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STUDIES ON VEDIC ACOUSTICS EFFECT OF BELLS IN TEMPLE PREMISES ON MICROORGANISM

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ABSTRACT

Microorganisms play an important role in maintaining the environment. Exploring the mechanism of activities of microorganism to various environmental factors has come into focus in the field of microbial pollution and human health. However, facing the increasingly serious efforts on acoustic factor, are lacking putting forth into studying the relationship between microorganisms and the sound of temple bells.

Herein, we studied the biological effects of sound exposure on the growth of microorganisms with different acoustic levels in Durgakund and Gauri-Kedar temple premises. Metallic sounds are a repeated pressure wave which travels through matter to environment. Experimental results indicated the growth of microorganisms inhibited by exposing sound waves produced by bells.

Moreover, it was observed that microorganisms can respond rapidly to sound stress at both transcriptional and posttranscriptional levels. Potential mechanisms are involved in the response of bacterial cells and the sound waves created by the temple bells which helped in microbe free temple environment.

The data collected in present investigation may open new front in the line of microbial research. Although microorganisms are present in temple premises (below the bell) is within the range (07-09 CFU/m3) which indicates a very low level of contamination according to the guidelines by World Health Organization report.

KEYWORDS: Bacteria, temple, bell, population, and acoustics sound.

1. INTRODUCTION

As per Indian customs in different religions, worship of deity in temples by various materials like flowers, leaves, fruits and also food items such as milk, honey, curd, ghee, oil, sugar, jaggery and different cereals, etc are frequently used. All these materials offered to the holy deity during daily worship, which has various airborne microorganisms which directly or indirectly contaminate the temple premises[1-3].

Microorganisms are capable to change the environment by metabolic activities on a major scale. Their activity involves many reactions which may participate in metabolic formations[4-5]. The microorganisms are directly affected by the temple environment and the environment has an influence on the various microbial populations[6]. In the temple, the presence of several offering materials is critical for microbiological growth and their metabolic activities[7]. In temple campus, different types of microorganisms existed separate isolation are impossible. Mostly microorganisms are capable to adjust them self to changes in the environment.

Sound produced by bells is a pressure mechanical wave which traverses throughout the temple premises. Whether sound and microorganisms can interact, whether sound can be exploited as a sound signal for microbial cell communication, whether and how microbes sense and respond to sound of varying frequency and/or intensity. When sound patterns are changed in various methods, it directly affects the environment[8]. Not much research has been done on effect of temple bell sound on the growth of microorganisms. The present study is aimed at investigating effect of temple bells on microbial growth.

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Airborne microbes are biological airborne contaminants (also known as bio aerosols) like bacteria, viruses or fungi as well as airborne toxins passed from one victim to the next through the air, without physical contact, causing irritation at the very least[9]. Types of airborne pathogenic microorganism are listed in Table-1.

The studies on the role of bell, shankh, drums, etc in temple premises have not yet been reported so far. The objectives of this investigation are the assessment of air sound wave on growth of microorganism in temple premises. The growth of microorganisms in the temple can be measured using air plate count method and by calculating the colony forming units per cubic meter of air (CFU/m3).

Table-1 : List of Some Airborne Pathogens.

S. No	Airborne Pathogen	Group	Disease	Status	Source
1	*Parvovirus B19*	VIRUS	disease, anemia	Contagious	Humans
2	*Rhinovirus*	VIRUS	Colds	Contagious	Humans
3	*Coxsackievirus*	VIRUS	Colds	Contagious	Humans
4	*Echovirus*	VIRUS	Colds	Contagious	Humans
5	*Reovirus*	VIRUS	Colds	Contagious	Humans
6	*Orthomyxovirus - Influenza*	VIRUS	flu	Contagious	Humans, birds
7	*Varicella-zoster*	VIRUS	chickenpox	Contagious	Humans
8	*Arenavirus - Junin*	VIRUS	hemmorhagic fever	Contagious	Rodents
9	*Arenavirus - Machupo*	VIRUS	hemmorhagic fever	Contagious	Rodents
10	*Monkeypox*	VIRUS	monkeypox	Contagious	Rodents
11	*Bordetella pertussis*	BACTERIA	whooping cough	Contagious	Humans
12	*Mycoplasma pneumoniae*	BACTERIA	pneumonia	Contagious	Humans
13	*Chlamydia pneumoniae*	BACTERIA	pneumonia, bronchitis	Contagious	Humans
14	*Klebsiella pneumoniae*	BACTERIA	opportunistic infections	Contagious	Environmental
15	*Pseudomonas aeruginosa*	BACTERIA	opportunistic infections	Contagious	Environmental
16	*Cardiobacterium*	BACTERIA	opportunistic infections	Endogenous	Humans
17	*Alkaligenes*	BACTERIA	opportunistic infections	Endogenous	Humans
18	*Pseudomonas mallei*	BACTERIA	opportunistic infections	Non	Environmental
20	*Staphylococcus aureus*	BACTERIA	opportunistic infections	Endogenous	Humans
21	*Mycobacterium intracellulare*	BACTERIA	cavitary pulmonary	Non	Environmental
22	*Nocardiaasteroides*	ACTINOMYCETES	nocardiosis	Non	Environmental
23	*Nocardiabrasiliensis*	ACTINOMYCETES	pulmonary mycetoma	Non	Environmental
24	*Nocardiacaviae*	ACTINOMYCETES	nocardiosis	Non	Environmental
25	*Phialaphoraparasitica*	FUNGI	allergic alveolitis	Non	Environmental
26	*Phialaphorarepens*	FUNGI	allergic alveolitis	Non	Environmental
27	*Exophialajeanselmei*	FUNGI	humidifier water	Non	Environmental
28	*Phialaphorahoffmannii*	FUNGI	allergic alveolitis	Non	Environmental
29	*Phialaphoramutabilis*	FUNGI	allergic alveolitis	Non	Environmental
30	*Acremonium spp.*	FUNGI	allergic alveolitis	Non	Environmental
31	*Aspergillus fumigatus*	FUNGI	aspergillosis	Non	Environmental
32	*Aspergillus niger*	FUNGI	aspergillosis	Non	Environmental

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33	*Cryptococcus neoformans*	FUNGI	cryptococcosis	Non	Environmental
34	*Scopulariopsisfusca*	FUNGI	onychomycosis	Non	Environmental
35	*Sporothrixschenckii*	FUNGI	sporotrichosis	Non	Environmental

The sound wave is playing an important role for improvement of environmental conditions. In the natural condition, generally microorganisms "interact" with the variety of sound waves and there is change in them. The mechanical sound wave generated by temple bell plays a major role as an environmental factor. Based on its frequency mechanical sound waves are roughly classified into three categories: Infrasound (10^{-4}–20 Hz), audible sound (20–2×10^4 Hz) and ultrasound (2×10^4–10^{12} Hz). Ultrasound biological effects and its biophysical mechanisms have been investigated in the recent years[10-11]. It has already been successfully combined with biotechnology with the objective of enhancing the efficiency of bioprocesses[12]. Moreover, ultrasound is also widely used in medicine as both diagnostic and therapeutic tools[13]. Nowadays, with rapid development, acoustic science has increasingly become the focus of attention towards microbiologists and physical scientists. Modern cities are directly affected by air, water and noise pollution is considered third-largest public hazard in the modern age[14].

In Vedic philosophy however, temple premises were cleaned using sound waves which are anthropogenic generated by bells, Shankh etc. are more economical and don't create any secondary environmental problems and health issues. In the modern concept, several chemical based methods are developed for sterilization of environments which create other side effects in due course. According to Vedic concept, "sound" is capable to remove or kill unwanted entities (negative part) and support to establish divine or positive energy (positive part)[15-17]. In Vedic literature, sound plays an important role in balancing temple premises and surrounding environment by the establishment of positive influence with deities without any negative influence. The effects of sound exposure on the growth of microorganism were also measured and discussed in this manuscript.

2. MATERIALS AND METHODS

Airborne microorganisms listed in Table-1 and are usually present in temple environments which are directly or indirectly influenced by temple bells, Shankh etc sound wave generated by devotees. The microorganism's present in temple premises were investigated. The study was performed during the months of February 2019 to March 2019. A total 27 Petri disses used as samples were collected in duplicate from temples named as Durgakund and Gauri-Kedareshwar, Varanasi. Temple bells are situated at different places different. Isolation and identification: The number of Bacteria and fungi present in temple premises were studied by exposing Nutrient agar medium for 60 seconds by opening upper lid of sterile Petri dishes in front of bell during the praying hours with knocking the bell at full force. After the exposure, the plates were taken to the laboratory and incubated at 36º C for 20hours. The species of bacteria were counted after incubation was over. The total number of bacteria in the samples collected from different points was determined. The total number of colony forming unit (CFU/m3) was calculated. Then it is converted to organisms per cubic meter air using the standard equation given below[5].

$$\boldsymbol{CFU/(M3)} = \frac{(\boldsymbol{No.\ of\ colony\ on\ petriplate}).\ \mathbf{10000}/(\boldsymbol{Petriplate\ surface})}{(\boldsymbol{Petriplate\ surface}).\ (\boldsymbol{Petriplate\ exposure\ time}).\ \mathbf{0.02}}$$

3. RESULTS AND DISCUSSION

In this investigation, the microbial population of temple premises were differs in different sampling points as shown in table-2 and figure 1-2. The results show that the average number of bacterial population of temple area near wall was (237 CFU/m3) and lowest bacterial population (below the bell) was (07-09 CFU/m3).

Table 2 Average number of Bacterial count in Temple premises

S. No.	Sampling Area	Bacterial count (CFM/m^3
1.	Durgakund/Below the bell	07
2.	Durgakund/ Near to bell	12
3.	Durgakund/Near the wall	237
4.	Gaurikedar/Below the bell	09
5.	Gaurikedar / Near to bell	47

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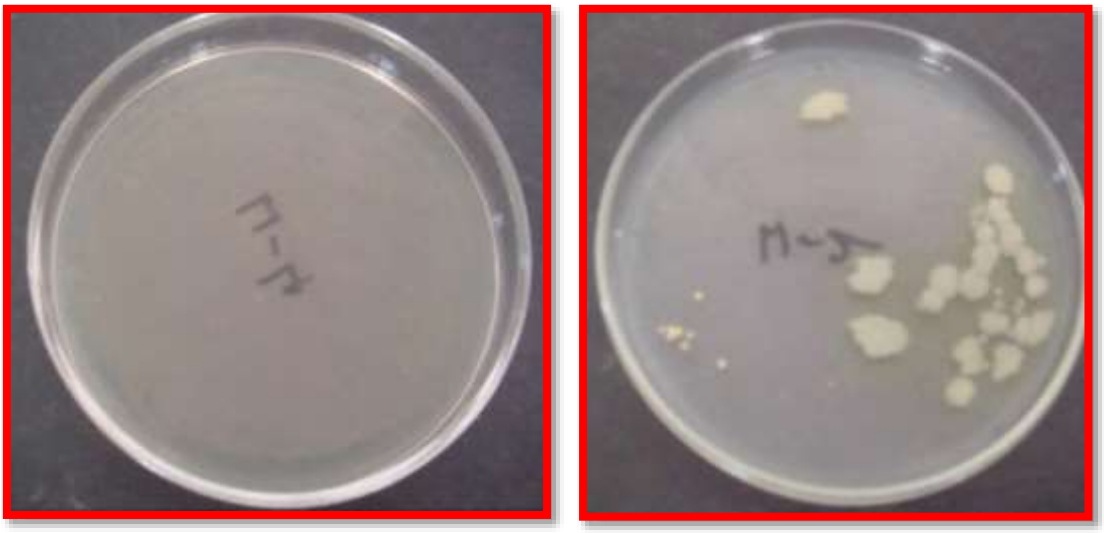
6.	Gaurikedar /neat the wall	216

Effect of acoustic bell sound on the growth of microorganism

The effects of sound frequency on the growth are shown in Fig. 1-2. The results indicated that the sound produced in different frequencies significantly decreased the growth of microorganism. This strongly suggests that high sound waves exposure prevented growth and due to the biological effects reduced by in number.

Temple bell sound is a mechanical wave that results from the vibration of the media. If it is moving through microorganisms, then cells will be activated both positive and negative direction as the energy of sound wave passes through them. Some microorganisms might respond to sound wave directly stimulate microbial growth which depend upon variety of sounds and their frequency. The acoustics sound waves effects on microbial population were also observed by many investigators[18-20].

Due to offering materials, temple premises contribute very low amount of nutrients with moisture which is not sufficient for the growth of microorganism but it can act as important medium for carrying and spreading them. The results from present investigation showed that the contamination below the bell is very less in comparison to other places in the temple premises.



(A) ***(B)***

Figure 1: Photograph of microbial colonies (A) control, (B) below the temple bell

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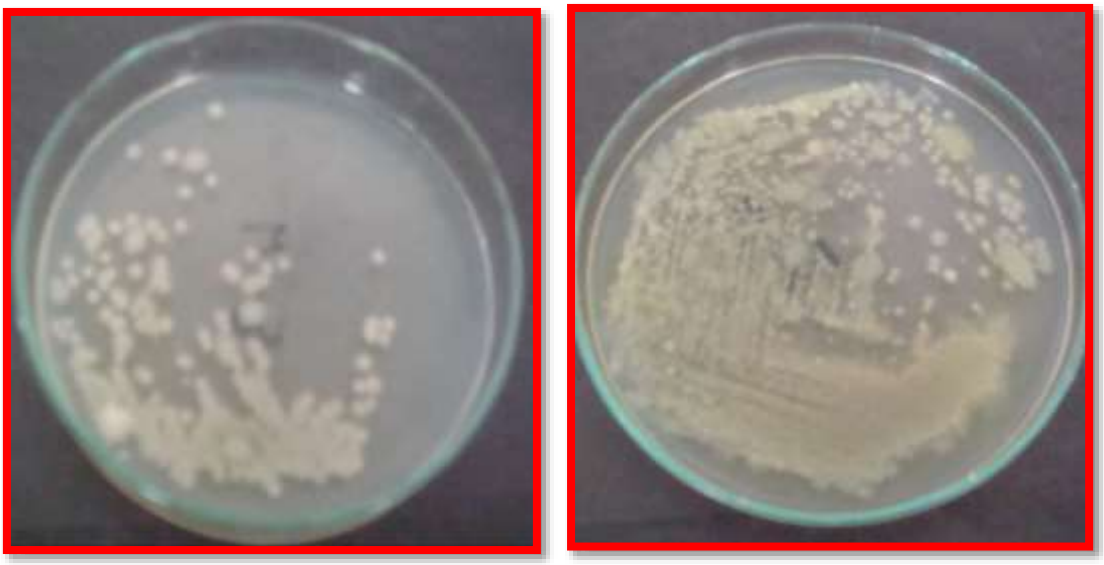

(A) *(B)*

Figure 2: Figure 1: Photograph of microbial colonies (A) near the bell, (B) near the wall

The reasons for high population of bacteria near the temple wall are due to weak effect of sound wave and low degree of vibration which are not capable to inhibit the behavior of microorganism which are present in the air. It can be assumed that metabolic activities of bio-contaminants microorganism shall be directly influenced by sound wave or sound energy. Very low bacterial population was recorded below the temple bell because of the high frequency of sound wave directly affecting the microbial activities and act as a good disinfectant. Many types of microorganism are present in temple premises. Due to which different material based bells (Asht-Dhatu) are more effective compared to a normal bell because different material based bells are capable to generate sound wave of different frequencies which affect activities of different microbial species.

The results of this present investigation reveal that mechanical sound waves travelling through aqueous medium generated various mechanical pressures, which can be sensed by microorganism. It is possible that pressurized stress rapidly repel to microorganism and both the transcriptional and posttranscriptional processes affected by sound quantity and quality. However, the exact mechanism of acoustic sound wave effect on microbial growth is still totally unknown. Our further work will dedicate on the investigation of different sound sources and controlling of microbial population.

4. CONCLUSION

Although microorganisms are present in the temple premises, the minimum number of bacteria is observed below the temple bell (07-09 CFU/m3) which indicates very low level of microbial contamination. Present investigation also support the guidelines established by World Health Organisation[18]. The results clearly indicate that the traditional bell sound arrangement in temple premises are scientific based concept which are economical, easily operable and very safe for removing the microbial contaminations. It does not create any other side effect and doesn't require any chemicals and/or electricity consumption which clearly indicate that the Vedic concept of acoustics is more useful and fruitful for the human beings and for the whole environment.

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