



Research Article

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Effects of COVID-19 pandemic on festival celebrations and noise pollution levels

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Abstract: India is a country where every religion and community celebrates their culture. Festivals have an important role in Indian culture and are celebrated whole-heartedly by the citizens. Most of these celebrations culminate to causing pollution especially noise pollution due to festivities and rituals. One such festival is Ganesh Chaturthi or Ganeshotsav which is magnificently celebrated in Maharashtra state of India. In the present study, noise pollution levels during Ganeshotsav at famous community *pandals* in Mumbai city were monitored in the year 2020. Noise level data was analyzed based on indices such as L_{10} , L_{50} , L_{90} , noise pollution level (L_{NP}) and noise climate (NC). Comparison of noise levels was carried out for the collected data during Ganesh Chaturthi in the previous years of 2018 and 2019. The city witnessed simple festival celebration in eco-friendly manner leading to significant decrease in noise levels due to CoVID-19 pandemic. The pandemic situation is an eye-opener for the city administration with demonstration in reduction of noise pollution. Many aspects of the pandemic can be carried forward in making new guidelines and policies to curtail pollution and eco-friendly celebration of festivals.

Keywords: pandemic, festive noise, Ganesh festival, noise pollution

1 Introduction

The year of 2020 has brought with itself the global pandemic which has caused huge chaos, fear and awareness amongst people. Everything is different when seen from behind the glass which in this case is an image, not just metaphoric of people forced to stay inside due to the CoVID-19 pandemic lockdown measures. The first mention of this viral outbreak was known when it was reported from Wuhan, China on 31st December 2019 [1] after which the news spread like wildfire about the rapid transmission of virus among human beings. This further led to panic and many countries across the world went into lockdown mode. The same situation was observed in India from the month of March 2020 when nationwide strict lockdown was imposed by the government. This is the beginning of a new era wherein people have come to self-realize on number of things which can be done within the confines of home. As the lockdown restricted all types of commercial, industrial, social and urbanization activities, nature bounced back on the path of recovery showing improved air quality, cleaner water in rivers and reduced noise levels up to 35% to 68% all over the world [2, 3]. The noise due to vehicular traffic and honking which contributes as the major source of urban noise pollution [4–8], was also at its lowest levels.

India is a secular country where every citizen has equal freedom to follow their religion across any region. Festivals are integral part of India's rich and diverse culture and are occasion for immense happiness and celebrations across the country. This is evident in every festival enjoyed by people to their heart's content be it the Janmashtami festival or Christmas or Holi or Eid, etc. An equally important festival that brings people together is the Ganesh Chaturthi or the Ganeshotsav (Ganesh festival) which is fondly celebrated across India but especially in Maharashtra state. In Mumbai, the celebrations assume huge proportions. This is an important festival honoring the elephant-headed Lord Ganesha, a Hindu deity, widely admired as the remover of obstacles, the patron of intellect and wisdom and is traditionally worshipped at the beginning of important undertakings, rites and ceremonies. Hindus throughout India and in countries including Nepal, Sri Lanka, Thailand, Bali (In-

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onesia), Bangladesh, Fiji and Mauritius with large ethnic Indian populations worship Lord Ganesha.

This festival is celebrated by worshipping the idol of Lord Ganesha in individual homes and in the community *pandals* also known as marquee or fabricated structures. It is celebrated annually on the birthday of Lord Ganesha which as per Hindu calendar falls in monsoon season during August or September. The celebrations last for 11 days during which the idol is worshipped every day and then bid adieu (on different days; after 1 and half day, 5th day or 11th day) as per traditions by ceremonial immersion in pond/lakes/sea. Very often these immersion processions are escorted by small music bands or cars playing loud devotional songs or ultimately community idols which have their own convoy of musical bands, loudspeakers, disc jockey sets (DJs), etc. and people of all ages descending onto the streets, dancing and singing, to the rhythms of drums and cymbals [9, 10] that accompany the idols until the final moment before they are immersed in ponds/lakes/sea. In the face of the reality what this festival does is create an unmatched level of noise pollution which is on par with the noise pollution experienced during Diwali festival where loud fire crackers are burst leading to noise pollution 1.2-1.3 times higher than that on normal days [11–13]. Thousands of devotees participate every year in the processions to mark the arrival as well as to bid adieu to their deity.

High noise levels can cause irritation, annoyance, insomnia, tinnitus, loss of hearing, etc. [14, 15]. As is the case, this is repeated every year when and where the festivals come and go with their own unique celebrations and environmental concerns. In the present study, an attempt has

been made to assess the noise levels due to Ganeshotsav (Ganesh festival) during CoVID-19 pandemic and its comparison with previous non-pandemic years of 2018 and 2019.

In the year of 2018 and 2019, famous and huge community *pandals* were monitored for their noise levels during this festival in Mumbai city. Places like Dadar, Ganesh Gully, Girgaum in Mumbai are famous for the community *pandals* wherein massive sized idols are placed and where the intensity of noise pollution is equally penetrating [12, 13]. In year 2020, huge difference in the noise levels was experienced due to ban on community *pandals* and very few people venturing outside for immersion procession due to lockdown. Small to medium sized idols were brought for immersion in the water without any music accompanying them. This was a surprise change wherein traditions were followed but keeping in mind to the sensitive surroundings and restrictions by the authorities. Comparison of noise levels was carried out for the collected data during Ganeshotsav in 2018 and 2019 against the noise levels or the lack of it observed in year 2020 due to pandemic protocols.

2 Materials and methods

2.1 Study area and noise monitoring locations

Mumbai city lies on the west coast of Konkan division of Maharashtra state in India ($18^{\circ}58'30''N$, $72^{\circ}49'3''E$). The city

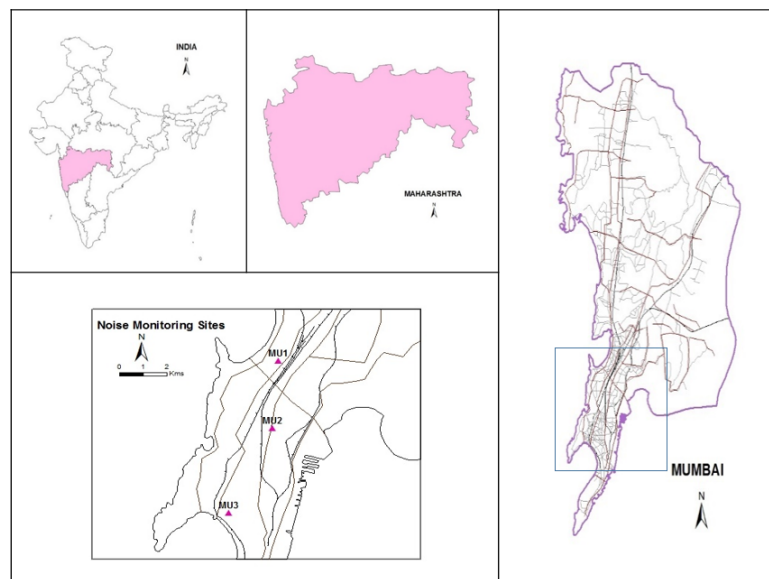


Figure 1: Study area and noise monitoring locations in Mumbai city at Dadar (MU1), Ganesh Gully (MU2) and Girgaum (MU3)

including whole state celebrates Ganesh festival with joy, happiness and lots of noise. The popular areas for Ganesh festival celebration located in the southern part of the city were selected for the noise monitoring study. Noise levels were monitored at three popular locations namely Dadar, Ganesh gully (street) in Laulbaug and Girgaum in Mumbai city as shown in the study area (Figure 1).

2.2 Noise monitoring and data collection

Festive noises are usually intermittent and impulsive in nature. Over a day, Ganesh festival is celebrated for four hours during 1800 hrs to 2200 hrs when crowd of devotees gather outside the *pandals* to worship the idol and play/sing devotional songs with DJ systems or loudspeakers. After 2200 hrs, playing music systems and loudspeakers is prohibited by the Government authorities. Using Type-I sound level meters, noise level data was collected for 75% of the total time *i.e.* three hours outside the *pandals* where continuous music and crowd of devotees was observed. Data is logged at an interval of 1 second. The instrument was mounted on tripod stand at the height of 1.5 meters from the ground and wind-ball was used to minimize the effect of wind. The microphone on the sound level meter was positioned at least 3 meters away from the hard surface or walls to minimize the effect of reflections [7, 8].

2.3 Data analysis

The sound level meter records the sound pressure level (SPL) in decibels (dB). From these readings, L_{eq} or equivalent continuous sound pressure level is calculated using following Eq. (1), which represents the SPL of a steady sound that over a period of time has the same energy as fluctuating sound.

$$L_{eq, T} = 10 \log \left(\frac{1}{n} \sum_{i=1}^n 10^{\left(\frac{L_i}{10}\right)} \right) \quad (1)$$

where:

L_i = noise level in dB

n = number of observations at equally spaced time interval

T = Time

L_{max} and L_{min} are the maximum and minimum SPL value, respectively, measured during the duration of monitoring. Exceedance percentiles L_{10} , L_{50} and L_{90} were calculated which, respectively, indicate the noise levels exceeded during 10%, 50% and 90% of the measuring time. Noise indices such as the noise pollution level (L_{NP}) and the noise climate (NC) were also computed using the following equa-

tions [16]:

$$L_{NP} = L_{50} + \left((L_{10} - L_{90})^2 / 60 \right) + (L_{10} - L_{90}) \quad (2)$$

$$NC = (L_{10} - L_{90}) \quad (3)$$

There is always fluctuation in sound levels over an interval of time and the range over which the sound levels are fluctuating is the Noise climate (NC).

3 Results and discussion

Noise levels were monitored at three popular locations in Mumbai city namely Dadar, Ganesh Gully and Girgaum which host grand celebrations during Ganesh festival. The graphical representations of the data collected and compared for three consecutive years of 2018, 2019 and 2020 are shown in Figure 2. The year of 2018 has recorded the highest noise levels at all the three locations with noise levels (L_{eq}) 102.1 dBA, 97.8 dBA and 96.3 dBA at Dadar, Ganesh Gully and Girgaum respectively (Table 1). The year of 2019 has recorded a significant decrease from the previous year with noise levels being recorded at 80.5 dBA, 74.7 dBA and 72.0 dBA for Dadar, Ganesh Gully and Girgaum respectively. In year 2020, the recorded noise levels for Dadar, Ganesh Gully and Girgaum were 73.7 dBA, 69.6 dBA and 68.8 dBA respectively indicating steep decrease compared to last two years.

Similar trend is observed in noise climate (NC) and noise pollution levels (L_{NP}) also at all the three locations. The permissible limit for L_{NP} is 88 dBA [17]. The L_{NP} during 2018 was found to be exceeding the permissible limit with 109.8 dBA, 103.3 dBA and 99 dBA at Dadar, Ganesh Gully and Girgaum respectively. It was slightly within the limit in 2019 and very low in 2020 during Ganesh festival at the three locations (Table 1). Significant reduction in background noise (L_{90}) and peak noise (L_{10}) was also observed from 2018 to 2020 at all the three locations (Table 1).

Over the last few years due to awareness campaigns and a new-found insight amongst the younger generation towards social causes have helped the society to understand the impact of higher noise levels on human and environment. It is observed that, the year of 2018 has recorded the highest noise levels (L_{eq}) at all the three locations for Dadar, Ganesh Gully and Girgaum (Figure 2). The year of 2019 has recorded a further decrease from the previous year (Figure 2). The difference observed in these two years is significant and can only be dedicated towards awareness campaigns by Municipal Corporation of Greater Mumbai (MCGM) and Maharashtra Pollution Control Board (MPCB)

Table 1: Noise descriptors representing noise environment during Ganesh festival in Mumbai city

| Sr. No. | Sites | Year | L_{eq} (dBA) | L_{min} (dBA) | L_{max} (dBA) | L_{10} (dBA) | L_{50} (dBA) | L_{90} (dBA) | NC (dBA) | L_{NP} (dBA) |
|---------|--------------|------|-------------------|--------------------|--------------------|-------------------|-------------------|-------------------|-------------|-------------------|
| 1. | Dadar | 2018 | 102.1 | 65.5 | 130.2 | 95.0 | 82.5 | 74.6 | 20.4 | 109.8 |
| | | 2019 | 80.5 | 57.4 | 111.3 | 77.4 | 69.6 | 63.7 | 13.7 | 86.4 |
| | | 2020 | 73.7 | 40.6 | 104.0 | 65.4 | 52.3 | 48.2 | 17.2 | 74.4 |
| 2. | Ganesh Gully | 2018 | 97.8 | 64.7 | 126.3 | 90.9 | 81.4 | 73.9 | 17.0 | 103.3 |
| | | 2019 | 74.7 | 56.3 | 95.4 | 77.2 | 69.1 | 63.0 | 14.2 | 86.7 |
| | | 2020 | 69.6 | 54.2 | 84.2 | 73.5 | 65.3 | 59.5 | 14.0 | 82.6 |
| 3. | Girgaum | 2018 | 96.3 | 66.2 | 129.4 | 88.3 | 80.5 | 73.5 | 14.8 | 99.0 |
| | | 2019 | 72.0 | 52.5 | 91.7 | 72.4 | 63.3 | 57.2 | 15.2 | 82.4 |
| | | 2020 | 68.8 | 51.4 | 83.9 | 72.7 | 66.4 | 60.3 | 12.4 | 81.4 |

**Figure 2:** Comparison of noise levels during Ganesh Festival at a) Dadar (MU1), b) Ganesh Gully (MU2) and c) Girgaum (MU3) in Mumbai City

along with various NGOs and research institutes [7] which educates the masses about the rising noise pollution in the city and its adverse impacts on health and environment and create responsibilities in individuals towards their contri-

bution for the society. Prohibitions on loudspeakers and DJ systems have been imposed by administration during night time after 10:00 pm. These efforts by local administration have contributed to reduced noise levels in 2019 compared to 2018.

On the other hand, the year 2020 which has witnessed a global pandemic due to COVID-19 outbreak has shown us the other side of the sentimental values attached to these festivals. When the government-imposed lockdowns were lifted step-by-step as the year progressed, there were new protocols laid down for social distancing and self-protection. Despite of this, people who whole heartedly wanted to celebrate this festival keeping in mind the pandemic situation did it in their own responsible and unique ways. A lot of individuals opted for clay idols which could be immersed in small tanks or water tubs inside the home so as not to leave the sanctuary of their homes. While on the other hand, the festivities in the name of music bands, DJs, loudspeakers, etc. was missing throughout the 11 daylong celebration. Instead the famous *pandals* like “Lalbugcha Raja Sarvajanic Ganeshotsav Mandal, Lalbaug” in Ganesh Gully organized blood donation camps on this occasion. Due to the pandemic situation the government prohibited community *pandal* set-ups for large crowd gatherings, people followed all the protocols even where the immersion was concerned. Processions for Ganesh idol immersions were quieter in 2020 compared to noise levels measured during entire festival days in the previous years; 2018 and 2019. Pandemic situation definitely improved the noise environment. Noise levels are lowered down from L_{eq} 102.1 dBA in 2018 to 73.7 in 2020 at Dadar, from 97.8 dBA in 2018 to 69.6 dBA in 2020 at Ganesh gully and from 96.3 dBA in 2018 to 68.8 dBA in 2020 at Girgaum due to pandemic which is impossible to achieve in typical scenario. Thus, it can be concluded that awareness campaigns do play a vital role in educating the citizens on hazards of man-made pollution

while at the same time it can only stress on the importance of communal harmony and well-being.

4 Conclusions

The present study throws a light on the impacts of CoVID-19 pandemic and awareness during most popular and longest festival – Ganesh Chaturthi, celebrated in Maharashtra state of India, especially in Mumbai city. Citizens have grand celebrations during Ganesh festival leading to noise pollution because of playing loud devotional songs and musical instruments. Present study represents the noise pollution due to festive noise during three years 2018, 2019 and 2020 during Ganesh festival. In the past years; 2018 and 2019 noise levels (L_{eq}) were recorded upto 102 dB and 80.5 dB respectively and in year 2020, highest levels of festive noise upto 73.7 were recorded. During pandemic, the city perceived simple festival celebration due to restriction by State Government authorities on processions to mark arrival and immersion of idols, guidelines to avoid crowd during daily worship and abidance of noise pollution norms, very less *pandals* and limited number of people celebrating the event in *pandals* which led to significant reduction in noise levels. In addition, State government also urged citizens to use marble or metal Ganesh idols at home or clay idols which can be immersed at home or in artificial ponds. Maharashtra being the worst hit state due to CoVID-19, live streaming of glimpses of Lord Ganesh idols at famous *pandals* through online cable networks and organization of health-related activities/camps were encouraged by government thereby reducing the crowd, vehicular traffic on roads and consequently, noise levels.

In year 2020, reduction in noise levels (L_{eq}) by 28.5 dBA, 28.2 dBA and 27.5 dBA at Dadar, Ganesh Gully and at Girgaum, respectively, were recorded compared to 2018. Pandemic situation on such a massive scale was never witnessed before and this is another eye-opener where the way of traditions and festivals can get along with the bare minimum participation and fanfare. This is a new leaf for the society where it clearly shows that to enjoy a festival, citizens can strive to abstain from old practices which can lead to various types of pollutions negatively affecting the environment. Many aspects of the pandemic can be carried forward in making new guidelines and policies to curtail noise pollution and eco-friendly celebration of festivals.

Conflict of interest: The authors declare no conflict of interest regarding the publication of this paper.

References

- [1] Xu H, Yan C, Fu Q, Xiao K, Yu Y, Han D, et al. Possible environmental effects on the spread of COVID-19 in China. *Sci Total Environ.* 2020 Aug;731:139211.
- [2] Arora S, Bhaukhandi KD, Mishra PK, Coronavirus lockdown helped the environment to bounce back. *Sci Total Environ.* 2020;742:140573. <https://doi.org/10.1016/j.scitotenv.2020.140573>.
- [3] Mandal I, Pal S. COVID-19 pandemic persuaded lockdown effects on environment over stone quarrying and crushing areas. *Sci Total Environ.* 2020 Aug;732:139281.
- [4] Vijay R, Kori C, Kumar M, Chakrabarti T, Gupta R. Assessment of traffic noise on highway passing from urban agglomeration. *Fluct Noise Lett.* 2014;13(04):1450031.
- [5] Vijay R, Sharma A, Chakrabarti T, Gupta R. Assessment of honking impact on traffic noise in urban traffic environment of Nagpur, India. *J Environ Health Sci Eng.* 2015 Feb;13(1):10.
- [6] Laxmi V, Dey J, Kalawapudi K, Vijay R, Kumar R. An innovative approach of urban noise monitoring using cycle in Nagpur, India. *Environ Sci Pollut Res Int.* 2019 Dec;26(36):36812–9.
- [7] Kalawapudi K, Singh T, Dey J, Vijay R, Kumar R. Noise pollution in Mumbai Metropolitan Region (MMR): an emerging environmental threat. *Environ Monit Assess.* 2020 Jan;192(2):152.
- [8] Thakre C, Laxmi V, Vijay R, Killedar DJ, Kumar R. Characterization of Honking Noise in Urban Environment of Nagpur. *Journal of Acoustical Society of India.* 2018;45(4):165–75.
- [9] Bhende SB, Bhawe PP. Study of noise pollution during Ganesh utsav in Mumbai city. *Int J Adv Res Sci Eng Technol.* 2014;3(7).
- [10] Sathe CP, Kadam AM, Ahire KD. Assessment of noise level during Ganesh festival in residential zone of Kolhapur city. *Int J Trend Sci Res Develop.* 2019. <https://www.ijtsrd.com/papers/ijtsrd23082.pdf>
- [11] Mandal P, Prakash M, Bassin JK. Impact of Diwali celebrations on urban air and noise quality in Delhi City, India. *Environ Monit Assess.* 2012 Jan;184(1):209–15.
- [12] Maharashtra Pollution Control Board (MPCB). Noise Monitoring during Ganesh Festival. 2017. Maharashtra. https://www.mpcb.gov.in/sites/default/files/noise-pollution/reports-ganesh-festival/Noise_Monitoring_Report_During_Ganesh_Festival_2017_29052019.pdf
- [13] Maharashtra Pollution Control Board (MPCB). Noise Monitoring during Ganesh Festival. 2018. Maharashtra. https://mpcb.gov.in/sites/default/files/noise-pollution/reports-ganesh-festival/Noise_Monitoring_Report_During_Ganesh_Festival_2018_29052019.pdf
- [14] Burden of disease from environmental noise: Quantification of healthy life years lost in Europe. World Health Organization. 2011.
- [15] Vijay R, Chakrabarti T, Gupta R. Characterization of Traffic Noise and Honking Assessment of an Indian Urban Road. *Fluct Noise Lett.* 2018;17:1850031.
- [16] Oyedepo SO, Saadu AA. Comparative analysis of noise descriptors in some selected areas in Ilorin metropolis, Nigeria. *Noise Control Eng J.* 2010;58:646–57.
- [17] Robinson DW. The Concept of Noise Pollution Level. *J Occup Environ Med.* 1971;13(12):602.