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RESEARCH ARTICLE

SCENARIO OF TRAFFIC NOISE POLLUTION AND ITS IMPACT ON HUMAN HEALTH: AN EMPIRICAL CASE STUDY OF KOLKATA CITY

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ABSTRACT

The recognition of noise as an environmental problem and its impact both on community and occupational environment is rapidly growing. Every day several thousands of vehicles are moving in and around Kolkata city and it creates immense heavy traffic congestion and severe noise pollution in the city. Therefore most of the major arterial roads in North, South and Central Kolkata are experienced huge vehicular congestion during peak and lean hours and it crosses the permissible limit of standard decibel of noise level as maintained by Central as well as West Bengal Pollution Control Board and this permissible limit is identified as 40-50 decibel in silent zone, 55-60 decibel in commercial zone and 80-85 decibel in heavy traffic zone. Therefore some busiest traffic intersection points of north, south and central Kolkata have been selected to make the research paper evident. While it has been compared among all the megacities in India, Kolkata placed its first position and it is because of immense vehicular traffic, bad condition of road, speed of the vehicles, narrow space of the road, occurring traffic congestion, more prone to accident followed by unscientific diversion of traffic which create positively noise pollution throughout the city. However high level of noise pollution effect on human health and it creates auditory disorder, problem of blood circulation, unconditional effect on brain and hormones followed by some psychological and personological effect among the residents of Kolkata. Therefore in this research paper an attempt has been made to point out the scenario of noise pollution in and around Kolkata city and its immense effect on body and mind among the civilian of Kolkata followed by some remedial suggestions and mitigation strategies through which this noise level should reduce in coming future and Kolkata will be placed as a sustainable city in next future.

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INTRODUCTION

Noise pollution is the most significant worldwide environmental issues. Worldwide every civilized society suffers a lot from environmental pollution such as air, soil, water and noise pollution is not an exception in this regard. Out of the several sources of noise pollution vehicular traffic is one of the more prevalent and damaging source of noise. Vehicular traffic noise is one of those everyday pollutions that one comes across and it is very much evident in the city of Kolkata. These noises are not only annoying in ambience nature but also have adverse impact on human health among the people in the city. Though this is ignored by the human being in everyday life but in reality this is killing many persons slowly. Therefore due to noise pollution different effect could me immanence on human being such as Sleep disturbance, cardiovascular disease, elevated hormone levels, psychological problems may arise and even death is possible in some cases in the long run process.

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Literature Review

Several literatures have been studied to reflect the situation of noise pollution and make to understand possible effect on human health in the city of Kolkata as well as throughout the country.

- According to *Skanbcrg and Ohrstrom (*2002), Traffic is the dominating source of noise and is the major source of nuisance and annoyance. Existing studies in regard to the traffic noise reveals several hazardous effect of noise pollution.
- *Sharp and Donovan* (1979) says that more people are exposed to noise from motor vehicles than any other single source of noise.

- *Bugliarello et al.* (1976) says noise produced during acceleration can be as much as 20 dB greater than that produced at cruising speed. He further finds that noise from heavy trucks and buses are equivalent to that from 10 to 15 cars taken together. Study carried out in Merseyside in 2004 found 30 percent of people felt traffic noise had become worse over the previous five years.
- *Stewart* (1998) forwarded a study and it is found a fifth of council tenants in the London Borough of Greenwich rated traffic noise as big a problem as crime, with those living on main roads the most concerned.
- *Jamrah et al.* (2005) studied on traffic noise in Amman shows the minimum and the maximum noise levels during night-time. The measured noise level exceeded the acceptable limit at most of the locations causing effect on the health.
- *Den Boer and Schroten* (2007) says, over 210 million people in Europe are exposed to traffic noise levels exceeding the threshold at which the World Health Organisation has found.
- *Pal and Bhattacharya* (2012) done their case study in Agartala and it is pointed out that the most prevalent problems from the traffic noise include irritation, headache, tinnitus, and sleeplessness.

Objectives of the Study

Several objectives have been taken into consideration to make the research paper more empirical.

- To identify different sources of noise pollution in the city of Kolkata on the basis of Noise meter in different busy traffic intersection points in the city of Kolkata.
- To assess the adverse impact of noise on the respondents.
- To explore the possible reactions of the people against excessive noise.
- To find out the some suggestive recommendations in order to control noise pollution in the city of Kolkata based on some pre-defined planning.

Methodological Observation

Any research work is based on some methodologies and this research paper is not an exception one, so a proper methodology could be followed to shape up the research paper.

Initial Phase: In this phase several data and information have been collected from several officials, websites, and journal as well as from articles. Several literatures have been studied to endeavour the knowledge regarding source of noise pollution and its effect on human health. However a structured questionnaire has been mechanised which have been assisted at the time of surveying on 100 respondents in different busy traffic intersection points.

Final Phase: In the final phase data have been processed based on some predefined statistical methods and several cartograms have been prepared to make the research paper more scientific. However some snap have been taken too evident and support the research paper.

RESULTS AND DISCUSSION

The discussion has been surveyed in the various traffic intersection points in the city of Kolkata under the jurisdiction of Kolkata Municipal Corporation which is located at $22^0$30'N to $22^0$40'N latitude and $88^0$15'E to $88^0$20'E longitude and has an area of 187.33 km^2.After the implementation of auto de-licensing policy most of the people from Kolkata wish to purchase their own personalised branded car, as a result huge congestion could be occurred followed by extreme level of traffic congestion could be observed at the busiest traffic intersection points in the city. According to the data obtained from West Bengal Pollution Control Board, ambient noise measurements have been taken by WBPCB and CPCB at 27 locations across residential, commercial, industrial and silence zones in the city of Kolkata from 1993 onwards. Road traffic noise pollution is also alarming and above the permissible standards in the city in today's context. However vehicular noise pollution is the predominant cause of noise pollution in the Kolkata city. To understand the situation of noise pollution, eight intersection points of the city have been selected. In northern part of Kolkata four traffic nodeshave been selected because these are busiest traffic sites there followed by in southern Kolkata another four busiest traffic pointshave been selected as monitoring sites. Using the Noise Meter noise data record has been collected during peak and lean hours of a day. The selected survey sites are Ultadanga, B.B.D Bag, Shyambazar, Maniktala from north Kolkata whereas Sealdah, Jadavpur, Gariahat and Rashbehari nodes have selected from south Kolkata as survey sites.

Permissible Noise limit in Kolkata city

Among all the megacitiesCentral Pollution Control Board declares the noise permissible limit as per the Indian standard and this limit (Table: 1) standard is reported below:

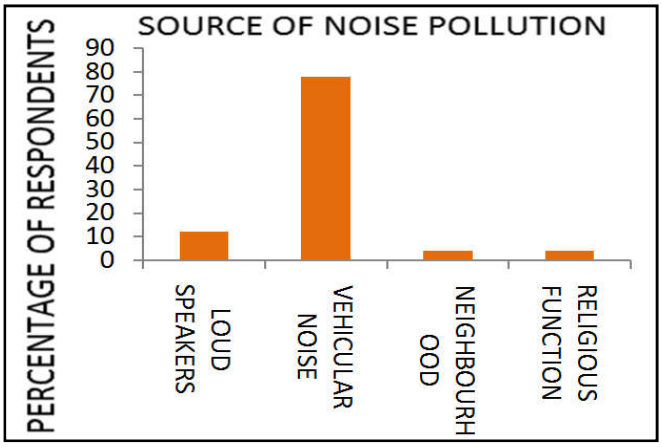
Table 1. Noise Level Standard Prescribed by CPCB

S.No.	Area	Day time noise level in dB(A)	Night time noise level in dB(A)
I	Industrial Area	75	65
II	Commercial Area	65	55
III	Residential Area	55	45
IV	Silence Zone	50	40

Source: West Bengal Pollution Control Board,2016

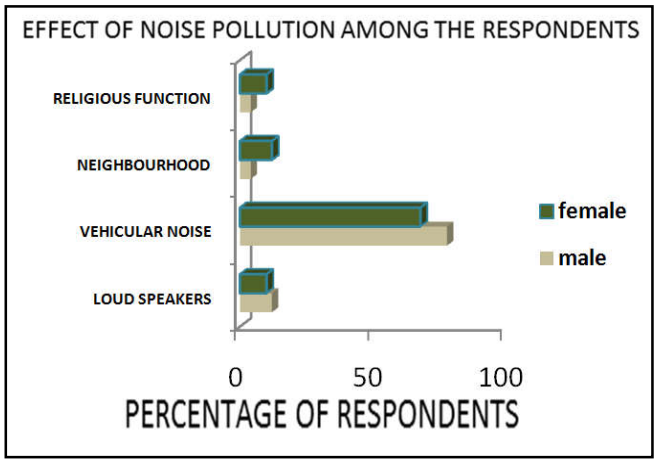
However excessive use of horns by the vehicles cause several health hazards to the inhabitants.Vehicular traffic is one of the most important sources of noise in this new technological age. The noise released from road traffic is determined by the speed and exhaust system. However more congestion reduces traffic speed and it enhances and cross the permissible limit of noise. However (Fig: 1) during primary survey 50 respondents were surveyed and point out how these vehicular noise effect on the civilian in the city of Kolkata.While the survey has been done, almost 80 to 90 percent respondents belief that the main reasons behind the noise pollution is vehicular traffic whereas 20 percent respondents stated the fact that loud speaker could be the another source of noise pollution but it has counted a least

proportion while a comparison has been made out. Therefore (Fig: 2), it has been examined that now the noise pollution affects male population and female population separately. Moreover 75 to 85 per cent respondents statedthatvehicular noise effect adversely on male and female population both in the city of Kolkata. However male population are effected more in proportion to female because they are going outside for their work and these busiest traffic points experienced with high noise from traffic.



Source: Primary data,2016

Fig. 1.



Source: Primary data,2016

Fig. 2.

Process of Noise Pollution Affecting Ear

Far receives sound waves and sends it to the brain. Sound waves first enter to the outer ear and next, the waves strike the eardrum, tympanic membrane, causing it to vibrate. The vibrations are transmitted through the middle ear along a short chain of three small bones, the hammer, anvil and stirrup. Finally, in the inner ear these vibrations reach to the cochlea. It is a chamber ear filled with fluid and lined with tiny hair cells. The hair cells signal the auditory nerve to electrical impulses to the brain which interprets these impulses as sound. When one is exposed to long and prolonged noise, the hair cells are damaged and the transmission of sound is permanently altered. The cells can recover from mild damage, but severe damage will kill nerve cells producing permanent hearing loss. Especially loud noise will damage anyone's ear. One can categorize its effect on human being involving different facts of human life. (Khan and Khan, 2003)

Vehicular Noise Pollution and its Effect on Human Health

According to School of Tropical Medicine,Kolkata (2016), and Anewsa Chakraborty and Prof Ranjan Basu(2015) revealed the fact in their article that; noise pollution does cause many functional disorders in the organs of human body. But mainly it hampers the audio-logical structure of human body. Several effects of noise pollution on the human body are listed below.

Audio-Logical Effects

If the noise is not too long and loud, then the hearing mechanism of a person gradually recovers threshold shift from noise pollution and the person experiences Temporary Threshold Shift (TTS). Many people who are exposed to industrial noise may in addition to a TTS, experience tinnitus (ringing in the ears), vertigo, headache and fatigue for shorter or longer periods after the end of their working time. But when the exposure of noise is louder and of longer duration, then person's hearing mechanism does not recover and the person experiences Permanent Threshold Shift (TTS).

Biological Effects

Biologically it does affect human being in various ways as listed below

Effects on Heart: A slowing of heart rate is also observed during high noise level. In fact, quicker heart beats, shrinkage of blood carrying and blood taking vessels, rising of blood pressure are the results of continuous exposure to high intensity sounds ultimately producing heart afflictions.

Effects on Blood Circulations: In man, sound has shown to increase the secretion of adrenocorticotropic hormone ACTH from the anterior lobe of the hypothesis giving rise to increased secretion of cortisol from the adrenal cortex. Cortisol is known to influence the function of a number of systems. It is important for the action of adrenalin and neo-adrenalin on the blood circulatory system; it increases the glucose contentof the blood, changes the reaction of the body to infections and decrease inflammatory reactions.

Effects on Brain: Somewhat louder sound (80-90 dB (A) SPL) has been shown to affect the secretion of most of the hypo- physical hormones. This reaction is mediated via the hypothalamus, a part of the brain that receives input from many other parts of the brain through a very complicated system allowing ample possibilities of interaction between different external and internal stimuli.

Effects on Hormones: Over all, loud sounds can cause an increased production of most hormones of the pituitary

gland; among the most important of these is the adrenocorticotropic hormone (ACTH). Adrenocorticotropic hormone (ACTH) in turn stimulates the adrenal gland, which secretes several different hormones. These hormones also affect human body in several ways i.e. 1. Enhance the body's sensitivity to adrenalin, 2. Increase blood sugar level, 3. Suppress the immune system, and 4. Decrease the liver's ability to detoxify blood.

Effects on Other Biological Functions: Sound in the range of 120-150 dB (A) can affect the respiratory system and affect balance to the extent of dizziness, disorientation, nausea and vomiting. It also affects the skin. Besides at 85-120 dB noise levels, blood vessels constrict, pupil dilate, voluntary involving involuntary muscles become tense.

Psychological Effects: Noise is one kind of mental torture to all intellectual people. Due to loud and prolonged noise it does hamper their concentration to think and study thus causing communication disruption, frustration, sleeplessness, lack of co-operation and social conflicts. Negative mental consequences include paranoia, suicidal and homicidal tendencies. This can cause nervous irritability, strain and tension in muscles. Intolerable agony may result when the source of noise is not known.

Personological Effects: In children, it may develop a feeling of inadequacy, lack of confidence and poor perceptions of their own self. This may paralyses person logical development of growing child. Once these feelings are developed in growing child in their growing age, its dangerous effects are not to be removed easily without leaving any marks behind. (Park, 2005)

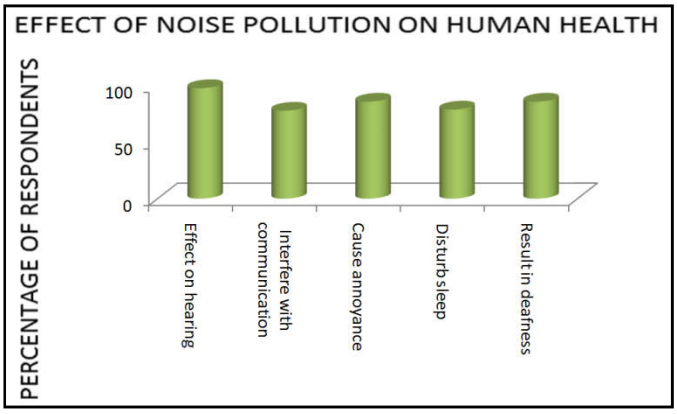
Behavioral Effects: The undesired sound may be the cause of sudden annoyance. Sudden noise distracts a person and can create nervousness within him. Certain abnormalities like inability to think, analyse, solve problems etc. are found in human being due to high noise pollution. Accumulate tension and uneasiness to settle down, also occurs because of this. The unwanted sound can influence unborn babies producing malfunction of the fetus nervous system that may effects on behavioural pattern later in life. (Agarwal, 2009)

Therefore Traffic noise does effects on human's health in many reverse ways. Some of these ill effects are given below

High Traffic Noise Exposure and Performance Level: Sudden traffic noise exposure during work performance in busy road sides may slow down the retention power of memory, influence the working power and also affects the tolerance level on human beings. Noise may reduce the helping behavior, increase aggression and reduce the processing of social cues seen as irrelevant to task performance

High Traffic Noise Exposure and Physical Disorders: Exposure to high traffic noise also causes physiological disorder including increase in heart rate and blood pressure, peripheral vasoconstriction and thus increased peripheral vascular resistance. Many occupational studies have suggested that individuals chronically exposed to continuous noise at levels of at least 85-90 dB (A) have higher blood pressure than those not exposed to high noise. Sudden exposure of high traffic noise like air horns etc. are responsible for increasing blood pressure level which is cause of the annoyance and increased rate of heart beats.

High Traffic Noise and Psychological Disorders: Regularly high noise exposure gives high level of nausea, headache, argumentativeness and changes in mood and anxiety.

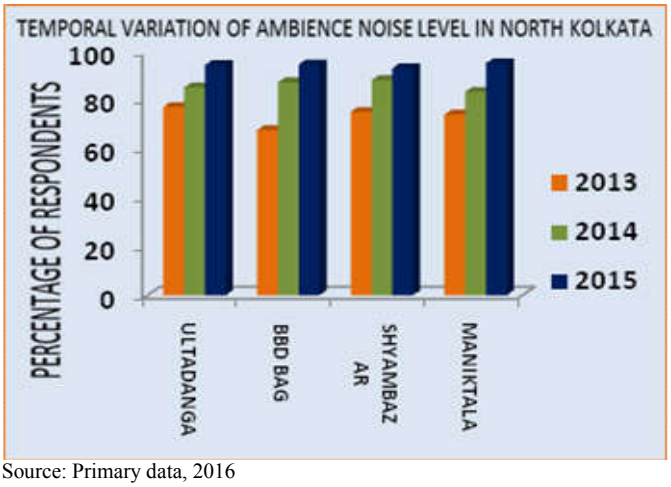


Source: Primary data,2016

Fig. 3.

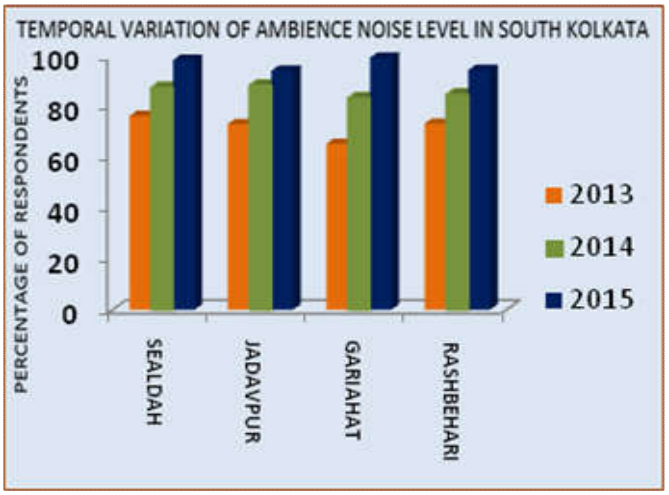
However, while it has been discussed (Fig: 3), the effect of noise pollution on human health, 100 per cent respondents support the fact that noise pollution may adversely effect on hearing followed by 70 per cent civilian are facing the problem in terms of interfere with communication and it is a very remarkable fact but while other effect of noise pollution could be considered 60 to 70 % respondents are suffering from problem of annoyance, sleep disturbance as well as problem of deafness and these facts are very much identified in all the busiest noisy traffic nodes from north and south Kolkata. Therefore during primary survey and the data record obtained from West Bengal Pollution Control Board, it is observed that, there is no significant change in ambient noise level from 2013 to 2015 and this level of noise is more than the permissible limit and it creates an adversely effect on the human health in the city. Moreover in North Kolkata (Fig:4) different busiest traffic nodes which include Ultadanga, BBD Bag, Shyambazar, Maniktala are experienced hike rate of noise level due to more traffic congestion as the roads of north Kolkata are narrower and it is very much prone to sound pollution during peak as well as lean hours. However Ultadanga area has a bus depot of SBSTC and CSTC bus terminus, so a huge number of public buses are operating to and fro in and around this depot so it immensely creates noise pollution. As it has been stated that BBD Bag area is the CBD area of Kolkata, so several offices and business organisation are located here and people mostly use their personalised vehicles in order to go to this place followed by Shyambazar and Maniktala are the two busiest traffic nodes through which several category of vehicles are plying throughout the day and it immensely creates noise pollution. While (Fig: 5) it has been discussed about the temporal variation of ambience noise level in south Kolkata same scenario has been observed in Sealdah, Jadavpur, Gariahat as well as in and around Rashbehari crossing. As it

has been under the supervision that Sealdah is the busiest traffic point in south Kolkata, because this site becomes very noisy as it is another gateway of the city from other sub urban places through Sealdah Station followed by Gariahat is the another nodal point in south Kolkata and different commercial spaces and markets are situated here, however encroachment of gariahat footpath by the pavement dwellers reduces the road space as it may enhance the noise level due more congestion by vehicular traffic. Therefore Jadavpur as well as Rashbehari crossing are another two busiest nodes where same rate of noise level could be observed.



Source: Primary data, 2016

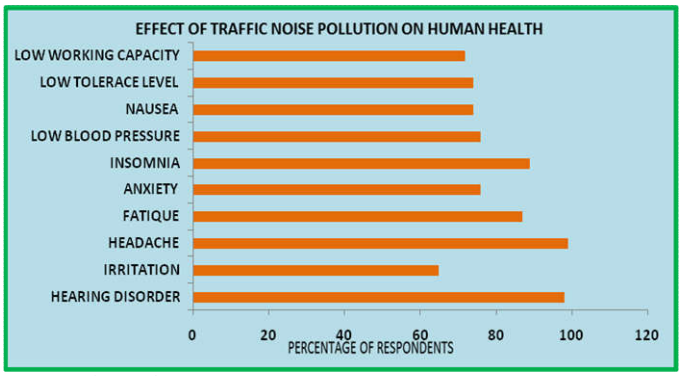
Fig. 4.



Source: Primary data, 2016

Fig. 5.

However the condition of noise pollution creates several health hazards and these are namely temporary hearing loss, permanent hearing loss, headache, irritation, fatigue, anxiety, insomnia, low blood pressure, nausea, low tolerance level and low working capacity. From the primary survey it has been marked out that most of the people especially traffic policemen, bus and auto drivers and pavement dwellers as well as hawkers people have been suffered from low tolerance level problems. On the other hand, very few respondents have been affected from anxiety and nausea problems. From the survey report by WBPCB, it has been reflected that drivers are the most affected persons from hearing disorders. On the other side, their younger counterparts are the least affected persons by the same disorders. An insight into the findings of the noise related health hazards reveals, mostly the aged auto drivers are affected from temporary hearing disabilities. Even permanent hearing disability cases also been noticed among them though these are very few in number. Mostly drivers included into middle aged group are affected more by irritation as well as low tolerance level problems due to long time exposure into noisy atmospheres.



Source: Primary data, 2016

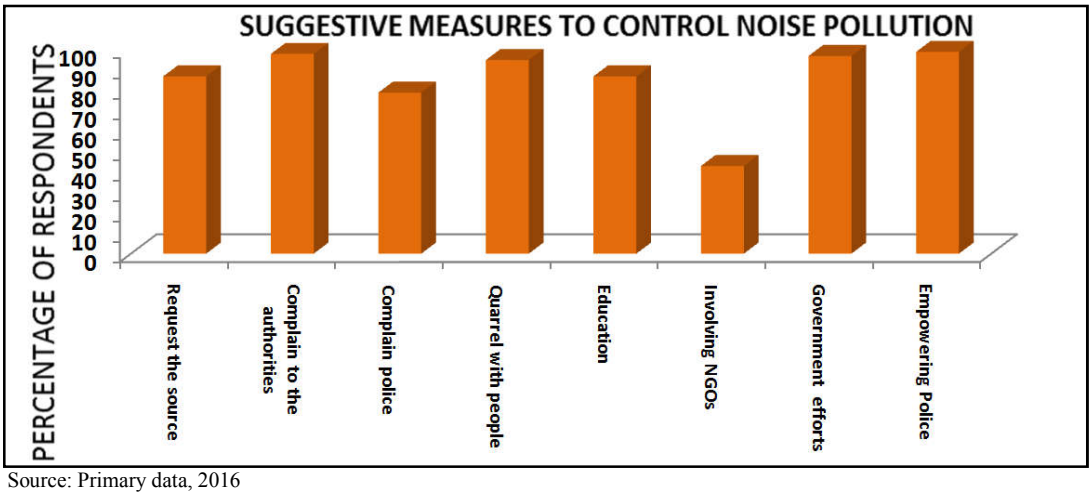
Fig. 6.

However several categories of diseases could be observed among the respondents in the city of Kolkata (Fig: 6) and in this respect almost 100 per cent respondents are suffering from hearing disorder and mostly the drivers are suffering from this type health disorder. Other diseases like Insomnia as well as problem of fatigue and headache again effect on the drivers as well as traffic policemen and almost 94 % respondents are suffering from the same and these could be deteriorate the health condition among the respondents. As these kinds of diseases cannot be observed directly but through the process of continuous observation among the respondents, these noise related diseases could be identified. On the other hand irritation, anxiety, low working capacity, low tolerance level, nausea as well as low blood pressure are the another noise related health hazard and these could observed also among the respondents and 70 to 80 % respondents are suffering from these type of problem and it is also more common among the students also.

Findings

Several findings could be identified while this research paper has been done; in this respect few findings have been incorporated.

- In north Kolkata, level of noise pollution is mostly hike due to existence of busy traffic intersection points as well as excavated road condition, thus this road condition reduces the speed of the vehicles and it enhances the noise level in this area.
- South Kolkata is experienced with more level of noise because of growing pattern of high rise building and most of the people have already purchased their own car and these could be created huge traffic congestion as well as noise emission.



Source: Primary data, 2016

Fig. 7.

- Male dominancy is more prone to suffer from maximum limit of noise level.
- As per the data record, conveyed by the West Bengal Pollution Control Board, it has been summarised that Industrial as well as commercial and residential zone crosses its permissible limit and it becomes 100 to 120 or more dB and it may effect on the human being.
- Though, there is lot of provisions as put forwarded by WBPCB but due to unwillingness and suppression process civilized people of Kolkata do not follow these mentioned and pre-defined regulations properly.
- Almost 80 to 90 per cent respondent are mostly suffering from headache, hearing disorder as well as insomnia and this could be deteriorated the health condition among the respondents.
- Those nodes or traffic points are more prone to congestion that might be responsible for noise pollution, so a positive relation could be observed in and around Kolkata city.
- People are more aware but they do not follow up the proper rules and regulations in order to control immense effect of noise pollution in the city of Kolkata.

Suggestive Recommendations

Several suggestive measures should be taken into consideration in order to control the noise level in and around Kolkata city. These include mainly:

- Proper education, Government effort and NGO involvement should be implemented to control the noise pollution.
- Regular checking of noise level along various traffic intersection points should be prioritised.
- Empowerment of police should be facilitated in order to control permissible noise level.
- A systematic multi-disciplinary approach should be suggested in terms of controlling the noise level at various busy traffic points.
- Think about the banning of encroachment of road space and enhance the road space which reduces traffic congestion as well as noise pollution.
- Separate noise monitoring station should be stated in each traffic nodes from which administrative and control body should get the regular update of noise level data and these data could be preserved for future correspondence.
- Scientific and proper diversion of traffic should be implemented in order to control the noise pollution.
- Involvement of nongovernmental organizations and government efforts could help us to reduce or prevent the noise pollution up to a limit.

Therefore (Fig: 7) while the question was asked to the respondents regarding control of noise pollution, 80 per cent respondents support in favour of peace and understanding that means peacefully request to the noise source and this could be more applicable in today's context, However 80 to 90 % people stated the fact that written up against the authority or complain to the police, proper education as well as Government efforts should be more applicable in controlling the noise level pollution.

Concluding Observations

The present study explores the different sources, effects, reactions and suggestions for controlling the noise pollution. The analysis shows that automobiles are the major sources of noise pollution. The adverse impact of noise may result in improper communication, sleepless and hearing impairment, nausea, low blood pressure, insomnia. In the majority of cases the affected civilian prefers a request to stop the noise. In this survey public education is found to be the most important tool to control the noise pollution in the city of Kolkata. Besides this the NGOs and government can also play a significant role in the process of controlling the excessive noise.

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