



Adverse Auditory Effects of Firecrackers on Living Creatures: A Mini Review

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Abstract

Firecrackers or fireworks in worldwide are used to celebrate various events, festivals, and ceremonies. These beautiful sparkling firecrackers are packets of dangerous pollutants which not only release dangerous gases on bursting but also produce enormous sound which is harmful for the human as well as animals. The vibrations caused by the sound can damage the ear and in the worst-case scenario may lead to loss of hearing ability. Besides auditory effects there are other effects like insomnia, headache, hypertension, myocardial infarction (commonly known as heart attack), etc. In this mini review some adverse effects of the firecrackers are discussed based on previous research and observations in support of the rules and regulations for controlling noise pollution in India.

Keywords: Firecrackers; vibrations; insomnia; hypertension; myocardial infarction

Abbreviations: MoEFCC: Ministry of Environment Forest and Climate Change; CPCB: Central Pollution Control Board; SPL: Sound Pressure Level; dB: Decibel

Introduction

Fireworks or firecrackers are part of our celebrations since years. In India it is impossible to witness Diwali, New Year celebrations, victory celebrations, marriages, and other festivals without firecrackers. Though these colorful sparkling fireworks are enjoyed by many, but these are a serious source of pollutants. They are responsible for causing atmospheric pollution by not only releasing toxic gases but also emitting enormous noise. It is widely assumed that the first fireworks were created in far eastern countries, most probably China, for use in religious festivals, and that knowledge of the technique spread to Europe via the Arab kingdoms. The fireworks consist of gunpowder or black powder which again is believed to be developed in China [1]. Sound pressure levels (SPL) is used to measure the intensity of sound, and the decibel (dB) is the most common unit of measurement of sound [2]. Noise is categorized into two kinds: continuous and impulse. Noise that is steady is known as continuous noise. An extremely quick sound or short burst with a sound pressure rise of at least 40 dB in 0.5 seconds or faster is known as an impulse or impact noise. It can occur single or in a series of episodes. Firecracker noise is an example of impulse noise [3].

Science Behind Firecrackers

Most fireworks are made from a short tube called an aerial shell, which contains explosive ingredients. These chemicals are responsible for all of a firework's lights, colors, and sounds. Gunpowder (a well-known explosive) and little globs of explosive components known as stars make up an aerial shell. A bursting charge with a fuse is located in the shell's core. When the fuse is lit with a flame or a spark, the bursting charge and the entire aerial shell explode causing a build-up of heat and gas beneath the shell. Due to the explosion, the hot gases expand rapidly. The loud sound that comes together with fireworks is basically a sonic boom caused by gases expanding faster than the speed of sound [4].

Noise Rules in India

After China, India is the world's second-largest manufacturer of fireworks, with almost all of it intended for local use [5]. The bursting of firecrackers in large amounts by such a huge population of India creates enormous noise pollution causing disturbances and other physical and psychological hazards. In India, MoEFCC and CPCB deals the affairs of environmental pollution and disturbances. According to Air Pollution act 1981, noise is also a pollutant. Under

the Environment Protection Act of 1986, the Central Government issued the Noise Pollution (Regulation and Control) Rules, 2000. As per this rule the standards for noise levels are as follows. As per notification, daytime is of 16 hours starting from 6.00 am to 10.00 pm and nighttime is of 8 hours from 10.00 pm to 6.00 am. According to the Noise Pollution rules, bursting of firecracker is not allowed in silence zones and during nighttime (Table 1).

Table 1: Standards for ambient noise levels in India (CPCB).

Zones	Day Time (dB)	Night Time (dB)
Silence	50	40
Residential	55	45
Commercial	65	55
Industrial	75	70

Impacts of Firecrackers

Firecrackers could be extremely dangerous to the public's health. Enormous noise causes a number of physical and psychological health problems in humans, including hypertension, heart attack, depression, anxiety, headache and hearing loss [6]. Interference with communication, insomnia, and decreased efficiency are other major effects of noise pollution [7]. Mandal et al., (2012) studied the residential areas of Delhi, India, to determine the influence of Diwali celebrations on urban noise quality and reported that ambient noise levels were 1.2 to 1.3 times higher than on a normal day. Plontke et al. [8] investigated the occurrence of acoustic damage caused by New Year's fireworks. The goal of their study was to evaluate the incidence of blast and explosion trauma caused by the use of New Year's firecrackers in a western industrialized society over time. They discovered that three times as many men as women were impacted while the incidence was substantially greater in the age group of 6 to 25 years. Thus, they concluded that firecrackers could be extremely dangerous to the public's health [8]. Segal et al. [9] studied the 53 cases of children who were affected by toy cap pistols and firecrackers in Israel. Their retrospective study found that there is possible inner ear damage in children due to exposure to toy pistols and firecrackers including other effects such as dizziness or tinnitus. Sensorineural high frequency hearing loss (injury to the inner ear) was the most common type of hearing loss, but some children also suffered sensorineural mid frequency hearing loss. A traumatic ear drum perforation occurred in few kids [9]. Flamme et al. [10] recorded the impulses produced by the firecrackers in USA. They discovered that the auditory patterns of firecracker impulses changed with distance, but there were only minor changes amongst different firecrackers used. At 0.5-meter, typical peak levels were 171 decibel SPL and at 8 meter, they were 142 dB SPL [10]. Children are the most vulnerable to noise exposure and require special attention against firecrackers [11]. Firecrackers are well-known for being a fire hazard and a risk of bodily injury (body and facial burns, as well as loss of sight and fingers). The noise produced by such activities can irritate people and cause

concern about their health, as well as have an influence on wild and domestic animals. Exposure to such explosions on a regular basis can result in the development of stress-related disorders [12]. Noise pollution of more than 75 dB for more than eight hours per day over a lengthy period of time can cause hearing loss. The risks grow as the noise intensity and exposure time increase. A bursting cracker's sound, which exceeds 150 decibels, can create tinnitus, a ringing sensation that can permanently impair hearing [7]. In the Netherlands, Shamoun-Baranes et al. [13] evaluated the reaction of birds to fireworks set off by people on new year's eve. The Netherlands is Europe's most important winter staging ground for various waterfowl species. Hundreds of thousands of birds are reported to have fled to the air in the Netherlands as a result of fireworks [13]. The dogs show fearful responses to the fireworks [14].

Conclusion

The firecrackers being a part of celebrations have been used since years but are a source of noise pollution. The tremendous amount of noise it creates has adverse effects on humans as well as on animals. The impulsive noise of firecrackers causes adverse effects including hearing problems, disturbances in conversation and sleep, headache, heart hearing loss which may be temporary or permanent depending on the intensity of sound and exposure rate. Sick, old and children are among the most vulnerable groups of population affected by the noise pollution. Domestic animals show fearful responses to the loud noise of firecrackers. Birds are also affected by the bursting of crackers. Even though the rules and regulation are in place to deal with the problem of noise pollution, it is generally observed that the rules are not strictly followed by the people. Lack of awareness and sense of responsibility are the main reasons behind this. Stringent punishments and awareness can be implemented so as to reduce the risks of noise related problems.

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References

- Russell MS (2009) The chemistry of fireworks. Royal Society of Chemistry p. 7-8.
- Mangalekar SB, Jadhav AS, Raut PD (2012) Study of noise pollution in Kolhapur city, Maharashtra, India. *Sleep* 35: 16.
- Tandon N (2003) Firecracker's noise. *Noise & Vibration Worldwide* 34(5): 9-12.
- De Antonis K (2010) Fireworks! *Chematters* 28(3): 8-10.
- Control Pollution Control Board, India (2017) Status of pollution abatement measures - Firecrackers (patakhas). *Control of Urban Pollution Series* p. 4-5.
- Lokhande SK, Pathak SS, Kokate PA, Dhawale SA, Bodhe GL (2018) Assessment of heterogeneous road traffic noise in Nagpur. *Archives of Acoustics* 43(1).
- Singh N, SC Davar (2004) Noise Pollution-Sources, Effects and Control. *Journal of Human Ecology* 16(3): 181-187.

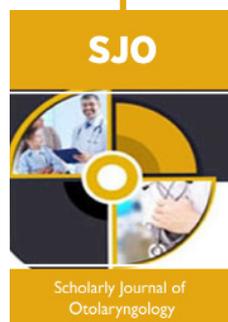
8. Plontke SKR, Dietz K, Pfeffer C, Zenner HP (2002) The incidence of acoustic trauma due to New Year's firecrackers. *European Archives of Oto-Rhino-Laryngology* 259(5): 247-252.
9. Segal S, Eviatar E, Lapinsky J, Shlamkovitch N, Kessler A (2003) Inner ear damage in children due to noise exposure from toy cap pistols and firecrackers: A retrospective review of 53 cases. *Noise and Health* 5(18): 13-18.
10. Flamme GA, Liebe K, Wong A (2009) Estimates of the auditory risk from outdoor impulse noise I: Firecrackers. *Noise and Health* 11(45): 223.
11. Lokhande SK, Garg N, Jain MC, Rayalu S (2022) Evaluation and analysis of firecrackers noise: Measurement Uncertainty, legal noise regulations and noise induced hearing loss. *Applied Acoustics* 186(1): 108462.
12. Čudina M, Prezelj J (2005) Noise due to firecracker explosions. *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science* 219(6): 523-537.
13. Shamoun-Baranes J, Dokter AM, van Gasteren H, van Loon EE, Leijnse H, et al. (2011) Birds flee en mass from New Year's Eve fireworks. *Behavioral Ecology* 22(6): 1173-1177.
14. Blackwell EJ, Bradshaw JW, Casey RA (2013) Fear responses to noises in domestic dogs: Prevalence, risk factors and co-occurrence with other fear related behaviour. *Applied Animal Behaviour Science* 145(1-2): 15-25.



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