SARS-CoV-2 are highlighted. This study raises the urgent need of an extended and detailed research to determine the definite role of fresh water and sanitation mediation to prevent this route of transmission in rivers Sone and other surface water sources.

CONCLUSION

The covid-19 lockdown provided improvement in WQI parameters but did not provide any expected significant improvement of river Sone. The improved water quality during the lockdown phase at the upstream site R-1 suggests a slight decrease in water quality, highlighting the possible impact of anthropogenic activities and the need of a good water treatment plant in the vicinity. As the river flows towards the site R-2 and R-3 an improved water quality was witnessed signifying the groundwater fed nature with constant refinement by the river. This attributes to the self-healing ability of the river. A nearly constant trend of water quality deterioration in sites R-5 to R-10 sites witnessed during all three sampling periods. This result inlights the influence of direct discharge of untreated effluent and urban sprawl into the river. The water quality assessment of

water in river Sone during pre lockdown, lockdown, and post-lockdown phases clearly indicates that the factor of concern for river Sone is sewage discharge which remains unaffected during the lockdown. It may be concluded that covid-19 lockdown partially as a ventilator for the revival of rivers Sone. Instead, domestic sewage release into the river has exposed the population to the virus outbreak risk through faecal oral transmission.It needs immediate in-depth research to ensure the health and safety of habitants. Thus the educt of this study calls for intervention to stop the continuous dumping and discharge of domestic waste materials and sewage water to accelerate the self- healing ability of river Sone and to restore it for a cleaner state and nation.

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REFERENCES

[1] Yunus, A. P., Masago, Y., &Hijioka, Y. (2020). COVID-19 and surface water quality: improved lake water quality during the lockdown. Science of the Total Environment, 731(139012), 1-8.

[2] WHO: Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations. (2020a). Retrieved November 18, 2020 from https://www.who.int/news-room/commentaries/detail/modes-oftransmission-of-virus-causing-covid-19-implications-for-pcprecaution-recommendations.

[3] WHO: Advice for the public. (2020b). Retrieved September 06, 2020 from https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public.

[4] Worldometer:Coronavirus cases. In: Worldometer. (2020c). Retrieved September 06, 2020 from https://www.worldometers.info/coronavirus/

[5] Dutta, V., Dubey, D., & Kumar, S. (2020). Cleaning the River Ganga: Impact of lockdown on water quality and future implications on river rejuve nation strategies. Science of the Total Environment, 743(140756), 1-17.

[6] Heller, L., Mota, C. R., & Greco, D. B. (2020). COVID-19 faecal-oral transmission: are we asking the right questions? Science of the Total Environment, 729(138919), 1-3.

[7] Wu, Y., Guo, C., Tang, L., Hong, Z., Zhou, J., Dong, X., Yin, H., Xiao, Q., Tang, Y., Qu, X., Kuang, L.,Fang, X., Mishra, N., Lu, J., Shan, H., Jiang, G., & Huang, X. (2020). Prolonged presence of SARS-CoV-2 viral RNA in faecal samples. The Lancet Gastroenterology and Hepatology, 5(5), 434-435.

[8] Wang, W., Xu, Y., Gao, R., Lu, R., Han, K., Wu, G., & Tan, W. (2020). Detection of SARS-CoV-2 in different types of clinical specimens. JAMA 323(18), 1843-1844,

[9] Ahmed, W., Angel, N., Edson, J., Bibby, K., Bivins, A., O'Brien, J. W., Choi, P. M., Kitajima, M.,Simpson, S. L., Li, J., Tscharke, B., Verhagen, R., Smith, W. I. M., Zaugg, J., Dierens, L., Hugenholtz, Thomas, P., K. V., & Mueller, J. F. (2020). First confirmed detection of SARS-CoV-2 in untreated wastewater in Australia: a proof of concept for the wastewater surveillance of COVID-19 in the community. Science of the Total Environment 728(138764), 1-8.

[10] Medema, G., Heijnen, L., Elsinga G., Italiaander, R., & Brouwer., A. (2020). Presence of SARS Coronavirus-2 in sewage. Environmental Science & Technology Letters 7(7), 511-516.

[11] Shukla, S., & Saxena, A. (2020). Water quality index assessment of groundwater in the Central Ganga Plain with reference to Raebareli district, Uttar Pradesh, India. Current Science, 119(8), 1308–1315.

[12] Mishra, S.,&Kumar,A.(2020). Estimation of physicochemical characteristics and associated metal contamination risk in the Narmada River, India. Environmental Engineering Research 26(190521), 1-11.

[13] Goel, P., Saxena, A., Singh, D. S., & Verma, D. (2018). Impact of rapid urbanization on water quality index in groundwater fed Gomati River, Lucknow, India. Current Science 114, 650-654.

[14] Selvam, S., Jesuraja, K., Venkatramanan, S., Chung, S. Y., Roy, P. D., Muthukumar, P., & Kumar, M. (2020). Imprints of pandemic lockdown on subsurface water quality in the coastal industrial city of Tuticorin, South India: a revival perspective. Science of the Total Environment, 738(139848), 1-7.

[15] Shukla, S., & Saxena, A. (2021). Appraisal of Groundwater Quality with Human Health Risk Assessment in Parts of Indo-Gangetic Alluvial Plain, North India. Archives of Environmental Contamination and Toxicology, 80(1), 55-73.

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