Original Article

Traffic Noise Pollution in Karachi, Pakistan

Muhammad Wasiullah Khan, Mushtaque Ali Memon, Muhammad Najeebullah Khan, Muhammad Moizullah Khan

ABSTRACT

OBJECTIVES: To determine the level of traffic noise in the city of Karachi.
STUDY DESIGN: Descriptive, cross sectional study.
PLACE AND DURATION: Karachi, August 2008.
MATERIALS AND METHODS: Six different sites were selected from busy locations in different areas of Karachi for study. Same persons made all recordings. Kamplex sound level meter (SLM3) with built-in calibrated condenser microphone was used for all recordings.
INCLUSION CRITERIA: Two major roads of the city namely M.A Jinnah Road and Shahrah-e-Faisal were selected for study.
EXCLUSION CRITERIA: Air traffic noise, Railway stations, vendors with their loudspeakers and loud music played on certain vehicles were all excluded from the study.
RESULTS: Maximum level of noise was 110 dB (A), recorded from Autorikshaw & Motorcycles (without silencers) and Minibuses. Maximum noise was observed during the peak rush hours between 01.00 p.m. to 03.00 p.m. & 05.00 p.m. to 07.00 p.m. and was in the range of 110 dB (A) with a dip of about 5 – 10 dB (A) between 03.00 p.m. to 05.00 p.m. The noisiest site was found to be M.A Jinnah Road (Merewether Tower & opposite K.M.C building). The mean values of noise level in the commercial and residential areas were 95.75dB (A) and 60 dB (A) respectively.
CONCLUSION: Karachi is facing an enormous problem of exceedingly high levels of traffic noise, which is significantly higher than all the available international data.

KEYWORDS: Traffic Noise, Pollution, Effects of Noise.

INTRODUCTION

Among all the creatures of the Almighty God, human being is the only one who has mastered the art of disrupting his environment with noise of such proportions as deemed utterly intolerable in this world. Any unwanted sound produced by humans or machines is described as "Noise". Thus defined, noise interferes with communication, work, rest, recreation or sleep.[1,2]
The menace of noise is an open secret and excessive noise is undoubtedly detrimental to human health and hearing. Immediate effects of noise are in terms of annoyance, but its cumulative effects result in either temporary or permanent hearing loss.[3] Several studies demonstrated the adverse effects of noise on cardiovascular system, autonomic nervous system and psyche.[4-6] It is a well known fact that persistent noise can lead to hypertension, hyperprotienemia and hyperlipidosis, nevertheless, the most deleterious effect of noise is on a person's hearing.[3, 7-10]
Noise is a ubiquitous environmental hazard of the modern world, originating from a wide variety of sources including traffic, which plays a dominant role in noise pollution. [11] About 60% of the population in the European Union is exposed to excessive road traffic noise.[6] Indeed, traffic noise has created a global crises as a result of which, almost the whole world is crying out for help. Published data from all over the world is a witness to that.[12-16]
Karachi is the biggest, bustling Metropolis in Pakistan. Its estimated population is around 15 million. About 5 million vehicles ply on its roads. No wonder this city is facing an enormous problem of uncontrolled traffic noise emanating from a wide variety of sources such as; Motorcycles, Autorikshaws, Cars, Wagons, Minibuses & Buses, Trucks, Tractors, Water tankers, Bulldozers and Machine drills etc.[2,17]
We selected two major roads of the Karachi city for our study, owing to the observation that most of the commuters plying those two roads, either to their work or business or back home. With this, we aimed at determining the level of traffic noise people were exposed to on a daily basis in the city of Karachi and discuss, in the light of international standards, the amount of risk to their health and hearing which they were subjected to, hitherto unawares.

MATERIALS AND METHODS

This is a descriptive, cross sectional study carried out at carefully chosen busy locations in different areas of Karachi, utilizing six consecutive working days in the last week of August 2008. Six different sites were selected for study i.e. Guru Mandar (M.A Jinnah Road), Opposite K.M.C building (M.A Jinnah Road),

Merewether Tower (M.A Jinnah Road), Main Shahrah-e-Faisal (Opposite Shah Faisal Colony), Malir Main Road, Pioneer Fountain Phase II (Residential area as a control), a newly constructed and inhabited area with 200 feet wide roads bordering it's two sides, but without much traffic (Table No I).

All Recordings were made by same persons. Kamplex sound level meter (SLM3) with built-in calibrated condenser microphone was used for all recordings. Microphone was guarded by polyurethane windscreen. All measurements were made at slow response. Universally accepted "A" weighted sound level measurements were used in this study.

Measurements were made at 09.00 am, 11.00 am, 01.00 pm, 03.00 pm, 05.00 pm, 07.00 pm, 09.00 pm and 11.00 pm. At each site and at each recording, the sound level meter was mounted on a tripod at a uniform height of 01 meter from the ground, on the kerb.

At the six selected sites, six consecutive days were consumed, designating one whole day for the recording at one site, starting from Monday. Same team of persons recorded the noise level at two hourly intervals at aforementioned timings. Every two hours on the hour, five measurements were made at intervals of three minutes each and a mean value was recorded as a sample. In addition to measuring the level of noise, all passing vehicles were counted and recorded. Microsoft Excel was used to compare the noise levels between commercial and residential areas of Karachi (Table No: II).

Two extra days were spent in evaluating traffic noise levels during peak hours (01.00 p.m. to 02.00 p.m.) and non-peak hours (10.00 p.m. to 11.00 p.m.) at important, busy locations in Karachi (Table No: III).

Two major roads of the city namely M.A Jinnah Road and Shahrah-e-Faisal were selected for study. Air traffic noise, Railway stations, vendors with their loudspeakers and loud music played on certain vehicles were all excluded from the study.

RESULTS

Six consecutive working days, starting from Monday up till Saturday, were allocated to measure the noise levels of different vehicles **(Figure I)** plying on the roads of Karachi city at selected sites, i.e. MA Jinnah Road, Shahrah-e-Faisal and a residential area in Gulshan-e-Iqbal, scheme 33, which was flanked by 200 feet wide roads on its two sides. The study was conducted from 9:00 am to 11:00 pm, taking measurements at the interval of 2 hours. Maximum level of noise was 110 dB (A), recorded from Autorikshaw & Motorcycles (without silencers) and Minibuses.

Table I illustrates level of noise at different sites of study. Maximum noise was observed during the peak rush hours between 01.00 p.m. to 03.00 p.m. & 05.00 p.m. to 07.00 p.m. and was in the range of 110 dB (A) with a dip of about 5–10 dB (A) between 03.00 p.m. to 05.00 p.m. Most noisy road was found to be M.A Jinnah Road (Merewether Tower & opposite K.M.C building).

The mean value of noise level in the commercial areas was 95.75 dB (A), ranging from 85 dB (A) to 110 dB (A), (± SD 11.29727). The mean value of noise level in the residential area was 60 dB (A), ranging from 50 dB (A) to 75 dB (A), (± SD 8.451543). The comparison of noise levels between the commercial and the residential areas is shown in **Table II**.

Noise produced by individual horns at the distance of one meter from the source is depicted in **Figure II**. Dreadfully noisy horns were honked by large buses, trucks and water tankers, reaching a level of 130 dB (A).

Average percentage of passing vehicles at different sites is shown in **Figure III**, in which motorcars and motorcycles outnumbered all the other vehicles and constituted 30% each of the total.

Two extra days were spent to study the noise levels during peak hours (01:00 p.m. to 02:00 p.m.) and non-peak hours (from 10:00 p.m. to 11.00 p.m.) at certain important busy locations in Karachi. As tabulated in Table No III, the average noise level at these sites during peak hours was 95 dB (A).

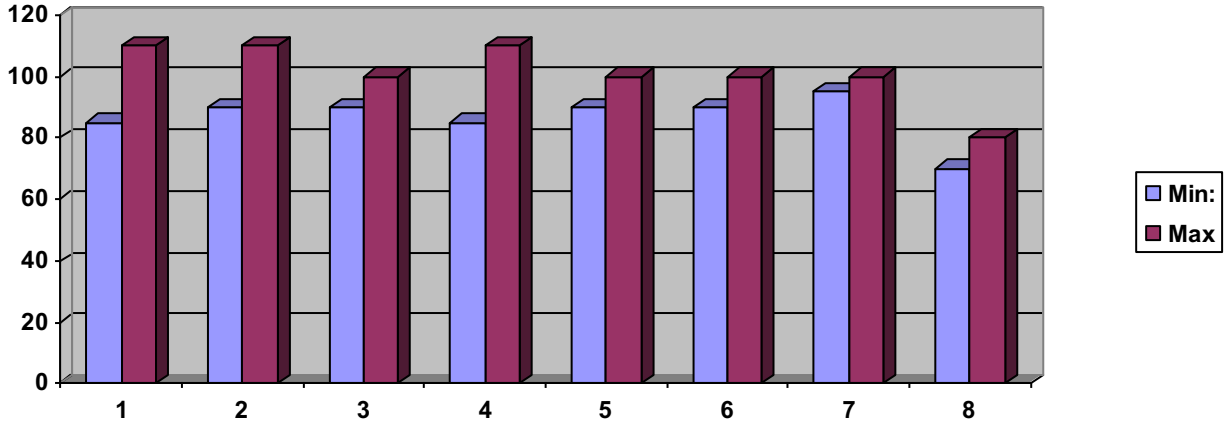
DISCUSSION

According to ISO standard, noise levels on roads should not exceed 70 dB (A). [18] This fact is proven by various studies, that noise levels of 70 dB or less, 24 hours a day, for lifetime, are not damaging to ears. [19]

In Pakistan, the traffic noise levels limit as laid down by National Environment Quality standards, Environmental protection agency is 85 dB (A) with in the radius of 7.5 meters. Also the motor vehicle rules 1969: section 158 states that every motor shall be so constructed and maintained as not to cause noise when in motion; but the fact is otherwise and noise levels on roads average around 90 dB (A). [2, 20, 21]

The sources of traffic noise in Karachi are numerous i.e. Autorikshaws, Motor cycles, Buses and Minibuses, Trucks, Water tankers, Pickups, Wagons etc, but the champion of them all is the Autorikshaw. This is a form of vehicle with three wheels, but, having its silencer removed to economize on fuel, it plays havoc

FIGURE I: TRAFFIC NOISE PRODUCERS *(Min: and Max: Sound in dB)*



1.Mini Bus 2.Rickshaw 3.Bus 4.Motorcycle 5.Truck 6.Pick up 7.Water Tanker 8.Car

TABLE I: LEVEL OF NOISE WITH INTERVAL OF TIME

Site of Study	9.00 a.m	11.00 a.m	1.00 p.m	3.00 p.m	5.00 p.m	7.00 p.m	9.00 p.m	11.00 p.m
Guru Mandar (M.A Jinnah Road)	90 dB	95 dB	105 dB	100 dB	105 dB	105 dB	90 dB	80 dB
K.M.C building (M.A Jinnah Road)	85 dB	90 dB	110 dB	100 dB	110 dB	110 dB	85 dB	70 dB
Merewether Tower (M.A Jinnah Road)	85 dB	95 dB	110 dB	100 dB	110 dB	110 dB	85 dB	70 dB
Opp: Shah Faisal Colony (Shahrah-e-Faisal)	90 dB	100dB	105 dB	100 dB	105 dB	105 dB	90 dB	80 dB
Malir (Main Road) (Shahrah-e-Faisal)	85 dB	90dB	105 dB	100 dB	105 dB	100 dB	90 dB	80 dB
Pioneer Fountain Phase II (Residential Area)	50 dB	55 dB	65 dB	60 dB	65 dB	75 dB	60 dB	50 dB

TABLE II: COMPARISON OF NOISE LEVEL BETWEEN COMMERCIAL AND RESIDENTIAL AREAS

Area	Mean (dB)	Variance	Standard Deviation	95% Confidence Interval
Commercial	95.75	127.6282	11.29727	73.61 – 117.89
Residential	60	71.42857	8.451543	41.41 – 78.59

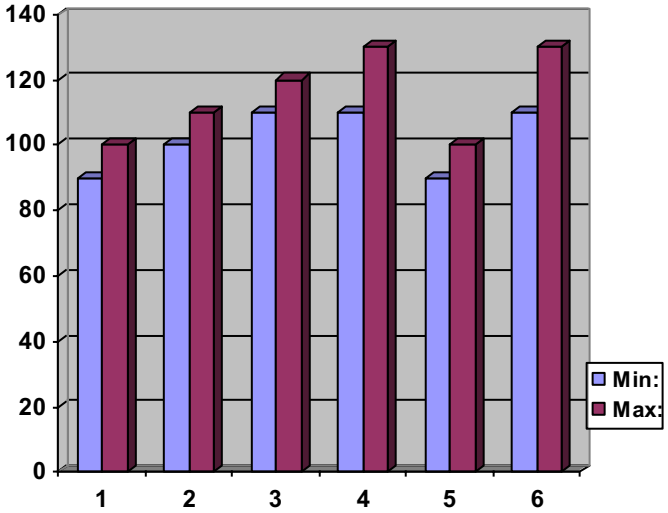
with the ears of the passengers as well as passersby alike. It is capable of achieving a staggering noise of about 110 dB! Other vehicle, which takes after the notorious Autorikshaw, is the motorcycle with its silencer taken out. An unmaintained vehicular engines as well as vehicular body noise is also a constant noise augmenting factor. On the slightest provocation, an orderly traffic very easily becomes a jumbled mess of vehicles and humans with pandemonium broken out, along with escalation in the amount of noise. It is mind boggling as to why those senseless and reckless drivers frequently honk their terribly disrupting horns? One might jump out of his skin on hearing it at close quarters and lose all control of himself as well as his vehicle. Infact, one does go berserk at times with those horrific outbursts of noise.

Several studies have demonstrated that traffic noise aggravation depends upon the type of road (whether main or side road), hours of the day (Peak hours etc), day of the week (Working day or a holiday), road width, road surface (Whether bumpy or smooth), high rise buildings along both sides of the road, types of

TABLE III: LEVEL OF NOISE AT OTHER IMPORTANT AREAS IN KARACHI

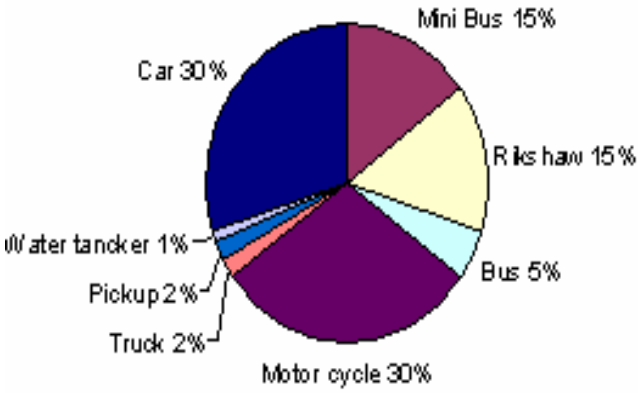
Site	01.00–02.00 p.m	10.00-11.00 p.m
Hassan Square	95 dB	80 dB
Jail Chorangi	100 dB	75 dB
Lasbella Chock	105 dB	80 dB
Ankle Saria Hospital	100 dB	70 dB
Rimpa Plaza	95 dB	75 dB
Old Radio Station	100 dB	75 dB
Jamia Cloth Market	95 dB	75 dB
Denso Hall	105 dB	70 dB
I.I Chundrigar Road	90 dB	70 dB
Burns Road	100 dB	75 dB
Saddar	100 dB	70 dB
Nursery	95 dB	70 dB
Star Gate	95 dB	80 dB
NIPA Chorangi	95 dB	80 dB
Liaquatabad Underpass	100 dB	75 dB
Nazimabad Underpass	95 dB	70 dB
Site Area	90 dB	70 dB
Numaish Chorangi	95 dB	75 dB

FIGURE II: NOISE PRODUCED BY INDIVIDUAL HORNS (IN DB) *(At 1meter from the source)*



1.Car 2.Mini Bus 3.Water Tanker 4.Large bus 5.Motorcycle 6.Truck

FIGURE III: PERCENTAGE OF PASSING VEHICLES PER HOUR ***(At different sites)***



shops along the road (with generators on the foot paths outside the shops), mechanical workshops, Iron and steel workshops, saw mills, Furniture makers, marble workshops etc. [22-25]

Excessive noise, apart from sensorineural hearing loss, can cause lack of sleep, irritability, heartburn, indigestion, ulcer, high blood pressure and possibly heart disease[8,9] One burst of noise, as from a passing truck is known to alter endocrinal, neurological and cardiovascular functions in many individuals. Prolonged or frequent exposure to such noise may make the physiological disturbances chronic. In addition, noise induced stress creates severe tension in daily life and contributes to mental illness. [4-6, 8, 9, 26]

Many researchers have expressed their concern over exceedingly high noise level generated by irksome traffic in Pakistan. A survey conducted to evaluate the noise produced by vehicles in Karachi, Lahore, Peshawar, Rawalpindi and Quetta showed it to be around 95 dB (A) +/- 5 dB, on a given day. [2,14]

In our study, Autorikshaws, Motorcycles and Minibuses (Fig. No: 1) surpassed all the other vehicles in the emission of excessive traffic noise. One previous study identified Autorikshaw as the most important cause of traffic noise in Karachi.[2] This may be due to the reasons that advancing years and rise in petrol prices have compelled most of the people to resort to a cheaper form of transport, which ultimately came out in the form of Motorcycles. This vehicle, unfortunately has become a favourite of the young generation in no time. Having removed its silencer, they get a thrill out of it and savour thundering around small streets and narrow alleys with ruthless speed. Thus enhancing environmental noise to a formidable degree. As far as the Minibuses are concerned, unmaintained and worn out engines, shaking vehicular bodies with their impending explosion due to overcrowding, topped with

equal number of heedless passengers on the roof, combined with the shouts of almost completely hanging out conductors (with only a precarious foothold on the entrance step), is a familiar sight which contributes much to the noise pollution in Karachi. Pathetic as it is, nevertheless worth seeing in order to realize what a terrible amount of noise is generated by it.

With a slight variation of location, we found M.A Jinnah Road (Merewether tower and opposite K.M.C building) the noisiest place in Karachi, which is again comparable to earlier studies that have pointed out M.A Jinnah Road (Tibet center) the noisiest place in Karachi (Table No: 1). [2, 11]

We also measured noise produced by individual horns at the distance of one meter from the source (Fig. No: 2). It revealed that trucks, large buses and water tankers blew most annoying and injurious horns. Reaching up to a level of 130 dB (A), these horns leave one's ears numb for a while!

Although, Autorikshaws account for only 15% (Fig. No: 3) of the traffic in Karachi, it is commonly used as a means public transport, hence found in every nook and cranny of the town creating a ubiquitous nuisance.

After hitting a peak at 110 dB (A) between 01.00 p.m. to 03.00 p.m., an imperceptible abatement of 5-10 dB (A) in the traffic noise was recorded during 03.00 p.m. to 05.00 p.m. interval at M.A Jinnah Road. This could possibly be explained by the fact that most of the commuters would have settled down to their offices or shops by that time. Meanwhile a steady level of traffic noise indicates the rank and file travelling to the business and trade centres. The traffic noise rose to another peak at 110 dB (A) between 05.00 p.m. to 07.00 p.m., subsequent to the closure of the offices and shops when commuters commenced their journey back home. The noise then gradually fell to a low level over a period of 3-4 hours.

The residential area taken as a control remained reasonably quiet with noise levels around 50-60 dB(A) during the whole day except around 7:00 p.m., when sparse traffic combined with children playing and shouting at one another made the noise level rise to a peak of 75 dB (A), which was again short lived.

The mean values of noise level in the commercial and the residential areas are 95.75 dB (A) and 60 dB (A) respectively (Table No: II). The difference in noise level between the commercial and the residential areas is highly significant. It denotes that the people in the areas of study are exposed to a significantly high level of noise for most part of the day, at least six days a week-- which is much higher than all the published international data. None of the local studies have discussed statistical differences in the level of traffic noise between the commercial and the residential areas of Karachi. It is reasonable to perceive that those who are exposed to such a tremendous level of noise for more than eight hours a day, are liable to develop deleterious auditory and / or systemic effects of noise in due course of time.

Average traffic noise during peak rush hours in Karachi is around 95 dB (A) $\pm$5 dB(A) (Table No: III), which is again comparable to various studies carried out in different cities of Pakistan.

Our study confirms that traffic noise pollution in Karachi is rampant and exceedingly higher than all the international standards [27]. It is a constant ordeal to live in a city where people are totally ignorant of the hazards of noise in general, and, traffic noise in particular. Our study corroborates the results of earlier studies carried out in the city and we wholeheartedly agree with the solicitous workers who have raised the issue of awful amount of noise being generated by the traffic in Karachi.

On average, inhabitants of Karachi are exposed to 8-10 hours per day and six days in a week, to excessive traffic noise in the range of about 95 dB (A). Such noise level combined with other forms of community noise can make life unbearable. Hence, it is bound to cause all the malicious effects of noise, which have already been discussed above. Most vulnerable to traffic noise are the traffic constables and the drivers of the noisy vehicles themselves.

CONCLUSION

Karachi is facing an enormous problem of exceedingly high levels of traffic noise, which is significantly higher than all the available international data. Vast number of people is at risk of developing noise induced hearing loss, Psychological, Cardiovascular or other systemic disorders in due course of time.

RECOMMENDATIONS

It is high time that the concerned authorities should wake-up to the hue and cry about traffic noise and its effects in Pakistan. Measures must be taken to create awareness in the people about the ill effects of noise and stringent rules made to control and mitigate the level of noise in every facet of life, including the traffic.

SUMMARY

Noise pollution has created a global crisis.

Traffic noise is one of the major contributors to noise pollution in all the big cities of the World.

Karachi being the largest city in Pakistan, is experiencing a tremendous increase in the traffic noise levels owing to millions of vehicles plying on it's roads without proper maintenance of body & engines, indifference of the inhabitants towards noise pollution and nonchalance of the concerned authorities.

Average traffic noise level recorded in this study was 95 dB (A)-much above the internationally recommended standards.

A vast number of people are at risk of developing noise induced hearing loss as well as other systemic manifestations of detrimental effects of excessive noise.

ACKNOWLEDGEMENT

The authors express their gratitude to Mr. Muhammad Saad ullah Khan for his great assistance in the collection of data for this study.

REFERENCES

1. Environmental Health criteria 12. World Health Organization, Geneva, 1980.
2. Zaidi SH. Noise level and sources of noise pollution in Karachi. J Pak Med Assoc 1989;39:62-5.
3. Ashrafi KA, Khan IA. Effects of noise pollution on hearing. Pak J Otolaryngol Aug 2005;21(2):33-4.
4. Kryter KD. The Handbook of Hearing and the Effects of Noise: Physiology, Psychology, and Public Health. San Diego, Calif.: Academic Press, 1994.
5. Lara SA, Staphens RWB, eds. Noise Pollution:Effects and Control. New York: Wiley, 1986.
6. Jakovljevic B, Belojevic G, Paunovic K, Stojanov V. Road traffic noise and sleep disturbances in an urban population: cross-sectional study. Croat Med J. 2006 Feb;47(1):125-33.
7. Aslam MJ, Aslam M A, Batool A. Effects of noise pollution on hearing of public transport drivers in Lahore City. Pak J Med Sciences. Jan-Mar 2008;24(1):142-6
8. Babisch W. Transportation noise and cardiovascular risk: Updated Review and synthesis of epidemiological studies indicate that the evidence has increased. Noise Health 2006;8:1-29
9. Babisch W. Road traffic noise and cardiovascular risk. Noise Health. 2008 Jan-Mar;10(38):27-33.
10. Chakraborty MR, Khan HS, Samad MA, Amin MN. Noise level in different places of Dhaka Metropolitan City (DMC) and noise-induced hearing loss (NIHL) in Dhaka City dwellers. Bangladesh Med Res Counc Bull. 2005 Aug;31(2):68-74.
11. Braj BS, Jain VK. A comparative study of noise levels in some residential, industrial and commercial areas in Delhi. Journal of Environmental Monitoring and Assessment.*2005, 35*(1):1–11.
12. Leong ST, Laortanakul P. Monitoring and assessment of daily exposure of roadside workers to traffic noise levels in an Asian city: a case study of Bangkok streets. Environ Monit Assess. 2003 Jun;85(1):69-85.
13. Bluhm G, Nordling E, Berglind N. Road traffic noise and annoyance-an increasing environmental health problem. Noise Health.2004 Jul-Sep;6(24);43-9.
14. Meijer H, Knipschild P, sale H. Road traffic noise annoyance in Amsterdam. Int Arch Occup Environ Health. 1985;56(4):285-97.
15. Datta JK, Sadhu S, Gupta S,Saha R, Mondal NK, Mukhopadhyay B.Assessment of noise level in Burdwan town, West Bengal.J Environ Biol. 2006 Jul;27(3):609-12.
16. Kisku GC, Sharma K, Kidwai MM, Barman SC, Khan AH, Singh R, et al. Profile of noise pollution in Lucknow city and its impact on environment.J Environ Biol. 2006 May;27(2 Suppl):409-12.
17. Shaikh GH, Rizvi SSH. Traffic noise in Karachi, Pakistan. J Sci. Ind. Res. 1987;30:197.
18. ISO 1990 Acoustics-Determination of occupational noise exposure and estimation of noise induced hearing impairment. International Standard ISO 1999, International Organization for Standardization. Geneva, Switzerland.
19. Lindemann HE, Van der Klaauw MM, Platenburg-Gits FA. Hearing acuity in male adolescents at the age of 17 – 23 years. Audiology 1987;26:65-78.
20. Wahab U, Zaidi SH. Noise induced hearing loss in Pakistan. Pak J Otolaryngol. 1997;13:75-8.
21. Kryter KD. The effects of noise on man. New York: Academic Press Inc. 1970.
22. Jamrah A, Al-Omari A, Sharabi R. Evaluation of traffic noise pollution in Amman, Jordan. Environ Monit Assess. 2006 Sep;120(1-3):499-525.
23. Wojcik A, Czarnopys M, Sieklucka-Dziuba M. The evaluation of noise level in different points of urban area. AnnUniv Mariae CurleSklodowska. 2001;56:15-9
24. Singh NM, Rao SN. A reconnaissance of traffic noise pollution in the city of Patna. Indian J Environ Health. 2001Oct;43(4):138-43.
25. Ma G, Tian Y, Ju T, Ren Z. Assessment of Traffic

Noise Pollution from 1989 to 2003 in Lanzhou City. Environ Monit Assess. 2006 Oct 12;[Epub ahead of print]

26. Björk J, Ardö J, Stroh E, Lövkvist H, Ostergren PO, Albin M. Road traffic noise in southern Sweden and its relation to annoyance, disturbance of daily activities and health.Scand J Work Environ Health. 2006 Oct;32(5):392-401

27. Berglund B, Lindvall T, Schwela HD, editors. Guidelines for community noise. Geneva:World Health Organization;1999.

AUTHOR AFFILIATION:

Prof. Muhammad Wasiullah Khan *(Corresponding Author)*
Professor, Department of E.N.T
Isra University Hyderabad, Sindh-Pakistan.
Email: mwasiullahkhan@yahoo.com

Dr. Mushtaque Ali Memon
Assistant Professor, Department of E.N.T
Isra University Hyderabad, Sindh-Pakistan.

Dr. Muhammad Najeebullah Khan
Medical Student
Isra University Hyderabad, Sindh-Pakistan.

Dr. Muhammad Moizullah Khan
Medical Student
Isra University Hyderabad, Sindh-Pakistan.