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Evaluation of Road Traffic Noise Pollution and Its Effects on Shop Workers in Gaza City

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Evaluation of Road Traffic Noise Pollution and Its Effects
on Shop Workers in Gaza City

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Evaluation of Road Traffic Noise Pollution and Its Effects on Shop Workers in Gaza City

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Dedication

This thesis is dedicated to

My parents, who have raised me to be the person I am today.....

My brothers and sisters.....

My wife and my sons.....

My country.....

My friends who always supported me.....

Shadi Mustafa Ishtaiwi

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿ وَاللَّهُ جَعَلَ لَكُمْ مِمَّا خَلَقَ ظِلَالًا وَجَعَلَ لَكُمْ مِنَ الْجِبَالِ أَكْنَانًا وَجَعَلَ لَكُمْ سُرَابِيلَ
تَقِيكُمْ الْحَرَّ وَسُرَابِيلَ تَقِيكُمْ بَأْسَكُمْ كَذَلِكَ يَتِمُّ نِعْمَتَهُ عَلَيْكُمْ لَعَلَّكُمْ تَسْلَمُونَ ﴾

صدق الله العظيم

(سورة النحل، آية 81)

Declaration

I certify that all this thesis submitted for the degree of Master is the result of my own research, except where otherwise acknowledged, and that this thesis (or any part of the same) has not been submitted for a higher degree to any other university or institution.

Signed:

Shadi Mustafa Ishtaiwi

Date: April-2009

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Abstract

Gaza city is one of the most crowded places on Earth. This rowdiness and the random haphazard urbanization have resulted in many environmental hazards including noise pollution. Therefore, this study has been designed to study noise pollution due to vehicular traffic in Gaza city and to determine the awareness level of noise pollution and its effects on shop workers. Traffic noise level was measured at 19 locations (18 in the noisy crowded areas and one in a quiet less crowded area as control location) by using a sound level meter. The continuous equivalent sound level (L_{eq}) was calculated manually in addition to statistical descriptors L_{10} , L_{50} , L_{90} . Also, during the measurement period, the vehicles flow was counted manually. The measurements were taken at rush hours; in the morning at 7:30-8:30, and in the afternoon at 2:00-3:00 all days. Also, a face-to-face questionnaire was used to measure the awareness level of noise pollution and its effects on shop-workers. The response rate was 91.5% (150 out of 164 workers). The results indicate that the noise level exceeded the permissible limits of the WHO standard in the 18 locations of the crowded study area at both times, while that of the 19th location was within the WHO standard, and the results revealed that noise levels are increasing with increased vehicles flow. Also the results shows that shop-workers are aware of the major sources of noise (98% said vehicles movement), but 54 % have misconception about the meaning of noise pollution. About 97.3 % of them reported that noise pollution affects on human health. Also the results illustrated that 29.3% of the shop-workers have hearing impairments, 46% have experienced of sleeping disturbances, and 40% complain of headache during working time. The study concluded that Gaza city has a higher noise levels compared to WHO standard and there is a need to reduce its level to protect people from its effects. Therefore, the study recommends setting national standard, raising population's awareness about noise adverse health effects, and improving traffic management and control with placing large signs banning the use of vehicles' horns to avoid above standards noise levels in public places.

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List of abbreviations

AM	Ante Meridiem
dB(A)	Decibel A-weighted
EQA-P	Environment Quality Authority-Palestine
EPA	Environmental Protection Agency
Leq	Continuous equivalent noise level
Max	Maximum
Min.	Minimum
NGOs	Non Governmental Organizations
PCBS	Palestinian Central Bureau of Statistics
PM	Post Meridiem
SPEAP	Strengthening the Palestinian Environmental Action Program
SPSS	Statistical Package for the Social Sciences
UNEP	United Nations Environmental Program
WHO	World Health Organization

Chapter (1)

Introduction

1.1 General

There are many types of environmental pollution and when we are talking about pollution, only water, air and soil pollution commonly strike our mind. We are unaware of the hidden pollution, which is the noise pollution. It is defined as unwanted or offensive sound that unreasonably intrude into our daily activities (Environmental Protection Agency, 1974), and classified as intrusive noise that distracts and disrupts regular functioning (World Health Organization, 2007). Noise is derived from the Latin word “nausea” implying ‘unwanted sound’ or ‘sound that is loud, unpleasant or unexpected’. It is the wrong sound, in the wrong place, at the wrong time. It is a significant environmental problem in many rapidly urbanizing areas. This problem is properly not recognized despite the fact that it is steadily growing in developing countries (Barboza *et al.*, 1995).

The noise pollution problem is also severe in cities of developing countries and caused mainly by traffic. Environmental noise is also called community noise, residential noise or domestic noise, which is defined as the noise emitted from all sources except noise at the industrial workplace. The main sources of community noise include road, rail and air traffic, industries, construction and public work, and the neighborhood. The response of human ear to sound depends both on the sound frequency (measure in Hertz. Hz.) and the sound pressure, measured in decibel (dB) which is measured by a sound level meter. The full, audible frequency range for young, healthy ears extends

from about 20 Hz (cycles per second) to about 20,000 Hz. However, the human hearing mechanism is most sensitive to sounds in the 500- to 8,000-Hz range. Above and below this range, the ear is inherently less sensitive (Roberts and Bayliss, 1967).

Traffic is the dominating source of noise pollution (Skanberg and Ohrstrom, 2002). Noise surveys in various cities throughout the world have revealed that traffic noise is typically the largest contributor to record sound levels and the most important source of annoyance. (UNEP, 1981, Pandya, 2003). Exposure to the traffic noise has a number of acute and chronic effect on human population (Koh, and Jeyaratnam, 1998).

Adverse effects due to exposure to noise may include interference with speech communication and decreasing learning skills of children (Mato and Mufuruki, 1999). While prolonged exposure to high intensity noise can damage and destroy sensory cells of the inner ear leading to irreversible hearing loss (Lusk, 1997), and increase in activity of endocrine glands, high blood pressure, heart rates and change in blood composition (Suter, 1992 and Brookhouser, 1994). Persons who are exposed to high noise levels are having more social conflicts at home and at work (Eldred, 2000).

Analysis of traffic noise generally constitutes an important component of environmental impact assessment which is needed for highway development and improvement (Bhattacharya *et al.*, 2002). Existing evidence indicating that noise pollution may have negative impacts on human health has justified research in order to provide better understanding of noise pollution problems and control (Georgiadou *et al.*, 2004).

The need for studies regarding the urban noise pollution and its consequences on the environment has motivated various researches on the problem in several countries (Zannin *et al.*, 2003; Zeid *et al.*, 2000; Zheng, 1996).

1.2 Research problem

Most of Gaza inhabitants are living in unhealthy environment, which is mainly caused by the Israeli occupation since many years as well as the absence of relevant regulations or enforcement of law. This situation could increase the sources of noise pollution. Noise is considered as unpleasant and affects the quality of life. It disturbs and interferes with activities of the individual including concentration, communication, relaxation and sleep (Schwela 2000; WHO 2000). Noise pollution is not only an aggravation, but also a serious health risks, therefore the WHO has established maximum allowable levels of noise, above which people are harmed. In developing countries such as Palestine the growth of their cities such as Gaza had been unplanned and haphazard resulted in many environmental hazards. One of these hazards is noise pollution, which is damaging to human health. But the noise level in Gaza city is unknown, therefore the present study will help in determining that level and also it will assess the consequent health effects on Palestinian shop workers.

1.3 Justification of the study

Noise pollution is one of the neglected environmental subjects in Gaza strip which led to lacking information about noise pollution, sources, and impacts. Noise pollution is a significant environmental problem, which is properly not recognized in Gaza strip despite the fact that it is steadily growing in developing countries.

No specific studies have been done to evaluate the environmental noise level in Gaza strip, just it was mentioned as one of the priorities of Strengthening The Palestinian Environmental Action Program (EQA, 2004).

Another factor that encouraged the researcher to do this study is the increase of traffic volume mainly after 1993 with bad general behavior of drivers (Sarraj, 2001) and lack of public awareness of noise pollution. According to the Ministry of Transportation, the number of licensed vehicles in Gaza strip was 57,568 which is not problem but the real problem is their ages. The vehicles were categorized into four group according to the age and they were about 15.1% belonged to the less than 10 years age group, 25.4% belonged to the 11-20 years, 38.6% belonged to the 21-30 years while 20.9% belonged to the more than 30 years age group (MOT, 2006).

In the absence of national standards for noise, the agencies are handicapped to take any legal action, therefore the results of this study could be used by the decision makers to start in creating the national community noise levels standard. Moreover, the results this study could provide a base-line information for further future studies related to noise pollution in Gaza strip

1.4 Research Objectives

1.4.1 Main objective

The main objective of this study is to evaluate the environmental noise levels in Gaza city due to road traffic, and its health effects on shop workers.

1.4.2 The specific objectives

1. To determine the noise level of road traffic in Gaza city.
2. To determine the days and times of the peak noise level in Gaza city.
3. To determine the area of the peak noise level in Gaza city.
4. To compare the noise level in Gaza city with the WHO's standard.
5. To assess the public awareness of noise pollution in the Gaza city.
6. To assist decision makers in creating national noise level standard.
7. To determine the most health effects of noise pollution on shop workers.

1.5 Research questions

1. Is there a relationship between weekdays (workdays, holiday, and mixed day) and noise level?
2. Is there a relationship between type of area (commercial, institutional, residential, or silence zone) and noise level?
3. Is there a relationship between number of vehicles and noise level?
4. Is there a relationship between morning and afternoon time and noise level?
5. Is there a relationship between education years of shop-workers and awareness of noise pollution?
6. Is there a relationship between awareness of noise pollution and effects of noise pollution?
7. Is there a relationship between age of shop-worker and effects of noise pollution?
8. Is there a relationship between working years of shop-worker and noise pollution effects?
9. Is there a relationship between working hours per day and noise pollution effects?

1.6 Context of the study

1.6.1 Geographic and demographic context

The total area of Palestine is about 27000 sq. kilometers constitutes the southwestern part of Belad El-sham which is eastern part of the Arab world, in addition to Palestine extends from Ras Al-Nakoura in the north to Rafah in the south. Palestine bordered by Lebanon in the north, Syria and Jordan in the east, the Gulf of AL-Aqaba in the south and by Egypt and Mediterranean Sea in the west (Annex 1).

Palestine was placed under British mandate, ended by Israel establishment in 1948 as a fulfillment of Balfour Declaration in 1917 to create a homeland for the Jews. The result from that situation was the uprooting of most of the Palestinians from their cities, towns, and the migrating to West Bank, Gaza strip, Jordan, Lebanon, Syria and other countries (Abu-Lughod, 1971). Now, the remaining part of the historical Palestine is limited to two geographically separated areas: Gaza strip and the West bank. Both areas represent about 22% of the total area of historical Palestine (MOH, 2006).

Gaza strip is a narrow piece of land lying on the Mediterranean Sea (Annex 2). It is a very crowded place with an area of 365 Km square and it is considered as the second populated place on the earth after Hong Kong (World Bank, 2002). This small piece of land is inhabited by approximately 1,500,000 persons; three quarters of them (70%) are registered as refugees. The inhabitants of Gaza strip live in 7 towns, 10 villages and 8 camps (PCBS, 2007).

Gaza strip comprises five governorates which are; North of Gaza (17% of Gaza strip total area), Gaza city (20.3%), Mid-Zone (15%), Khan-Younis (30.5%), and Rafah (16.2%)(MOH, 2006).

1.6.2 Economical context

Unstable political situation negatively affects the socioeconomic status in Palestine. According to World Bank, 67% of Palestinian households are living below the poverty level. Percentage of people who live in deep poverty had been steadily increase to reach 35% in Gaza strip, and 15% in West Bank, also the unemployment rate is increased to reach 28% in West Bank and 39% in Gaza strip (World Bank, 2007).

1.6.3 Health system context

Health services are provided through government, NGO, United Nation Relief and Works Agency (UNRWA), and private sectors (PCBS, 2007). The health infrastructure is in need of repair and upgrading, and there are shortages of some personnel. Considering the overall investment in the sector, services are generally poor. Primary health facilities are inadequate; services are not coordinate, and there is no adequate referral system. The recent unrest has left the population with unmet rehabilitation and mental health needs. Health sector data collection and training and institutional standards are uncoordinated (World Bank, 2001).

Ministry oh Health (MOH) is the health authority responsible of supervision regulation licensure and control of all health services, and responsible of the Primary Health Care (PHC) and secondary care and some tertiary care. MOH operates 416 primary health care centers (56 PHC in Gaza strip and 360 PHC in West Bank), and operates 22 hospitals (10 hospitals in Gaza strip and 12 in West Bank) (MOH, 2005).

1.6.4 Educational context

The ministry of education of the Palestinian National Authority (PNA) assumed responsibility for the education of the Palestinian population of the West Bank and Gaza strip in 1994. The educational system of Palestine has five cycles. The first is preprimary education for four and five years olds, which lasts for two years. The second or basic, cycle consist of 10 years of education for 6 to 15 years old. The third or secondary, cycle last for two years to 16 and years old. The forth, or post secondary, cycle consists of two years in at technical college, and the fifth, or higher education, cycle consist of four or more years of schooling (MOE, 2007)

1.6.5 Environmental context

The environmental health status is also in a very critical state manifested by shortages and pollution of resources, coupled with long-term environmental degradation that has accumulated over previous years of occupation (EQA., 2004).

1.6.6 The study area

Gaza city was chosen for the study because it is one of the most populous cities in Gaza strip, and reflects both the modern and traditional, infrastructure (roads, localities, buildings etc.). Moreover, its inhabitants represent a cross-section of Palestinian culture. Gaza city is relatively considered the largest city in the Gaza strip, it has an area of 50 sq. kilometers (Municipality of Gaza, 2006) and has a registered population of 550,700 with a population growth rate 3.8%, crude birth rate of 41.7 per 1000 population and a crude death rate of 3.8 per 1000 population (PCBS, 2007).

According to the Ministry of Transportation, the density of licensed vehicles per 1000 people in Gaza city is 40.19 (about 22,000 licensed vehicles). The main problem of this figure is that, there are many old types of vehicles in Gaza city, which play a major role in noise level in the city, in addition to air pollution caused by these vehicles. The city of Gaza has been expanding continuously in all directions mainly since 1994. Many significant changes have been experienced in terms of urbanization, industrialization, expansion of road network and infrastructure.

The city of Gaza is considered the main trading center in Gaza strip and serves as a transportation hub for Gaza strip. In addition, all universities, ministries, banks, hospitals and most of vital centers in the Gaza strip are located in the city of Gaza.

1.7 Operational definition

Environment

Is the circumstances or conditions that surround an organism or group of organisms as well as the complex of social or cultural conditions that affect an individual or community (Cunningham and Saigo, 2001).

Health

Is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 1948)

Environmental health

Environmental health addresses all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviors. It encompasses the assessment and control of those environmental factors that can potentially affect health. It is targeted towards preventing disease and creating health-supportive environments (WHO, 2008).

Health Effect

Is the specific damage to health that an environmental hazard can cause to an individual person. Often the same hazard can cause a range of different effects of different severity (Yassi et al., 2005).

Environmental awareness

The growth and development of awareness, understanding and consciousness toward the biophysical environment and its problems, including human interactions and effects.

Environmental Pollution:

The contamination of air, water, or food in such a manner as to cause real or potential harm to health or well-being, or to damage or harm nonhuman nature without justification (Peirce et al, 1998).

Decibel

The decibel is the unit used for sound level measurement and abbreviated as dB. A logarithmic scale is used to easily represent the wide range of sound pressure to which the human ear responds (EPA, 2007).

dB (A)

Unit of sound level, in A-weighted decibels. The human ear is not equally sensitive to all frequencies of sound. The A-weighting approximates the sensitivity of the human ear by filtering these frequencies. An A-weighted measurement is considered representative average human hearing (EPA, 2007).

Leq: The constant sound pressure level, which would have produced the same total energy as the actual level over the given time(EPA, 2007).

Statistical Descriptors

Statistical descriptors most often used to describe variations in noise level include:

L90 : The level exceeded 90% of the time during a specified period, usually 1 hour, 24 hours, or during the day or the night. In some instances, this value may be considered the background level.

L50 : The level exceeded 50% of the time during a specified period as noted above. This value has sometimes been considered the average or median noise level.

L10 : The level exceeded 10% of the time during a specified period as noted above for traffic noise, this value has been considered the peak period level. (EPA, 2007)

Chapter (2)

Literature review

This chapter was divided into two parts, the first part is the conceptual framework of the study, and the second part is the literature review. Noise level standard and many studies related to noise levels and its effects were included in the part of the literature review.

2.1 Conceptual framework

To simplify the understanding and applying of the study, the researcher created a framework for the study. This framework was used to express the main factors that are causing noise pollution.

2.1.1 Factors affecting the noise pollution

From the evidence of literature reviewed, noise level may be influenced by many factors, therefore some of these factors were studied in this study. These factors can be summarized as follow:

- **Regulations related factors**

One of the major factors that affects on noise levels is the absence of noise standard (limit), in addition to the absence of no horn signs. In this situation, the agencies related to noise pollution are handicapped to take any legal action. The results may lead to increase noise levels.

- **Place related factors**

Internationally, there are four categorizations of zones related to noise levels, these zones are silence, residential, commercial and industrial zone. Each zone has a noise level standard. These settings of noise limits are considered as measures for abatement of noise including noise emanating from vehicles movements and ensure that the existing noise levels do not exceed the specified level.

- **Vehicles related factors**

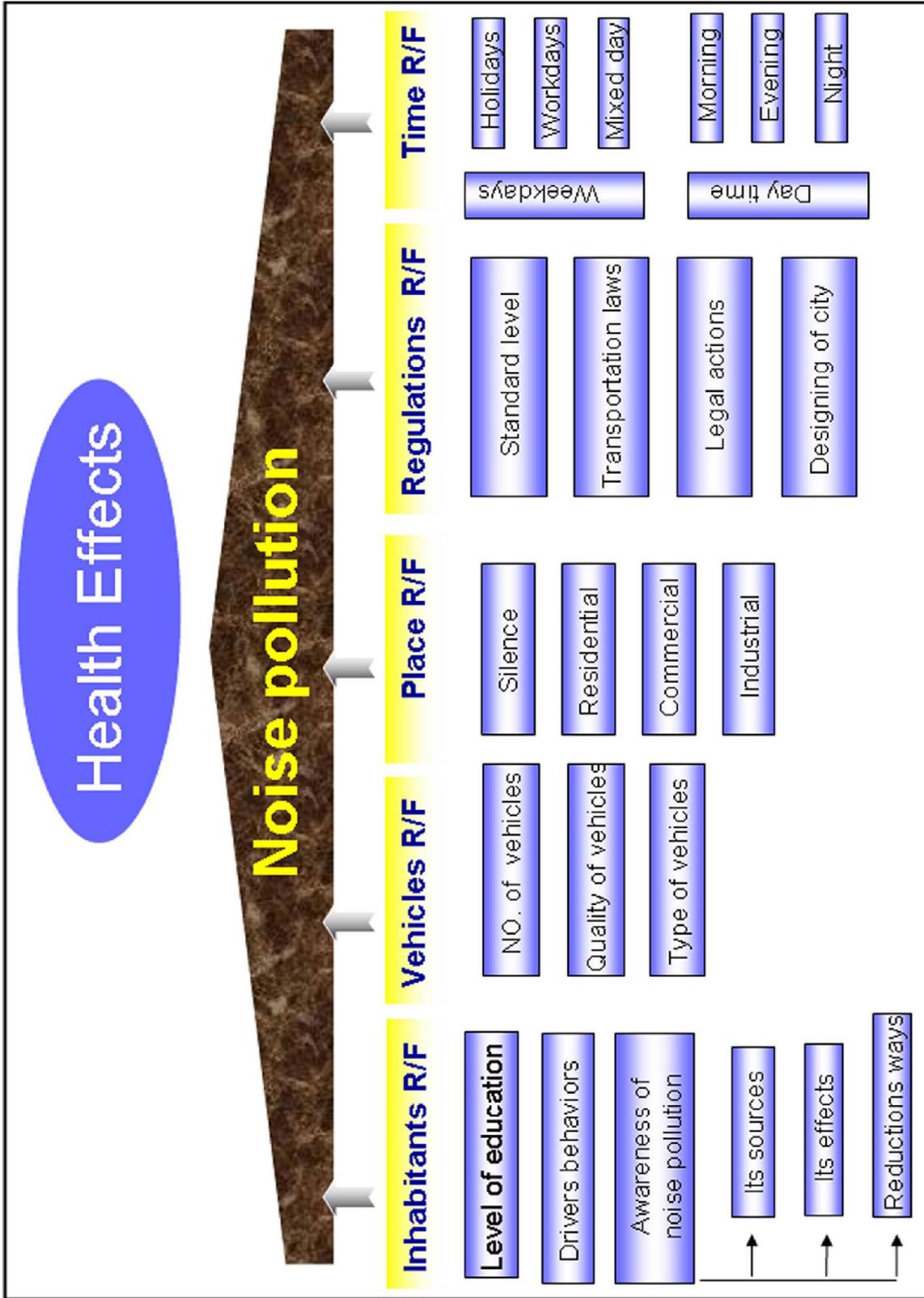
Many scientific studies revealed that, there is a relationship between number of vehicles flow, type of vehicles (taxi, bus,..) and the quality of vehicles, and noise level.

- **Time related factors**

Weekdays play a vital role in levels of noise, where noise levels in weekends are less than workdays. Noise levels differ also according to the type of area in addition to the time of the day (morning, evening and night) .

- **Inhabitant related factors**

According to the definition of environmental awareness, it is the attitude of having consciousness about the consequences of the human intervention on the environment and the performance of appropriate behavior to reduce negative effects (Nunez, 2000). Therefore the awareness level about noise is very important to reduce noise level in addition to behavior of drivers (using of horns) which also has an effect on noise level.



2.2 Literature review

2.2.1 Guidelines for Community Noise

Since 1980, the World Health Organization (WHO) has addressed the problem of community noise. Health-based guidelines on community noise can serve as the basis for deriving noise standards within a framework of noise management. Key issues of noise management include abatement options; models for forecasting and for assessing source control action; setting noise emission standards for existing and planned sources; noise exposure assessment; and testing the compliance of noise exposure with noise emission standards.

In 1992, the WHO Regional Office for Europe convened a task force meeting which set up guidelines for community noise. A preliminary publication of the Karolinska Institute, Stockholm, on behalf of WHO, appeared in 1995. This publication served as the basis for the globally applicable Guidelines for Community Noise presented in this document. An expert task force meeting was convened by WHO in March 1999 in London, United Kingdom, to finalize the guidelines (WHO,1995).

The Guidelines for Community Noise have been prepared as a practical response to the need for action on community noise at the local level, as well as the need for improved legislation, management and guidance at the national and regional levels.

WHO will be pleased to see that these guidelines are used widely. Continuing efforts will be made to improve its content and structure. It would be appreciated if the users of the guidelines provide feedback from its use and their own experiences (WHO, 1995). Until this moment there is not an environmental noise level standard used in the

world, in spite of WHO set up guidelines for community noise. Although, WHO is not an authority to prescribe the limits of noise, it recommends some permissible limits of noise which are just advisory for its member states.

2.2.2 Noise level standard

People work and live under various types of environmental noise, and today most of the countries of the world are aware of the impact of noise on humans, therefore they try to protect humans from the hazard as also for their comfort and convenience. Many countries of the world have carried out the exercise of finding out the most suitable environmental noise levels to which a human being can be exposed with the least harm in that particular environment (Pak-EPA, 2005). Consequently, national standards have been adopted by many countries laying down maximum permissible noise level for environment and occupational noise exposure to give relief to the people working or living in those environments. These standards vary from country to country and have been laid in the form of recommendations, guidelines or statutory requirements as per the economic conditions, advancement of technology and burden on industry (Pak-EPA, 2005).

According to the Indian Regulation and Control Rules, 2000 of the noise pollution, it is recommended to categorize the areas into:

1. Industrial zones.
2. Commercial zones.
3. Residential zones.
4. Silence zones.

(Regulation and Control. Rules, 2000).

2.2.2.1 Industrial Zone

Lands designated Industrial Zone shall generally be industrial where protection against damage to hearing may be required, and the necessity for conversation is limited. The land uses in this category would include, but not be limited to, manufacturing activities, transportation facilities, warehousing, mining, and other lands intended for such uses.

2.2.2.2 Commercial Zone

Lands designated Commercial Zone shall generally be commercial in nature, areas where human beings converse and such conversation is essential to the intended use of the land. The land uses in this category would include, but not be limited to, retail trade, personal, business and professional services, government services, amusements, agricultural activities, and lands intended for such commercial or institutional uses.

2.2.2.3 Silence Zone

Lands designated Silence Zone shall generally be special areas where peace, tranquility and extreme quiet is essential to the intended use of the land. The land use in this category would comprise not less than 100 meters around hospitals, educational institutions and courts. Certain activities (e.g. the use of car horns and loudspeakers) are banned in a silence zone.

2.2.2.4 Residential Zone

Lands designated Residential Zone shall generally be residential areas where human beings sleep or areas where quiet is essential to the intended use of the land.

The land uses in this category would include, but not be limited to, single and multiple family homes, hotels, prisons, religious facilities, cultural activities, forest preserves, and land intended for residential or special uses requiring such protection. . (Regulation and Control. Rules, 2000).

2.2.3 Noise level standard in different countries

2.2.3.1 Noise level standards (Guideline values) for WHO

Table (2.1): Noise level standard for WHO

Type of area	Day time Leq dB(A)	Night time Leq dB(A)
Industrial area	65	65
Commercial area	55	55
Residential area	55	45
Silence area	45	35

Source: (WHO, 2001)

2.2.3.2 Noise level standards for some countries

As illustrated in Annex 3, that there are four categorizations of area with differences in noise level for each type according to national standard for countries. But in some countries mainly developing countries like Dhaka-Bangladesh there are five types, where the fifth type is mixed (residential-commercial) area (Shamannay, 2001).

2.2.4 Some studies related to noise level.

National studies about noise pollution, mainly in Gaza strip are absent, but there is only one study related to road traffic which is "Behavior of Road Users in Gaza, Palestine", this study was conducted by Dr. Sarraj in 2001.

The researcher made several field observations about the behavior of drivers in Gaza strip, one of these observations is using horns. Using horn of the vehicle is very common in Gaza. Drivers use it as multi-use such as, to warn others, to greet a friend or to attract the attention of a passenger by a taxi driver. Also it might be used to inform a person living on the high floor, for instance, that the taxi that he/she ordered has arrived or that his/her friend has come to pick him/her up. Some drivers use the horn very late at night. Drivers are not aware of the noise pollution they are causing, and that this behavior is no longer acceptable (Sarraj, 2001)

Krishna et al.(2007) evaluated the traffic noise pollution in Banepa, a semi urban town of Nepal, and found that the very high environmental noise level is due to vehicle traffic, and that there is an urgent need to set up noise standards in the country of Banepa to control the noise .

Evaluation of traffic noise pollution in Amman, Jordan was studied by Jamrah et.al (2006). They used a sound level meter, it was held in the arms about 1.5 meters above the ground to measure the L10 (1h). The readings were taken twice a day; from 07:00 to 08:00 during the early morning rush hour, and from 07:00 to 08:00 during the early evening rush hour. The readings were taken from 28 locations. They concluded that the day-time statistical noise level L10 throughout Amman has an average of 69 dB(A) and ranges between 46 and 81 dB(A) in the streets, and the night-time statistical noise level L10 throughout Amman has an average of 65 dB(A) and ranges between 58 and 71 dB(A) in the streets. The measured noise level exceeded the 62 dB(A) acceptable limit at most of the locations.

(Monica and Shrivastava, 2000). This study was an effort to comprehensively test noise pollution levels at different locations, covering all zones of Jabalpur city in India with its major road cutting across the city boundary

Ravichandran et al. (2000) assessed noise pollution in Pudukkottai, Tamil Nadu. The ambient noise levels were measured at selected places representing the silence zone, the residential zone and the commercial zone, to assess the extent of noise pollution and they concluded that the vehicular traffic with air horns are the main reason for these high noise levels .

Muttamara and Tet Leong (2003) investigated the relationship between the traffic noise level and the traffic volume, by the study of assessment and measurement of traffic noise level on Bangkok streets, they found that there is a statistical difference in traffic

noise levels and the traffic volume, and also between noise levels according to day times and night times .

Subrata and Sridharan (1999) assessed noise levels in the Neyveli region of India and found that industrial activity and vehicular movement are the two major sources of noise in the region. Various mitigation measures have been suggested to keep the noise level within the prescribed standards .

A study by Murli and Murthy (1983) conducted in Delhi and Calcutta, found that the noise level is 95dB as against the ambient limit of 45dB. Even at the “calm” places, it does not fall below 60dB.

Until this moment there is not any international agreement on the index which should be used to determine road traffic noise, for example the United Kingdom uses L10(18h), Leq is used in United Stat, some countries use L10, L50,L90 for specified time and some countries use the minimum, maximum, and average of readings such as Karachi. Noise level in the urban center (core city or CBD) was unbearable. The internationally accepted tolerable range of 60 to 70 dB (A) had been far exceeded. The traffic congestion points in the central districts are highly noisy. Table 2.2, illustrates the Noise Intensity levels at various locations in Karachi.

Table (2.2) : Noise levels at various location in Karachi

Location no	Location	Noise Intensity Level dB (A)		
		peak	low	Average
1	Empress Market	82.41	69.14	74.33
2	Guru Mandir	85.75	72.57	78.24
3	Merewether Tower	87.67	70.50	77.66
4	Lea Market	86.71	68.56	75.10
5	Numaish	83.19	69.40	74.97
6	Jinnah Bridge	84.40	69.27	75.77
7	Mauripur Truck Stand	84.63	65.67	73.37
8	MetroPole	81.96	64.54	71.95
9	Goethe Institute	85.66	68.71	77.17
10	Shara-e-Iraq	82.04	64.77	72.28
11	Regal	82.80	67.49	74.21
12	Plaza	86.63	71.30	78.32
13	Shaheen Complex	87.21	71.22	77.84
14	Denso Hall	86.51	70.66	77.85
15	Sindh Madrsa	84.75	66.08	74.16
16	Burns Road	86.08	70.36	76.81
17	Eid Gah	85.33	68.61	76.29
18	Garden	86.10	70.74	76.92
19	West Wharf	81.87	63.65	70.73
20	Agha Khan Jamatkhana	86.69	70.87	76.97
21	Wazir Mansion	88.89	67.83	79.01
22	Zainab Market	80.44	65.55	71.70
23	Lucky Star	83.50	66.75	73.38
24	Zaibunisa Street	81.22	62.37	70.78

Source: (SEPA, 1994)

Bombay is one of the cities that too suffer from high levels of noise pollution. Therefore, many studies have been carried out to assess the noise pollution in Bombay. Shetye et al. (1980) had estimated that noise level in crowded locations in Bombay was almost double that of residential standards adopted by most countries (45 dB during day and 35 dB at night).

In the 2006 Banerjee and Chakraborty, studied the different between noise levels in night time and day time in Asansol city (India). They revealed that night time noise levels in all the locations exceeded the limit prescribed by Central Pollution Control Board and the day time noise level was much higher at all locations in respect to the night time noise level. The Day-Night equivalent noise level (Ldn) was determined and ranged between 67.16 dB (A) and 89.44 dB (A) .

To assess the noise pollution and its effects in Lucknow city, Kisku et al, carried out a study at 12 locations with sound level meter to assess day time and night time noise levels of the city. In residential areas, noise ranged between 67.7 to 78.9 in day time and 52.9 to 56.4 in night time; in commercial traffic areas 74.8 to 84.2 and 68.2 to 74.9 and in industrial areas 76.9 to 77.2 and 72.2 to 73.1 dB (A) during day and night time respectively. Values were higher than their prescribed standards which may pose a significant impact on quality of life (Kisku et al, 2006).

2.2.5 Noise pollution in silent zone

Educational and health institutions must be included in special zone, which is considered as a silent zone with permissible level 45 dB (A) according to the WHO standard. School design must take into consideration the reduction of undesirable background noises or the amplification of desired sounds because noise can create sufficient interference with verbal instruction and hinder learning. In 2006, the noise pollution around an educational institution was studied and the results of that study were used to assess the noise levels at the major traffic junctions and community area near an educational institution of an urban city. Noise equivalent level L_{eq} and the statistical levels L10, L50, L90 were measured in the neighborhood community areas as well as at the traffic junctions. The study indicates a need for proper land-use planning when traffic corridors are built in the silence zone areas (Thakur et al, 2006).

Many studies related to the effects of noise pollution on learning process were carried out. In 1917, Morgan, in his study on the effects of noise distraction on memory, he concluded that noise distraction interferes with learning of simple associations and that subjects were tenser while learning in noisy classroom (Morgan, 1917).

In 1980 Christie and Glickman studied the effects of noise pollution on children in classroom, they found that children's performance on many classroom tasks will vary as a function of classroom noise levels. Also they concluded that 70 decibels of sound constitutes a noisy classroom while 40 decibels would be the likely measure of a quiet classroom (Christie and Glickman, 1980).

2.2.6 The effects of noise pollution

There is no doubt that noise affects human health adversely. Health effects of noise include both the auditory as well as non-auditory effects, it result in loss of hearing, stress, high-blood pressure, loss of sleep, distraction affecting productivity, and a general reduction in the quality of life. Many scientific studies have been carried out to study these effects in different categories of population exposed to high intensity and frequencies of sound in their places (Ohrstrom, 2004).

The following figure shows a reaction schema used in epidemiological noise research for hypothesis testing (Babisch 2002). It simplifies the cause-effect chain i.e.: sound annoyance (noise) - physiological arousal (stress indicators) - (biological) risk factors - disease - and mortality (the latter is not explicitly considered in the graph). The mechanism works directly through synaptic nervous interactions and indirectly through the emotional and the cognitive perception of the sound. It should be noted that the 'direct' pathway is relevant even at low sound levels particularly during sleep, when the organism is at its nadir of arousal. The objective noise exposure (sound level) and the subjective noise exposure (annoyance) may serve independently as exposure variables in the statistical analyses of the relationship between noise and health endpoints.

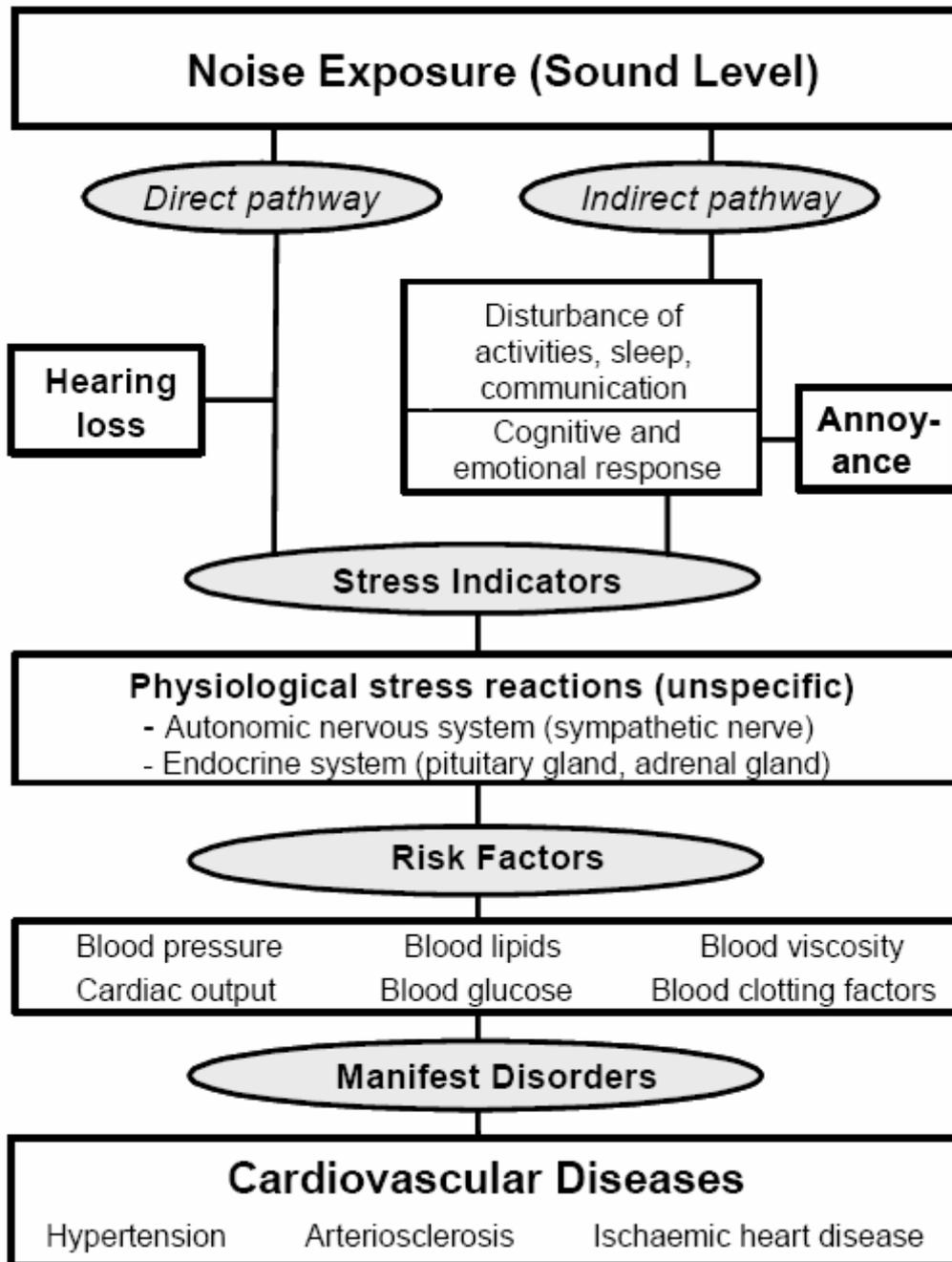


Figure (2.1) : Noise effects reaction scheme (Babisch 2002)

In 2005, Sumiani Yusoff and Asila Ishak evaluated the urban highway environmental noise pollution in Malaysia. Two tools were used to accomplish this study, the first tool is a sound level meter to evaluate the level of noise pollution. Readings were taken every one-minute on the site investigation and the highest in two hours are taken as the peak and so on. The day time of readings were conducted early in the morning (7.30 – 9.30a.m.), in the afternoon (12.00- 2.00 p.m.), in the evening (4.30 – 6.30 p.m.) in order to take the all rush hour readings. The collected sound pressure level readings were analyzed to give L10, L50, L90, and Leq as the most statistical descriptors. The result shows that the majority of the residual noise for all data taken is above 60dBA. The second tool is a questionnaire survey, which is used to detect the public's degree of tolerance and awareness to highway noise with consideration to various parameters such as location, age of respondent, occupation and a number of general psychological, personal as well as physical aspects.

The results show that the highway has been constructed through this residential area has caused an increase in the level of noise and a lot of people attribute increased headache and stress to the excessive noise levels and the most source of traffic noise pollution is cars, which compose about 72% of the road traffic vehicles (Yusoff and Ishak, 2005).

The noise perception survey carried out by a questionnaire administered to 50 individuals in Banepa indicated that most of the people including vehicle drivers were aware about Noise Pollution but their health significance was not fully realized. About 60% respondents were not satisfied with the noise level in their place.

Headache, bad temper, hearing problem, loss of concentrations were some of the significant effects manifested by noise pollution. Forty three percent of the respondents identified headache as the main health effect of noise pollution and 47% visited the doctors for treatment of health problems. 92% of students reported that their studying was disrupted by frequent air-horns of vehicles. The general public strongly supported actions from the government to reduce noise pollution (Krishna Murthy et al., 2007).

2.2.6.1 Noise Annoyance

The most widespread and well documented subjective response and parameter to noise is annoyance, which may include fear and mild anger, related to a belief that one is being avoidably harmed. (Cohen and Weinstein, 1981) .

The maintains Team of the European Commission of Noise said that; "*Annoyance is the scientific expression for the non-specific disturbance by noise, as reported in a structured field survey. Nearly every person that reports to be annoyed by noise in and around his home will also experience one or more of the following specific effects: Reduced enjoyment of balcony or garden; When inside the home with windows open: interference with sleep, communication, reading, watching television, listening to music and radio; Closing of bedroom windows in order to avoid sleep disturbance. Some of the persons that are annoyed by noise also experience one or more of the following effects: Sleep disturbance when windows and doors are closed; Interference with communication and other indoor activities when windows and doors are closed; Mental health effects; Noise-induced hearing impairment; Hypertension; Ischemic heart disease*" (European Communities, 2000).

2.2.6.2 Effects on Physical Health

Exposure to noise may result in a variety of biological responses. Most of the information has been derived from short-term studies on animals and human subjects, but it has been postulated that, if provoked continuously, such responses would ultimately lead to the development of clinically recognizable physical or mental disease in human beings. Numerous clinical symptoms and signs have been attributed to noise exposure including nausea, headache, irritability, instability, argumentativeness, reduction in sexual drive, anxiety, nervousness, insomnia, abnormal somnolence, and loss of appetite (Jirkova & Kromarova, 1965).

Many people experience sleep disturbance due to noise and the problem has been reviewed by several authors. Sleeping is one of the most important phenomenon that reflects the different physiological and psychological activities in humans. A number of studies shows that the exposure to noise causes falling asleep and less in deep sleep activity, even though there are 10-20 % sleep disturbance due to other reasons than noise (Langdon & Buller, 1977).

Chapter (3)

Methodology

This chapter illustrates the research methodology which was used to conduct this study. It includes the study design, study population, and ethical consideration. Also, it illustrates the tools and instruments that were used in addition to its validity, reliability, piloting, data collection and analysis process. Finally, it presents selection criteria and the limitation of the study.

3.1 Study design

The design of this study is a cross-sectional descriptive analytic one. This design was selected because it enables the researcher to meet the study objectives efficiently and because it is quick and saves time and money. By using this design, cause and effect are being examined at the same point of time (Burns and Grove, 1997). This design was used to evaluate the level of traffic noise pollution and to determine the most subjective complaints by shop workers in Gaza city due to exposure to noise pollution.

3.2 Study population

The population of this study included two sub-populations; the first study population was all crowded areas in Gaza city as locations for measuring noise level. The crowded areas may be health centers, educational institutions, services centers, commercial points. The second study population was all shop-workers in the selected locations.

3.3 Selection criteria

3.3.1 Inclusion criteria for the questionnaire

All shop workers with age of more than 20 years old, and their shops are located about 40 meters from the areas of measuring points in all directions.

3.3.2 Exclusion criteria:

All shop workers less than 20 years old and out of the identified areas (40 meters around the areas of measuring points in all directions) are excluded from this study.

3.4 Sample size

3.4.1 Sample size of shop workers

The sample size was 150 shop-workers, which was selected by convenience sampling.

3.4.2 Sample size of the measuring points location

Road traffic noise levels were measured at 19 points in Gaza city. Table (3.1) shows the locations of the measurement points for this study. These points were selected, because they represent most of the educational institutions (universities), health institutions (hospitals and clinics), main crossroads and main crowded areas in the city.

These points were chosen by the researcher and the municipality of Gaza without using any type of sampling.

Table (3.1): The locations of measurement points.

No.	Location Name	No.	Location Name
1	El- shifa hospital	11	AL-jalaa and Saftawi junction
2	Al-quds hospital	12	Al-Sedra
3	Al –nassr hospital	13	Palestine crossroad
4	Dar al arqam bookshop	14	Al-Moghrabi crossroad
5	Al- azhar university	15	Salah Al-Dine mosque district
6	Palestine square	16	Bahlol station (Nassr street)
7	Al-shigaaia	17	Jabalia park
8	Asqola	18	Abu-Mazen square
9	Frass district	19	Count Bernadott street
10	Al -sarraia crossroad		

3.5 Ethical Consideration

The principles of research is highly respected by the researcher, so before carrying out the study, an official letter was obtained from Helsinki Committee at the ministry of health on 15th of August 2008 which permitted the researcher to carry out this study (Annex 4). Also, another official letter was obtained from the Municipality of Gaza to permit the researcher and to facilitate the process of data collection (Annex 5). The researcher added a cover letter to each questionnaire to explain and clarify the study objectives and purpose and study confidentiality , in addition to verbal explanation about some study concepts. The participation in this study was voluntary.

3.6 Period of the study

The study was conducted in the year 2008, started with the literature review in February 2008. The proposal was approved by the school of Public Health-Al Quds University in May 2008. The measurements of noise levels were collected from 15-7 to 15-9-2008.

3.7 Tools of the study

The tools, which were used in this study are;

1. Sound level meter.
2. Face to face interview questionnaire

3.7.1 Sound level meter

Sound level meter, this is an instrument which responds to sound in approximately the same way as the human ear and gives reproducible measurement of sound level (Mato and Mufuruki, 1999).

Two sound level meter devices were used in this study

- a. Sound level meter type 7188 Mip-oy (Annex 6)
- b. Sound level meter type Peak Tech 8000 (Annex 7)

The sound level meter was examined and calibrated as mentioned in the manufacture institution to measure noise level. The sound level meter devices were held on special stand about 1.5 meter above the ground and the distance of two meters from the nearest driving lane, where passengers wait to catch up a taxi.

3.7.1.1 Times and days of measurements

The measurements were carried out during four days per week. These days are Saturday, Monday, Wednesday and Friday. These days were chosen, because Monday and Wednesday are working days for all institutions in Gaza strip, while Saturday is a working day for some institutions and considered as a holiday for other institutions. Friday is the holiday for all institutions in Gaza strip. This means that, the period of measurement was about 10 weeks, one week for each two locations.

The measurements were taken two times daily, from 7:30 to 8:30 in morning and 2:00 to 3:00 in afternoon. These periods are considered the rush hours and included in the official work time of all institutions in Gaza Strip.

3.7.1.2 Recording of the readings

The readings were recorded in the measurement sheet (Annex 8) for one hour to give the equivalent noise levels Leq . Leq (hr) was calculated manually by using the following equation

$$Leq = L50 + (L10 - L90)^2 / 60 \quad (\text{Rao,1995})$$

During the measurement period, the number of vehicles flow into the area of measuring points was counted manually by using the counting sheet of vehicles volume (Annex 9).

3.7.2 The questionnaire

The data was conducted by face to face interview of closed ended questionnaire, which was constructed in Arabic language and translated into English language (Annex 10) . Accordingly, the questionnaire was divided into four sections and contains 42 items. The first section is related to the socio-demographic data, and contains nine items on age, education years, years of work, working hours per day and place of the shop. The second section is about the awareness of noise pollution, which contains 12 items. The third section is related to the times and places of noise pollution and contains 7 items, while the last section is about the effects of noise pollution (Hypertension, hearing problems, annoyance, sleep pattern disturbance, nervousness, and Headache) and it contains 14 items.

3.7.2.1 Content validity

The validity of the questionnaire has been examined by sending it with enclosed covering letter about the objectives of the study to 8 experts to assess it from clarity and relevancy to the topic. The experts were persons who have a good experience in related fields such as public health, environmental science and research methodology. They were asked to add their suggested modifications that could enrich the questionnaire.

3.7.2.2 Pilot study

A pilot study was conducted as pretest in order to examine the response rate and suitability of the questionnaire items before the starting of data collection, and to identify any weakness or confusion in its components. A sample of 9 shop-workers were selected conveniently from three measuring points. These measuring points are the Palestine square, Al –Nassr Hospital square and Dar al Arqam bookshop.

Also for measuring the noise level, one point was taken to determine the noise level by using a sound level meter and recording in the specialized sheet to check the measurement process. In addition, the counting sheet of vehicles volume was piloted also.

3.8 Data collection

In order to achieve the objectives of this study, the researcher relied on face to face interview for closed ended questionnaire together with the measurement of noise levels as the tools of the study.

3.8.1 Noise levels measurement

The measurement of noise levels were collected by team of 10 persons(2 persons for measuring noise levels and 8 persons for counting the vehicles flow through the measurement points). Therefore the team was divided into two groups (five persons each)

3.8.2 The data of the questionnaire

The data of the questionnaire was collected by the researcher himself through face to face interview for the shop workers in their shops.

3.9 Response rate for the questionnaire

The total number of the shop workers who were visited by the researcher was 164. Out of the164 visits for shop workers, 150 positively responded to make the interview to fill the questionnaire. This means that, the response rate was 91.5 %.

3.10 Data management

3.10.1 Data entry

The data were checked and overviewed to screen out any incompletely answered questions. Then the data was entered into a computer using the Statistical Package for Social Science (SPSS) version 12, because it's a very helpful program in analysis of data and because of its ability in organizing, managing, processing and analyzing of the data.

3.10.2 Data analysis

Before making any statistical analysis, the data was cleaned. In reporting the results of the study population distribution, frequencies, percentages, mean, and standard deviation were measured for each dependent and independent variable. In addition to using some advanced statistical analyses such as one way ANOVA test, independent t-test, pearson correlation test and cross tabulation. These tests were used to clarify potential differences and relationships between the study variables. Finally, some tables and graphs were used to present the data in an organized way and easier for readers to understand.

Note; Differences and correlations were considered as statistically significant when $p\text{-value} < 0.05$

3.11 Limitations of the study

1. The current political and economical situation, mainly the current restriction on Gaza strip that may affect the results and conclusion of the study.
2. The limited number of sound level meter in the institutions related to this study.
3. The cost of the study that the researcher carried out it from his own resources.
4. The measurement time was in morning and afternoon while evening time was excluded due to political and cultural causes.
5. The health status of the shop workers was assessed by using close-ended questionnaire and no laboratory or clinical investigation were done

Chapter (4)

Results and Discussion of noise levels measurements

4.1 General

The researcher used this chapter to present the main study results and discussion of the measurements of noise levels for the 19 locations selected in this study to determine the noise levels in Gaza city, then making comparisons between these levels and WHO's standard of noise level. In addition, it presents in which location, day (working day, holiday, or mixed day) and time (morning, evening) is the highest level of noise pollution.

According to the municipality of Gaza, Gaza city is categorized as residential, commercial, tourist, agricultural and industrial areas. There is no noise level criteria included in these areas, as recommended by international categorization for areas related to noise pollution and limited noise levels. Therefore the researcher distributed the 19 locations into these zones (residential, silent, commercial and industrial) as shown in table 4.1, to make a comparison between these locations levels and WHO's which is shown in table 2.1.

Table (4.1): Categorization of the locations according to type of area

Location	Type of area	Location	Type of area
El- shifa hospital	Silence zones	AL-jalaa and Saftawi junction	Mixed areas(commercial and residential)
Al-quds hospital		Al-sedra	
Al –nassr hospital		Palestine crossroads	
Dar al arqam bookshop		Al- Moghrabi crossroads	
Al- azhar university		Salah Al-din mosque district .	
Palestine square		Bahlol station (Nasser street)	
Al-shigaaia	Commercial zones	Jabalia park	Residential areas
Asqola		Abu-Mazen square	
Frass district		Count Bernadott st	
Al -sarraia crossroad			

4.2 The results of noise level measurements.

The vehicles volume and noise levels for each location are discussed separately below.

4.2.1 El- shifa hospital location

This location is classified in this study as silent zone. Since this location is considered as the main health institution (hospital) in Gaza strip, therefore the permissible noise level is 45 dB(A) according to the WHO standard.

Table (4.2) : Noise levels at El- shifa hospital

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	50	61	70.9	68.2	46	83	306
Evening Friday	48	59	66.9	64.9	42	82	311
Morning Saturday	59	66	73	69.2	56	85	684
Evening Saturday	59	64	72.7	67.1	55	83	514
Morning workdays	69	75	80.9	77.4	64	85	1185
Evening workdays	71	75	81.9	76.9	67	88	1090

As illustrated in table 4.2, the highest equivalent noise level (Leq) per hour (hr) was 77.4 dB(A) in the morning of workdays with minimum and maximum noise levels were 64 dB (A) and 85 dB(A) respectively and the vehicles volume was 1185 vehicles. The lowest Leq (hr) was 64.9 dB (A) in the evening of weekend (Friday) with minimum and maximum noise levels were 42 dB (A) and 82 dB (A) respectively and vehicles volume was 311 vehicles during the measuring hour.

These results indicate that both the highest and lowest Leq (hr) noise levels in this location exceeded the permissible limit according to the comparison with WHO standard which is 45 dB(A).

According to the definition and criteria that must be included in the silence zone, it would comprise not less than 100 meters around hospitals and educational institutions with noise level 45 dB (A). The distance between El-Shifa hospital border and the measurement points is about 5 meters only. It is important to mention that this location is used as transportation hub from Gaza city to the governorates of Mid-Zone, Khan-Younis and Rafah. This situation plays a major role to making noise pollution by increasing the number of vehicles flow to this location.

4.2.2 El- quds hospital location:

This location should be considered as silence zone according to the WHO's guidelines, with a permissible limit of 45 dB (A) in daytime. Table 4.3 summarizes the main results of measurements including Leq (hr), Maximum and Minimum noise levels.

Table (4. 3): Noise levels at AL-quds Hospital location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	49	57	70	64.4	43	80	125
Evening Friday	51	59	71	65.7	46	83	200
Morning Saturday	60	71	80	77.7	50	92	335
Evening Saturday	56	69	76	75.7	49	85	730
Morning workdays	64	74	82	79.4	54	92	890
Evening workdays	61	70	84	78.8	51	96	620

As shown in table 4.3, the highest Leq in this location was 79.4 dB (A) in the morning of workdays with min. and max. noise levels were 54 dB(A) and 92 dB(A) respectively and the vehicles volume was 890 during the measured hour. The lowest Leq was 64.4 dB (A) in the morning of weekend (Friday) with min. and max. noise levels 43 dB(A) and 80 dB(A) respectively and vehicles volume was 125 during the measured hour. According to the WHO's standard, both the lowest and highest Leq exceeded the permissible noise limit (45 dB(A)). In this location, it is noticed that, in front of El-Quds hospital, the street is a narrow two-way traffic that does not accommodate the number of vehicles. The researcher observed that many buses use this street, which plays a major role in the noise level in this location.

4.2.3 Al –nassr hospital location

This location is called Al-nassr medical hospital area which is composed of four hospitals. Also, this location is considered a transportation hub between Gaza governorate and the North governorate.

Table (4.4): Noise levels at Al- nassr hospital location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	47	58	67	64.7	40	83	180
Evening Friday	43	56	64	63.3	40	67	96
Morning Saturday	54	62	70	66.3	50	75	409
Evening Saturday	60	66	75	69.7	55	86	587
Morning workdays	61	67	81	73.7	58	93	680
Evening workdays	63	70	77	73.3	59	89	940

As shown in table 4.4, the highest Leq was 73.7 dB (A) in the morning workdays with min. and max. levels were 58 dB(A) and 93 dB(A) respectively and the vehicles number was 680 vehicles during the measured hour. The lowest Leq was 63.3 dB (A) at the evening weekend with min. and max. levels were 40 dB (A) and 67 dB(A) respectively and the vehicles number was 96 during the measuring hour. In spite of the vehicles number in the morning of workdays(680) was less than in the evening work day (940), the noise level in the morning work day 73.7 dB(A) was more than in the evening work day 73.3 dB(A). This result disagree with the result of a study conducted in Bangkok streets, where the researchers found that there is a positive relationship between traffic noise level and the traffic volume (Muttamara and Tet Leong, 2003).

Note, Nassr street was under temporary blocking, because there were some repairs of it. this indicates that, the vehicles flow to Al-nassr location was less than before which led to decreased noise level. In spite of that situation, both the lowest and the highest Leq (hr) exceeded the permissible limit according to WHO standard.

4.2.4 Dar Al- arqam bookshop location

This location is composed of the major educational institutions in Gaza strip, therefore it should be considered as silent zone with permissible noise level of 45 dB(A) according to the WHO's guidelines.

Table (4.5): Noise levels at Dar al arqam bookshop location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	40	49	54	52.3	38	68	190
Evening Friday	54	61	67	63.8	50	69	508
Morning Saturday	71.1	78	83	80.3	69	88	2040
Evening Saturday	72	78	84	80.4	70	90	1800
Morning workdays	70	76	84	79.2	67	90	2335
Evening workdays	73	79	87	82.3	69	92	2656

As illustrated in table 4.5, the highest Leq was 82.3 dB (A) in the evening workdays with min. and max. levels were 69 dB(A) and 92 dB(A) respectively and the vehicles number was 2656 vehicles during the measuring hour. The lowest Leq in this location was 52.3 dB (A) in the morning of the weekend (Friday) with min. and max. were 38 dB(A) and 68 dB(A) respectively and the vehicles number was 190 vehicles in the measured hour. According to the WHO's standard 52.3 dB (A) exceeds the permissible level of silent zone but it is accepted and normal for residential zones which is 55 dB (A).

4.2.5 Al- azhar university location

This location also composed of major educational institutions in Gaza strip, therefore it should be considered as silent zone. The permissible noise level is 45 dB(A) according the WHO's guidelines. There are two internal transportation parks in this location, which hamper vehicles movement.

Table (4. 6): Noise levels at Al- azhar university location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	51	57	65	60.3	45	69	476
Evening Friday	55	64	71	68.3	51	79	983
Morning Saturday	68	72.5	81	75.3	66	87	2772
Evening Saturday	67	76	86	82	65	100	2173
Morning workdays	71	76	83	78.4	69	89	2956
Evening workdays	71	77	84	79.8	70	89	2809

As illustrated in table 4.6, the highest Leq was 82 dB (A) in the evening Saturday with min. and max. noise levels were 70 dB (A) and 89 dB (A) respectively and the vehicles number was 2173 vehicles. The lowest Leq was 60.3 dB (A) in the morning weekend with min. and max. noise levels were 45 dB (A) and 69 dB (A) respectively and the vehicles number was 476 vehicles during the measured hour. Saturday is considered mixed day where some universities work and other universities do not work, this means that the number of students decreased compared with the workdays. In Gaza strip drivers use horns as multi-options, where it is the main tool to attract the attention of passengers.

4.2.6 Summary I (Silence zones)

Five locations were categorized as silence zone in this study, these locations were El-Shifa hospital, Al-Quds hospital, Al-Nassr hospital, Dar Al-Arqam book shop and Al-Azhar university. Since these are the major health and educational institutions in the city, the permissible noise level is 45 dB(A) according to the WHO's standard.

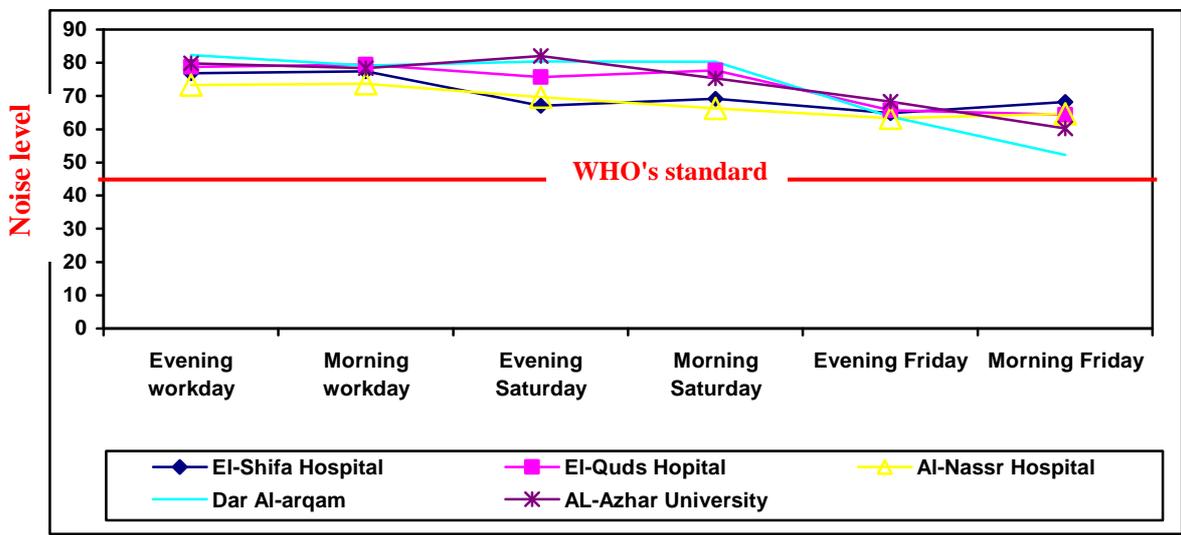


Figure (4.1): Noise levels in the silence zones

The average L_{eq} (hr) in these locations was observed to be 77.9 dB(A) in workdays, 74.4 dB(A) in Saturdays and 63.6 dB(A) in Fridays. The results indicate that, all noise levels exceeded the permissible limit 45 dB(A) according to the WHO's standard.

As shown in figure 4.1, there was only a small difference in noise levels observed between workdays and Saturday. However, a moderate decrease in noise level was recorded during Friday, mainly in the morning.

4.2.7 Palestine square location

This location is called Al-Saha. The municipality of Gaza and the researcher consider it as a commercial zone and according to the WHO standard the noise limit is 55 dB (A). This location is considered as the major transportation hub between all Gaza governorates and also it is considered as the main commercial center in the city

Table (4. 7): Noise levels at Palestine square location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	60	66	75	69.7	55	84	564
Evening Friday	62	68	79.9	73.3	58	91	910
Morning Saturday	64	70	80	74.3	58	88	1046
Evening Saturday	69	74	83	77.3	66	97	1486
Morning workdays	64	70	79.9	74.2	59	93	907
Evening workdays	67	73	85	78.4	63	98	1036

As illustrated in table 4.7, the highest Leq(hr) was 78.4 dB (A) in the evening workdays with min. and max. noise levels of 63 dB (A) and 98 dB (A) respectively and the vehicles number was 1036 during the measured hour. The lowest Leq was 69.7 dB (A) in the morning of weekend with min. and max. noise levels of 55 dB (A) and 84 dB (A) respectively and the vehicles number was 564. These results indicate that both the lowest and the highest Leq exceeded the permissible limit (55 dB (A)).

4.2.8 Al-shigaaia location

This location is considered as a commercial area, therefore the permissible noise level is 55 dB (A) according to the WHO standard. There are a large market, and two transportation parks, the first is internal transportation park and the second is a transportation hub to other governorates. In addition to this, the location intersects with other streets.

Table (4. 8): Noise levels at Al-shigaaia location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	62	68	78	72.3	58	92	722
Evening Friday	63	68	77	71.3	61	93	1090
Morning Saturday	59	65	74	68.7	55	85	675
Evening Saturday	65	69	76	71	62	83	878
Morning workdays	64	71	80	75.3	58	88	1287
Evening workdays	68	75	84	79.3	61	96	1563

As shown in table 4.8, the highest Leq was 79.3 dB (A) in the evening of workdays with min. and max. noise levels of 61 dB (A) and 96 dB (A) respectively and the vehicles number was 1563. The lowest Leq was 68.7 dB (A) in Saturday morning with min. and max. noise levels of 55 dB (A) and 85 dB (A) respectively and vehicles number was 675 vehicles during the measured hour. Both the lowest and the highest Leq(hr) exceeded the permissible limit. This location is different compared to other locations where the noise level in Friday was more than Saturday, since offices and governmental departments were closed during weekend (Friday). The main cause of this difference is the occurring of a large market. In addition to this, the location is considered the transportation park for a big market (the Friday market).

4.2.9 Asqola location

This location is considered as a commercial area according to the study and the municipality of Gaza, therefore the permissible noise level is 55 dB (A) according to the WHO standard.

Table (4. 9): Noise levels in Asqola location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	59	65	74.9	71.9	55	85	617
Evening Friday	66	71	76.9	73	62	83	820
Morning Saturday	65	71	80.9	75.2	59	91	1692
Evening Saturday	68	73	79	75	64	88	1686
Morning workdays	66	70	80	73.3	58	89	1495
Evening workdays	68	72	81	74.8	60	97	1852

As shown in table 4.9, the highest Leq (hr) was 75.2 dB (A) in the morning of Saturday with min. and max. noise levels of 59 dB (A) and 91 dB (A) respectively and the vehicles number was 1692 during the measured hour. The lowest Leq (hr) was 71.9 dB (A) in the morning of Friday with min. and maxi noise levels of 55 dB (A) and 85 dB (A) respectively and the vehicles number was 617 during the measured hour. Both the lowest and the highest Leq exceeded the permissible noise level. There were only small differences in noise levels observed among workdays, Saturday and the weekend (Friday). However, a moderate decrease in noise level was recorded during the weekend.

4.2.10 Frass district location

This location is considered as the largest and oldest market in the city. It was categorized by both the study and the municipality of Gaza as a commercial area, therefore the permissible noise limit is 55 dB (A) according to the WHO standard.

Table (4. 10): Noise levels at Frass district location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	63	68	76	70.8	59	83	890
Evening Friday	60.1	66	76	70.2	57	87	1300
Morning Saturday	64	71.5	81.9	76.5	58	88	987
Evening Saturday	69	75	84	78.7	66	96	1485
Morning workdays	68	73	80	75.4	65	87	1294
Evening workdays	68.1	75	87	80.9	64	96	2367

As illustrated in table 4.10, the highest Leq was 80.9 dB (A) in the evening workdays with min. and max. noise levels of 64 dB (A) and 96 dB (A) respectively and the vehicles number was 2367 and more than 80 animals carts during the measured hour which hamper the traffic movement. The lowest Leq was 70.2 dB (A) in the evening of Friday with min. and max. noise level of 57 dB (A) and 83 dB (A) respectively and the vehicles number was 890 during the measured hour. Both the lowest and the highest Leq (hr) levels exceeded the permissible limit of 55 dB (A).

4.2.11 Al -Sarraia crossroad location

This location is one of the major crossroads in the city of Gaza and it is considered by both the municipality of Gaza and the study as a commercial area, therefore the permissible noise level is 55 dB (A) according to the WHO standard.

Table (4. 11): Noise levels at Al -sarraia crossroad location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	55	62	70	65.7	52	83	550
Evening Friday	63	69	78	72.7	58	93	1132
Morning Saturday	63	70	81.8	75.9	60	88	1165
Evening Saturday	68	75	82	78.3	65	91	1422
Morning workdays	69	76	83	79.3	64	89	2500
Evening workdays	68	75	87	81	63	94	2710

As shown in table 4.11, the highest Leq was 81 dB (A) in the evening of the workdays with min. and max. noise levels of 63 dB (A) and 94 dB (A) respectively and the vehicles number was 2710 during the measured hour. The lowest Leq was 65.7 dB (A) in the morning of weekend (Friday) with min. and max. noise levels of 52 dB (A) and 83 dB (A) respectively and the vehicles number was 550 vehicles during the measured hour. These results indicate that, both the lowest and the highest Leq (hr) exceeded the permissible noise level.

4.2.12 Summary II (Commercial zones)

Five locations were chosen to reflect the noise levels in commercial zones, these locations were Palestine square(Al-saha), Al-shigaaia, Asqola, Frass district and Al-sarraia crossroad. Since these locations are the major commercial zones in Gaza city, the permissible noise level is 55 dB(A) according to the WHO standard.

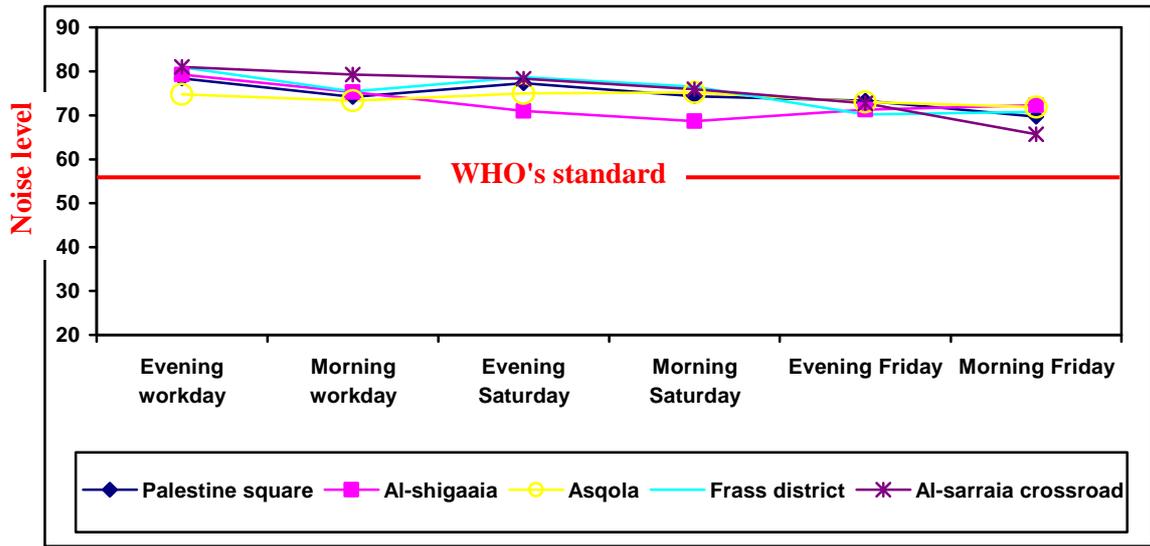


Figure (4.2): Noise levels in the commercial zones

The average $Leq(hr)$ in these locations was observed to be 77.2 dB(A) in workdays, 75.1 dB(A) in Saturday and 71.9 dB(A) in Friday. The results indicate that, all noise levels exceeded the permissible limit 55 dB(A) according to the WHO standard.

As shown in figure 4.2, there was only a small difference in noise levels observed between workdays and Saturday. However, a moderate decrease in noise level was recorded during Friday, mainly in the morning in all locations except Al-shigaaia location, where the noise level in Friday was more than Saturday, because this location is used as a parking for a large market(Friday market).

4.2.13 AL-jalaa and Saftawi junction location

This location is the junction area between the North governorate and the Gaza governorate. It includes two taxi parkings; the first is to the internal Gaza city, and the second is to the North governorate. In addition to this, there are many shops within the residential area, therefore the municipality of Gaza categorizes it as residential-commercial area. Also it is categorized in the study as a residential-commercial area but this categorization is not included in the WHO standard, therefore the permissible noise limit is 55 dB(A) as a commercial areas.

Table (4. 12): Noise levels at AL-jalaa and Saftawi junction location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	46	54.5	64.9	60.4	42	76	420
Evening Friday	60	65	73.9	68.2	55	83	1070
Morning Saturday	65	73	79	76.3	60	86	1189
Evening Saturday	63	69	80	73.8	58	89	1018
Morning workdays	67.1	73	79	75.3	61	87	1320
Evening workdays	70	75	81	77	65	89	1836

As shown in table 4.12, the highest Leq (hr) was 77 dB(A) in the evening of workdays with min. and max. noise levels of 65 dB(A) and 89 dB(A) respectively and the vehicles volume was 1836 during the measured hour. The lowest Leq was 60.4 dB (A) in the morning of Friday with min. and max. noise level of 42 dB (A) and 76 dB(A) respectively and the vehicles number was 420 during the measured hr. These results indicate that both the lowest and the highest Leq (hr) exceeded the permissible limit.

4.2.14 Al-sedra location

. This location is considered as residential commercial area according to the municipality of Gaza and this study, therefore the permissible limit of this location is 55 dB(A).

Table (4. 13): Noise levels at Al-sedra location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	55	61	68	63.8	48	76	300
Evening Friday	65	71	78.9	74.2	61	89	687
Morning Saturday	62	69	76	72.3	58	84	600
Evening Saturday	67	72	79	74.4	62	88	1160
Morning workdays	65	70	80	73.7	60	86	740
Evening workdays	69	74.5	83	77.8	66	90	860

As shown in table 4.13, the highest Leq was 77.8 dB (A) in the evening of workdays with min. and max. noise levels of 66 dB(A) and 90 dB(A) respectively and the vehicles number was 860 during the measured hour. The lowest Leq was 63.8 dB (A) in the morning of the weekend (Friday) with min. and max. noise levels of 48 dB(A) and 76 dB(A) respectively and the vehicles number was 300 vehicles during the measured hour. These results indicate that both the lowest and the highest Leq (hr) exceeded the permissible noise level.

4.2.15 Palestine crossroad location

This location is considered as residential-commercial area according to the municipality of Gaza and this study, therefore the permissible limit of this location is 55 dB(A). There are many shops in all sides of the crossroad, in addition to this, the location is one of the major crossroads in the city of Gaza.

Table (4. 14): Noise level in Palestine crossroad location

Time	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	48.1	60	70	67.9	40	79	257
Evening Friday	53	60	67	63.3	50	75	578
Morning Saturday	59.1	68	75	72.2	54	82	525
Evening Saturday	61	70	80	76	51	96	1276
Morning workdays	65	70	77	72.4	61	88	1220
Evening workdays	70	79	84	82.3	67	91	2184

As shown in table 4.14, the highest Leq was 82.3 dB (A) in the evening workdays with min. and max. noise levels of 67 dB(A) and 91 dB(A) respectively and the vehicles number was 2184 during the measured hour. The lowest Leq was 63.3 dB (A) in the evening of the weekend (Friday) with min. and max. noise level of 40 dB (A) and 79 dB (A) respectively and the vehicles number was 257 during the measured hour.

These results indicate that both the lowest and the highest Leq (hr.) exceeded the permissible limit (55 dB (A)).

4.2.16 Al- Moghrabi crossroad location

This location is considered as a residential commercial area according to the municipality of Gaza and the study, therefore the permissible limit of this location is 55 dB(A).

Table (4.15): Noise levels in Al- Moghrabi crossroad location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	57.1	64	73	68.2	51	79	465
Evening Friday	56	61	68	63.4	51	80	439
Morning Saturday	66.1	70	75	71.3	61	85	1240
Evening Saturday	66	71	80	74.3	50	90	1620
Morning workdays	70	74	82	76.4	65	90	1500
Evening workdays	62.1	74	81	79.9	54	92	1378

As shown in table 4.15, the highest Leq was 79.9 dB (A) in the evening of workdays with min. and max. noise levels of 54 dB (A) and 92 dB(A) respectively and vehicles number was 1378 vehicles during the measured hour in addition to many animal carts which hamper traffic movement. The lowest Leq was 63.4 dB (A) in the evening of the weekend (Friday) with min. and max. noise levels of 51 dB(A) and 80 dB(A) respectively and the vehicles number was 439 during the measured hour. These results indicate that the lowest and the highest Leq (hr) exceeded the permissible noise limit.

4.2.17 Salah Al-din mosque district location

This location is considered as a residential commercial area according to the municipality of Gaza and the study, therefore the permissible limit of this location is 55 dB(A).

Table (4.16): Noise levels at Salah Al-din mosque district location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	58.1	66	73	69.7	54	80	485
Evening Friday	66	71	77	73	63	84	934
Morning Saturday	65	73	78	81	60	83	1273
Evening Saturday	69	74.5	83	77.8	66	93	1565
Morning workdays	65	70	81	74.3	58	89	1374
Evening workdays	67	73	85	78.4	64	96	1698

As shown in table 4.16, the highest Leq was 81 dB (A) in the morning of the mixed day (Saturday) with min. and max. noise levels of 60 dB (A) and 83 dB (A) respectively and the vehicles number was 1273 during the measured hour. This location different is when compared with other locations, where the highest Leq (hr) was in the workdays but in this location was in Saturday. The lowest Leq was 69.7 dB (A) in the morning of the weekend (Friday) with min. and max. noise levels of 54 dB (A) and 80 dB (A) respectively and the vehicles number was 485 during the measured hour. The results indicate that both the highest and the lowest Leq(hr) exceeded the permissible noise level.

4.2.18. Bahlol station (Nasser street) location

There are many commercial shops at all sides of this location, a bank, and a petroleum station, and in addition to this, the location is considered a crossroad. Also this location is a residential area, therefore it is categorized as a commercial-residential area and the permissible noise limit is 55 dB (A).

Table (4.17): Noise levels at Bahlol station (Nasser street) location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	53	61	69	65.3	44	87	357
Evening Friday	52	62	68	66.3	50	77	296
Morning Saturday	58	62	70.9	64.8	55	83	516
Evening Saturday	60	66	71	68.1	57	84	584
Morning workdays	63	70	77	73.3	60	93	780
Evening workdays	65.1	70	82	74.8	61	88	1270

As illustrated in table 4.17, the highest Leq (hr) was 74.8 dB (A) with min. and max. noise levels of 61 dB (A) and 88 dB (A) respectively and vehicles number was 1270 during the measured hour. The lowest Leq (hr) was 64.8 dB (A) in the morning of weekend (Friday) with min. and max. noise levels of 55 dB (A) and 83 dB (A) respectively and the vehicles number was 516 during the measured hour. These results indicate that, both the lowest and highest Leq (hr) exceeded the permissible noise level.

4.2.19. Jabalia park (Al-wehda street) location

This location is one of the major service parks in Gaza city. There are many commercial shops in addition to being in a residential area. According to the municipality of Gaza it is considered as a commercial area, but it is considered as a residential commercial area according to this study, therefore the permissible limit is 55 dB (A)

Table (4.18): Noise levels at Jabalia park location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	55	64	70.9	68.2	49	75	450
Evening Friday	57	64	70	66.8	53	77	360
Morning Saturday	66.1	73	81	76.7	65	89	795
Evening Saturday	68.1	77	84	81.2	65	90	980
Morning workdays	68	75	83	78.7	64	90	730
Evening workdays	73	78	86	80.8	67	92	1140

As shown in table 4.18, the highest Leq (hr) was 81.2 dB (A) in the evening of mixed day (Saturday) with min. and max. noise levels of 65 dB (A) and 90 dB (A) respectively, and the vehicles number was 980 during the measured hour. The lowest Leq (hr) was 66.8 dB (A) in the evening of weekend (Friday) with min. and max. noise levels of 53 dB (A) and 77 dB (A) respectively and the vehicles number was 360 during the measured hour. The results indicate that, both the lowest and the highest exceeded the permissible noise limit according the WHO.

4.2.20 Summary III (Residential-Commercial zones)

The residential-commercial zone is not included in the WHO standard of noise levels, but it is included in other national standards of noise level mainly in developing countries. Therefore the permissible noise level is taken as 55 dB(A). Seven locations were considered as residential-commercial zones; Al-Jalaa and Saftawi junction, Al-sedra, Palestine crossroad, Al-Moghrabi, Salah Al-dine mosque district, Bahlol station and Jabalia service park.

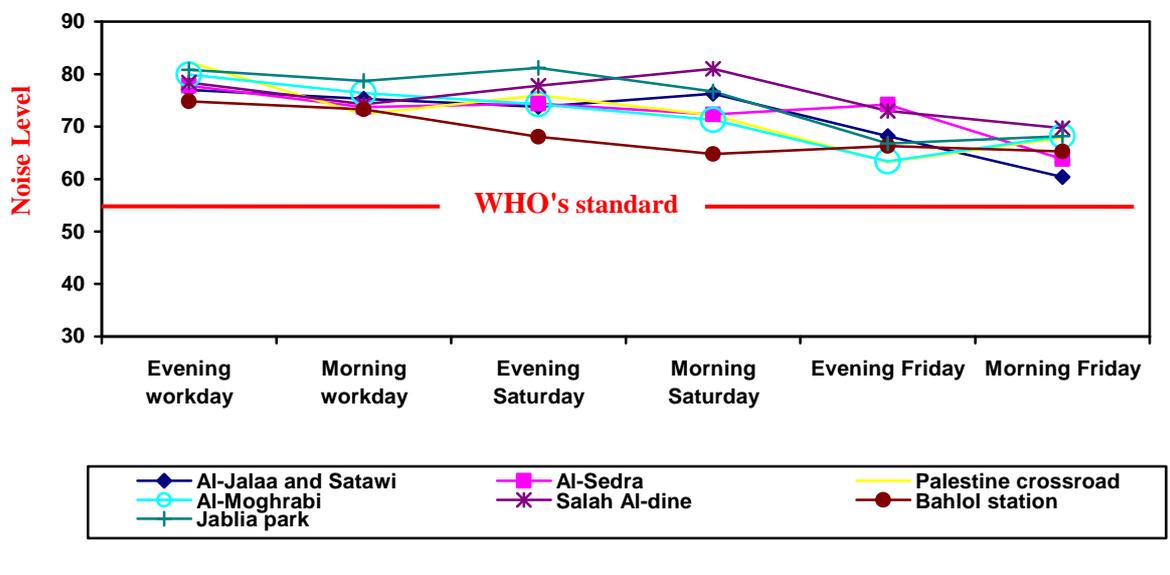


Figure (4.3): Noise levels in the residential-commercial zones

The average $Leq(hr)$ in these locations was observed to be 76.8 dB(A) in workdays, 74.3 dB(A) in Saturday and 67.1 dB(A) in Friday. The results indicate that, almost all noise levels exceeded the permissible limit of 55 dB(A) according to the WHO standard. As shown in figure 4.3, there was only a small differences in noise levels observed between workdays and Saturday. The noise level in workdays was more than Saturday in all locations except Jabalia park and Salah El-dine mosque district. However, a moderate decrease in noise levels was recorded during Friday, mainly in the morning.

4.2.21 Abu-Mazen square location

In spite of this location being in a residential zone, it is one of the vital squares in the city of Gaza therefore, the permissible noise level is 55 dB (A) according to the WHO standard for community noise level.

Table (4.19): Noise levels at Abu-Mazen square location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	48	59	66	64.4	43	71	290
Evening Friday	53	60	67	63.3	50	75	385
Morning Saturday	59	64	73	67.3	49	86	525
Evening Saturday	58	64	71	66.8	54	79	665
Morning workdays	57	63	73	67.3	51	80	870
Evening workdays	56	61	68	63.4	53	80	965

As shown in table 4.19, the highest Leq (hr) was 67.3 dB (A) in the morning of workdays and in mixed day (Saturday) with min. and max. noise levels for workdays of 51 dB (A) and 80 dB (A) with 525 vehicles and for mixed day 49 dB (A) and 86 dB (A) respectively, with 865 vehicles during the measured hour. The lowest Leq (hr) was 63.3 dB (A) in the evening of the weekend (Friday) with min. and max. noise levels of 50 dB (A) and 75 dB (A) respectively and vehicles number was 385 during the measured hour. These results indicate that, the noise levels in this location were accepted compared with the other locations, but both the lowest and highest Leq (hr) exceeded the permissible noise level. In spite of the parameters for this location being very good compared with others, the drivers use the horns without any cause.

4.2.22 Count Bernadotte Street

This location is considered as residential zone and it is one of the major silent zones in the city of Gaza, therefore the permissible limit is 55 dB (A) according to the WHO standard.

Table (4.20): Noise levels at Count Bernadotte Street location

Noise level	Statistical Distribution			Equivalent Leq dB(A)	Minimum Level dB(A)	Maximum Level dB(A)	Vehicles/hr
	L90 dB(A)	L50 dB(A)	L10 dB(A)				
Morning Friday	39	40	46	40.8	37	60	2
Evening Friday	40	46	61	53.3	39	70	11
Morning Saturday	41	47	58	51.8	39	67	36
Evening Saturday	44	49	66	57.1	40	83	63
Morning workdays	44	49	63	55.1	40	65	48
Evening workdays	44	48	60	52.3	40	73	73

As shown in table 4.20, the highest Leq (hr) was 57.1 dB (A) with min. and max. noise levels of 40 dB (A) and 83 dB (A) respectively and vehicles number was 63 during the measured hour. The lowest Leq (hr) was 40.8 dB (A) in the morning of the weekend (Friday) with min. and max. noise levels of 37 dB (A) and 60 dB (A) respectively and vehicles volume was 2 vehicles only. These results indicate that the noise level was normal according to the WHO standard. The main sources of noise in this location were the vehicles of learning driving and the working of cleaners. In spite of being a residential zone, it is better than the silent zones related to noise level.

4.2.23 Summary IV (Residential zones)

Two locations were categorized as residential zone in this study, these locations were Abu-Mazen square and Count Bernadottetwo street, these locations were considered as residential zones according to the municipality of Gaza, therefore, the permissible noise level is 55 dB(A) according to the WHO's standard.

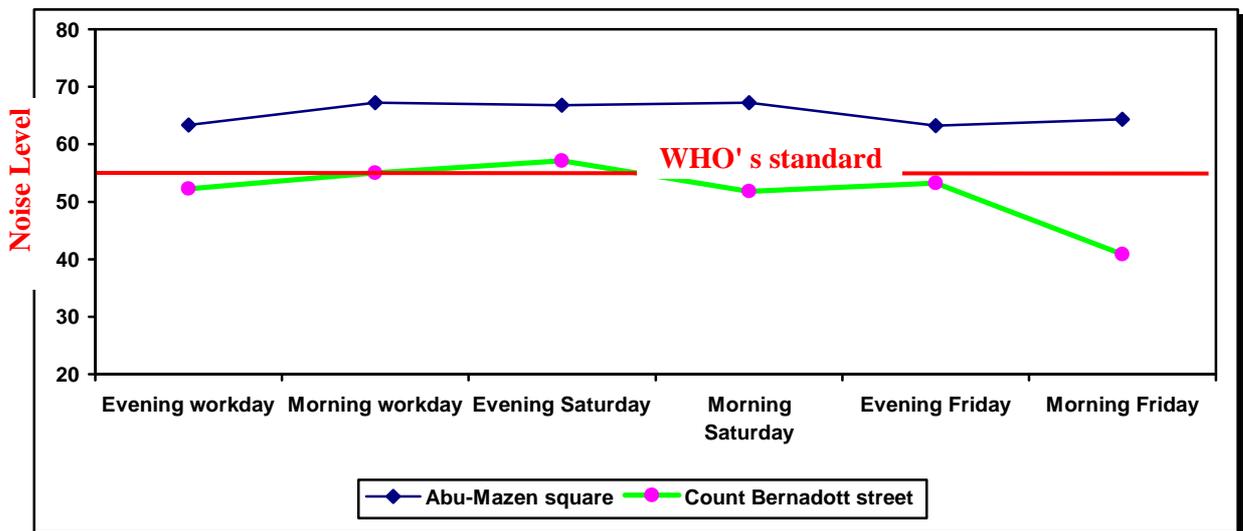


Figure (4.4): Noise levels in the residential zones

The average $Leq(hr)$ in these locations was observed to be 59.5 dB(A) in workdays, 60.7 dB(A) in Saturday and 55.5 dB(A) in Friday. As shown in figure 4.4, in spite of the noise level in Abu-Mazen location exceeding the permissible limit, it is accepted compared with other locations. In Count Bernadotte street, the noise level was below the WHO standard and also it is considered silence zone according to its level.

4.2.24 The answers of the research questions

4.2.24.1 Traffic noise level according to weekdays and time

Here the mean and standard deviation of noise levels for different times and weekdays were calculated to clarify the differences between the measured times (morning and evening) and weekdays (holiday, mixed day and workdays) at the 19 locations. One-way ANOVA test was used to examine if the mean differences among the locations reached a statistically significant levels.

Table (4.21): Differences in the noise levels according to time and weekdays

Items	N	Mean	Std		Sum of Squares	df	Mean Square	F	Sig.
Morning Friday	19	64.7	7.5	Between Groups	1958.006	5	391.601	9.429	0.000
Evening Friday	19	67.3	5.2	Within Groups	4485.252	108	41.530		
Morning Saturday	19	72.3	6.7	Total	6443.258	113			
Evening Saturday	19	73.9	6.1						
Morning workday	19	74.3	5.5						
Evening Workday	19	76.4	7.2						
Total	114	71.5	7.6						

As illustrated in table 4.21, the highest mean was 76.4 for evening workdays and the lowest mean was 64.7 for morning holiday (Friday). The differences were very highly statistically significant with a p- value of 0.000.

According to the Scheffe test, the differences of noise levels (Leq) in morning Fridays were statistically significant with morning Saturdays, evening Saturdays, morning workdays, and evening workdays, while there were differences between morning and evening Fridays. But the differences were not statistically significant, p-value of 0.907 . The differences between evening Fridays and evening workdays were statistically significant, where p-value equals 0.003. Also there were statistically significant differences between morning Saturdays and morning Fridays, p-value equals 0.028.

By using Pearson correlation test, there is a relationship between vehicles number and noise level, $r = 0.732$. $P = 0.000$

The result of the study agreed with many international studies. One of these studies was done in Bangkok street and it showed that there is a relationship between traffic noise levels and the traffic volume. And also they found that there are a statistically significant differences between noise levels according to day times and night times (Muttamara and Tet Leong,2003).

4.2.24.2 Traffic noise level according to the location

Table (4.22): Differences in the noise levels by location

Items	N	Mean	Std		Sum of Squares	df	Mean Square	F	Sig.
Abu-Mazen square	6	65.4	1.9	Between Groups	3252.528	18	180.696	5.380	0.000
Al-quds hospital	6	73.6	6.7	Within Groups	3190.730	95	33.587		
El- shifa hospital	6	70.6	5.2	Total	6443.258	113			
AL-jalaa and Saftawi junction	6	71.8	6.4						
Al -sarraia crossroad	6	75.4	5.5						
Frass district	6	75.4	4.2						
Palestine square	6	74.5	3.0						
Asqola	6	73.8	1.3						
Jabalia park	6	75.4	6.3						
Al-sedra	6	72.7	4.7						
Al-shigaaia	6	72.9	3.7						
Salah Al-din mosque district	6	75.7	4.1						
Al- azhar university	6	74.0	8.2						
Dar al arqam bookshop	6	73.0	12.2						
Palestine crossroads	6	72.3	6.5						
Al- Moghrabi crossroads	6	72.2	5.9						
Al -nassr hospital	6	68.5	4.4						
Bahlol station	6	68.7	4.2						
Count Bernadott st	6	51.7	5.7						
Total	114	71.486	7.5512						

As illustrated in table 4.22, there are differences among noise levels due to the location.

These differences were statistically significant with a p-value of 0.000

Chapter (5)

Results and discussion of The questionnaire

5.1 General

In this chapter the main study results and the discussions of the questionnaire findings will be presented. The questionnaire was administered on shop-workers for investigating public awareness and the effects of noise pollution on human health.

In this study, the awareness level of noise pollution and effects of noise pollution on the shop workers were considered as dependent variables, while Socio-demographic characteristics of shop workers (age and education years), working variables such as shop type, place of shop, work years, and working hours per day were considered as independent variables.

5.2 Number of the distributed questionnaires

The total number of subjects (shop workers) that were visited by the researcher was 164 and distributed into 12 out of 19 measurements locations. The positive response rate was 91.5 % (150 subjects). Table 5.1, shows the number and percents of subjects for each location.

Table (5.1): Distribution of study questionnaires according to the location

Items	No.	%
Location		
AlShifa Hospital	9	6.0
Saftawi	9	6.0
Frass	20	13.3
Palestine square	12	8.0
Asqola	14	9.3
Jabalia park	17	11.3
Al-sedra	12	8.0
Dar al arqam bookshop	10	6.7
Palestine crossroads	14	9.3
Al- Moghrabi crossroads	11	7.3
Al -nassr hospital	10	6.7
Bahlol station	12	8.0
Total	150	100.0

As shown in table(5.1), the questionnaire was distribute into 12 out of 19 locations. The 12 selected locations were chosen by using simple random sample after exclusion of the Count Bernadotte street location, because the noise level was very quiet in this location.

The number of the distributed questionnaires for each location was selected by using the convenience sample.

5.2.1 Socio-demographic characteristics of shop workers

In this section of data, the researcher presents the main characteristics of shop workers that may play a role in awareness level and effects of noise pollution. These data are the age, education years, type of house(asbestos or concrete), the places of houses of shop workers. Table 5.2, shows the distribution of the shop workers according to socio-demographic characteristics

Table (5.2): Distribution of socio-demographic characteristics of shop workers

Items	No.	%
Age		
30 Yrs and less	53	35.3
From 31 to 40 Yrs	39	26.0
More than 40 Yrs	58	38.7
Total	150	100.0
Mean = 37.4 , MD=37.0 Std=11.3		
Education		
Preparatory and less	36	24.0
Secondary	58	38.7
Diploma	19	12.7
Bachelor and above	37	24.7
Total	150	100.0
Mean = 12.0 , MD=12.0 Std=3.7		
Residency place of shop worker		
Camp	13	8.7
City	137	91.3
Total	150	100.0
Type of housing		
Concrete	129	86.0
Asbestos	21	14.0
Total	150	100.0

As illustrated in table 5.2, the mean age of shop workers was 37.4 years with standard deviation equal 11.3. The minimum age was 20 years and the maximum age was 65 years. The age of subjects was categorized into three groups.

Most of the subjects belonged to the more than 40 years age group who represented about 38.7 % of the total number of the subjects followed by 30 years and less group (35.3%), while 26% of them belonged to the 31-40 years age group.

The minimum and maximum education years were 2 and 22, and the education years were divided into four groups. As shown in table 5.2, the mean of education years was 12 with a standard deviation of 3.7 years. About 38.7 % of the respondents belonged to secondary education (12 years), followed by the bachelor and above group (more than 16 years)(24.7%). About 12.7 % of the subjects have a diploma (14 years), while 24% of them belonged to the group of preparatory and less.

The type and design of the house play a major role in the reduction of noise pollution; therefore, the researcher asked the shop workers about the type of their houses (concrete or asbestos).

As shown in table 5.2, 13 of them live in camps while the remaining (137) of the shop workers live in the city of Gaza. About 86 % of their housing type was concrete and about 14 % of them was asbestos.

5.2.2 Working variables of the shop workers

Many factors may affect the impact of noise pollution on the shop workers. Some of these factors were the shop type, place of shop, working years, working hours, and traffic management.

Table(5.3): Distribution of shop workers by working variables

Items	No.	%
Shop type		
Containing machinery or tools	4	2.7
Not containing machinery or tools	146	97.3
Total	150	100.0
Place of shop		
Market	15	10.0
Common street	108	72.0
Beside an educational institution	10	6.7
Beside a health institution	17	11.3
Total	150	100.0
Work Years		
5 Yrs and less	67	44.7
From 6 to 15 Yrs	58	38.7
More than 16 Yrs	25	16.6
Total	150	100.0
Mean = 8.7 , MD=6.5 Std=4.1		
Work hours		
8 Hours and less	38	25.3
More than 8 Hours	112	74.7
Total	150	100.0
Mean = 10.1 , MD=10.0 Std=2.1		
Measures to regulate traffic		
Yes	119	79.3
No	31	20.7
Total	150	100.0

MD: Median

The mean of working hours per day of the shop workers was 10.1 hours with standard deviation 2.1. The minimum and maximum working hours were 5 and 15 hours respectively. According to the ministry of labor in Palestine , that the legal limit of the working day is eight hours (Labor Law No. 4, 2000). Therefore, the working hours per day were divided into two groups (≤ 8 hrs. and > 8 hrs). As illustrated in table 5.3, about 74.7 % of the shop workers were working or exposed to noise pollution for more than 8 hours, which exceeds the legal limited time of working day, and 25.3% of the shop workers were working ≤ 8 hours.

As illustrated in table 5.3, the mean of working years was 8.7 years with standard deviation 7.1. About 16.6 % of the shop workers belonged to more than 16 years of working and 38.7 % of them belonged to the 6-15 working years, while 44.7% of the shop workers have worked for ≤ 5 years. All of them (100%) reported that the period of work was in the same place.

In spite of the that 79.3 % of the shop-workers have reported that there are measures (policemen) to regulate the traffic movement as shown in table 5.3, the noise levels of all locations exceeded the permissible limit as compared with the WHO standard of community noise levels. Only 20.1 % of the shop workers reported that, there are no measures to regulate the traffic.

One hundred and fifty questionnaires were filled from 12 locations; these locations were divided into four types (Market, Common Street, beside an educational or health institution).

As shown in table 5.3, the majority of the questionnaires (72%) were filled in common street. About 18 % of the distributed questionnaires were filled in sensitive or silent areas (beside educational and health institutions), while only 10 % of them were filled in market areas.

Figure 5.1 shows that, about 97.3 % of the shop workers work in shops, that does not contain any machines or tools causing a noisy sound, while the remaining (2.7%) of the shop workers work in shops containing machines or tools that generate noisy sound. This means that, the main cause of noise pollution in these locations is the traffic movement.

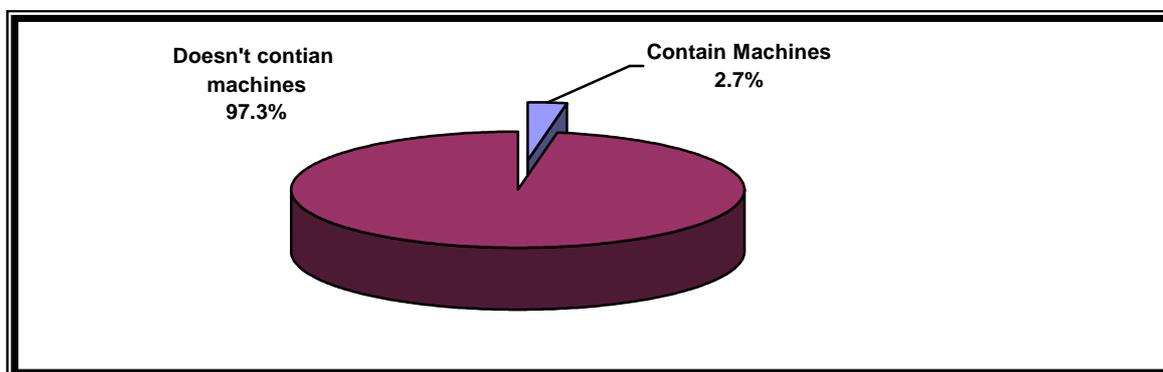


Figure (5.1): Distribution of shop types

5.2.3 The levels, sources, and the time of noise pollution in both the shop places and residence places:

Table 5.4, shows that, all of the shop workers agreed that, there is noise pollution in their shop places with different degrees (high or very high). About 83.3% of them reported that, the noise levels in their shop places are very high, and 16.7 % answered that the noise level in their shop places is high. In response to the question about the cause of noise pollution in their shop places, 98.7 % of them reported that the main cause of noise pollution is the vehicles movements and only 1.3 % of them said that, the main cause is the pedestrians movement.

Also table 5.4, illustrates that 78 % of the shop workers reported that, the highest noise level in the place of their shops is at the noon time (rush hours), and 20 % of them said that, the highest noise level is at the morning time, while the remaining (2%) said that, the highest noise level is at the afternoon time. This means that 78 % of the shop workers agreed with the results of the measurements of noise levels that, the highest of noise levels were in noon time(2 pm to 3 pm) in most of the study locations.

Also, as shown in table 5.4, only 57.4 % of shop workers live in noisy environment (high or very high) and 42.6 % of the shop workers live in quiet or very quiet environment according to their reporting.

About 79 % of 86 shop workers (who live in noisy environment) reported that, the main cause of noise pollution in their houses places is the movement of vehicles, followed by 14 % who said that, the main cause is pedestrians. Industrial machines have only 7 % of the main cause of the noise pollution level in their house places.

Also table 5.4, illustrates that, The time of the highest noise pollution level in their houses places was reported at morning time by 47.1% of the shop workers , 37.6 % said that , noon time is the highest noise level. About 11.8 % of them said that, evening time is the highest noise level and only 3.5 % of them said that, the time of the highest noise level is at afternoon time. This indicates that, some of the shop workers are exposed to noise pollution in both their shops and houses.

Table 5.4, shows that, 71.3 % of the shop workers (150) reported that, the level of noise pollution in the shops places are more than the house places, while 4 % of them reported that, the noise pollution level in the houses places is more than the shops places. About 24.7 % of them reported that, the noise pollution levels in both the shop places and houses places are equal.

Table (5.4): The levels, sources, and the time of noise pollution in both the shop places and place of residence

Item	No.	%
Noise level in shop place		
Very high	125	83.3
High	25	16.7
Total	150	100.0
Source of noise pollution in shop place		
Cars movement	148	98.7
Pedestrian	2	1.3
Total	150	100.0
Time of the highest level of noise pollution in shop place		
Morning	30	20.0
Noon	117	78.0
Afternoon	3	2.0
Total	150	100.0
Noise level in your place of residence		
Very noise	46	30.7
Noise	40	26.7
Quiet	38	25.3
Very quiet	26	17.3
Total	150	100.0
Source of noise pollution in housing place		
Cars movement	68	79.1
Pedestrians	12	14.0
Industrial machinery	6	7.0
Total	86	100.0
Time of the highest level of noise pollution housing place		
Morning	40	47.1
Noon	32	37.6
Afternoon	3	3.5
Evening	10	11.8
Total	85	100.0
Difference btw. housing and shop place in term of noise pollution		
Work more than the house	107	71.3
Work less than the house	6	4.0
No difference	37	24.7
Total	150	100.0

5.2.4 The awareness level of noise pollution:

To determine the awareness level of noise pollution among the shop workers in Gaza city, they were asked ten questions. Table 5.5 shows the answers of workers.

Table (5.5): distribution of the shop workers according to their perception of noise pollution

Item	Yes		NO		DK	
	No.	%	No.	%	No.	%
Heard about noise pollution	69	46.0	81	54.0	0	0.0
Loud voice is problem	147	98.0	3	2.0	0	0.0
Read or hear any scientific bulletin about noise pollution	46	30.7	104	69.3	0	0.0
Noise pollution affects on human health	146	97.3	1	0.7	3	2.0
Organizations work to raise public awareness of noise pollution	4	2.7	117	78.0	29	19.3
Noise pollution due to failure to follow traffic instructions and laws	134	89.3	1	0.7	15	10.0
Noise pollution due to lacking of separation btw. areas	126	84.0	4	2.7	20	13.3
Noise pollution due to non-income noise pollution in to account	111	74.0	6	4.0	33	22.0
Noise pollution due to lacking of knowledge of noise pollution	127	84.7	0	0.0	23	15.3
Need for laws and regulations to reduce noise pollution	150	100.0	0	0.0	0	0.0

* DK: DO NOT KNOW

* No.: NUMBER

As illustrated in table 5.5, 46 % of the shop workers reported that, they had an idea about noise pollution, while 54 % reported that, this is the first time to know what is the meaning of noise pollution. Most of those who do not have any idea about noise pollution have misconception about it. In spite of more than half of the shop workers had not any idea about noise pollution, 98 % of them(150) reported that, the loud voice is a major problem as shown in table 5.5, and only 2 % reported that loud voice is not a problem. This agrees somewhat with the difference between sound and noise where the sound is what we hear and noise is the unwanted sound. The difference between sound and noise depends upon the listener and the circumstances. Rock music can be pleasurable sound to one person and an annoying noise to another.

About 69.3 % of the shop workers did not read and hear any scientific bulletin about noise pollution, while 30.7 % of them read or heard. The sources of this knowledge as shown in figure 5.2, about 53.3 % from the study, 28.9 % from TV, 6.7 % from newspapers, and 11.1 % from other sources.

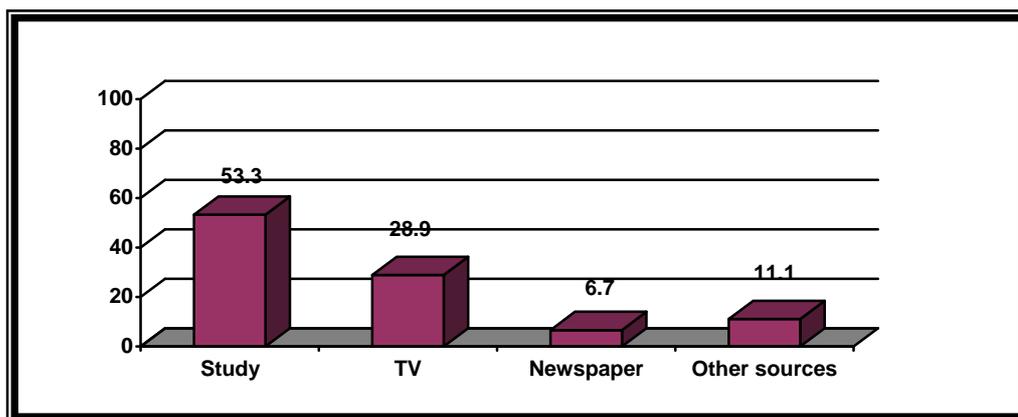


Figure (5.2): Percentage of knowledge sources of noise pollution

As shown in table 5.5, the shop workers were asked, if noise pollution affects human health?

Only 0.7 % of them said NO, followed by 2 % said do not know, while 97.3 % reported that, noise pollution affects human health. This is consistent somewhat with the study carried out in Lahore city which found that, 84 % of the study subjects (100 drivers) are aware of the effects of noise pollution on human health (Javed Aslam et al, 2008).

Four questions about the causes of noise pollution in Gaza city were answered by the shop workers . Table 5.5, indicates that 89 % of the worker reported that, failure to follow traffic instructions and laws is one of the causes of noise pollution , only 0.7 % of them said NO, and 10 % said do not know.

Lack of separation between areas (silent, commercial, residential and industrial) is one of the causes of noise pollution in Gaza city, about 84 % of respondents said Yes, 13 % said that they do not know and only 2.7 % of them said No.

No one of the shop workers denied that, lack of knowledge and awareness of noise pollution is one of the causes of noise pollution in Gaza city. About 84.7 % of them reported yes, and 15.3 % of them said do not know as illustrated in table 5.5.

This means that, there are major causes of noise pollution in Gaza city. The failure to follow the traffic instructions and laws is clear, mainly when taxi drivers violate the speed limit to pick up passengers. Using the horn is the only tool to attract passengers attention by taxi drivers. How, when, and where using of horns is permitted, unfortunately is absent, even the sign of no horn are also absent. There are no sound symbols to indicate no horn use in the specified areas. The no horn sign (Annex 11) is used to avoid noise pollution in public places. Ironically, the horn is considered as a multi-options tool to warn others, to greet a friend or to attract the attention of a passengers, in addition to some taxi drivers using illegal types of horns.

In spite of the assigning of specified areas (parks) to pick up passengers, there is no commitment from the taxi drivers, which usually leads to crowding. Finally the behaviors of drivers are unacceptable according to the researcher's observations. These observations results agree with the results of Sarraj's study that, the behaviors of taxi drivers are no longer acceptable (Sarraj, 2001). This plays a major role in traffic noise pollution.

Also, lack of separation between areas is considered one of the major causes of noise pollution in Gaza city. In the city of Gaza, the schools are located beside the markets, hospitals in commercial area, and small industries in residential area. This means that the city is a mixed area.

The subject of noise pollution is one of the most silent forms of pollutions. In spite of noise pollution as a cause of many health effects, there is a little concern about it in Gaza strip. This agrees with the results of this study that, as shown in table 5.5, where about 78 % of the shop workers reported that, there is not any work organizations to raise the public awareness of noise pollution and its effect, while 19.3 % of them said do not know and only 2.7 % reported that, there are work organizations to raise public awareness of noise pollution.

In spite of the disagreement among the shop workers concerning the presence of work organizations to raise public awareness on noise pollution, all of them(150), agreed that there is a need to have such work organizations and agencies to raise public awareness of noise pollution and its effects.

5.2.5 Results of the study questions related to the awareness level of noise pollution

5.2.5.1 Awareness level of noise pollution

To determine the awareness level of noise pollution among the shop workers in the Gaza city, descriptive statistics including mean, and standard deviation of correct answers scores reflecting the level of shop worker's noise pollution awareness were developed to illustrate the current awareness level of noise pollution among the shop workers. Ten questions were asked to the shop workers to reflect the awareness level of noise pollution. Out of the 10 points(marks) reflecting the awareness level of noise pollution among the shop workers, the mean and standard deviation were 7.1 points and 1.5 respectively.

5.2.5.2 The categories of awareness levels of noise pollution

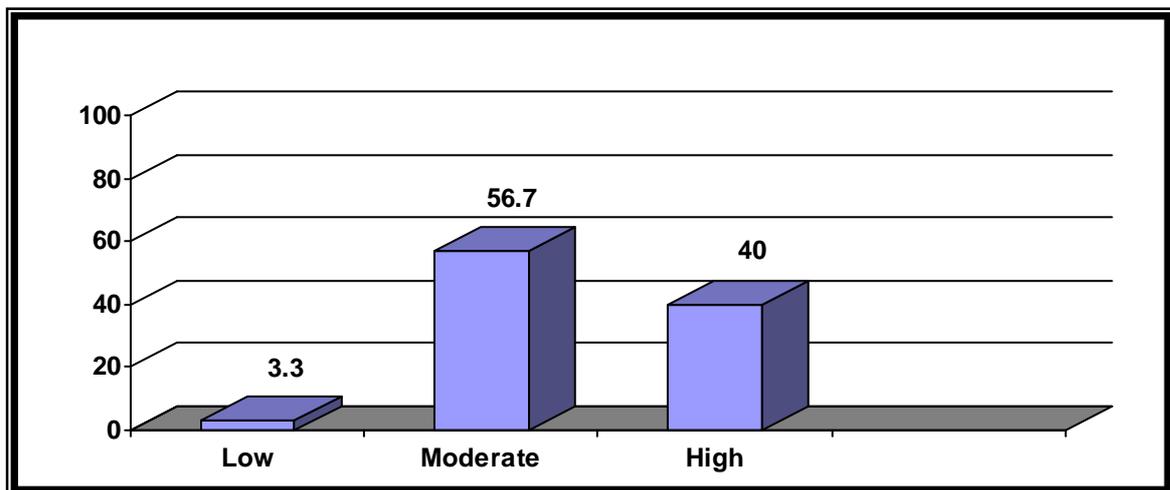
The awareness level of noise pollution was categorized into three levels as low, moderate and high. The shop workers with low level of awareness who are those have less than 5 point out of 10, moderate level is 5 to 7 points and the high level is 8 to 10 points.

Table (5.6): Number and percentage of awareness level of noise pollution among the shop workers

Item	level	Frequency	Percentage
Awareness level of noise pollution	Low	5	3.3
	Moderate	85	56.7
	high	60	40
Total		150	100

As shown in table 5.6 and figure 5.3, 56.7 % of the shop workers have moderate awareness level of noise pollution with 5 to 7 points out of 10, followed by high awareness level with percent of 40 % and 8 to 10 points, while 3.3 % of the shop workers have low awareness level of noise pollution with less than 5 points out of 10.

These results indicate that, more than half of the shop workers have moderate awareness level of noise pollution and 40% have high level, therefore the awareness level of noise pollution among the shop workers was moderate.



figure(5.3): Awareness level among the shop workers in Gaza city

5.2.5.3 The relationship between the awareness of noise pollution and age, education years, and residency of the shop workers

All items in table 5.5 were used in this study to assess the awareness of noise pollution, therefore the researcher used some statistical analyses between the awareness of noise pollution as dependent variable and other independent variables like the age, education years and the residency of the shop workers.

5.2.5.3.1 Awareness of noise level and age

To measure the differences in awareness level of noise pollution among shop workers according to their age, the mean, standard deviation and one-way ANOVA test were used to explore if the awareness level of noise pollution differs due to the age.

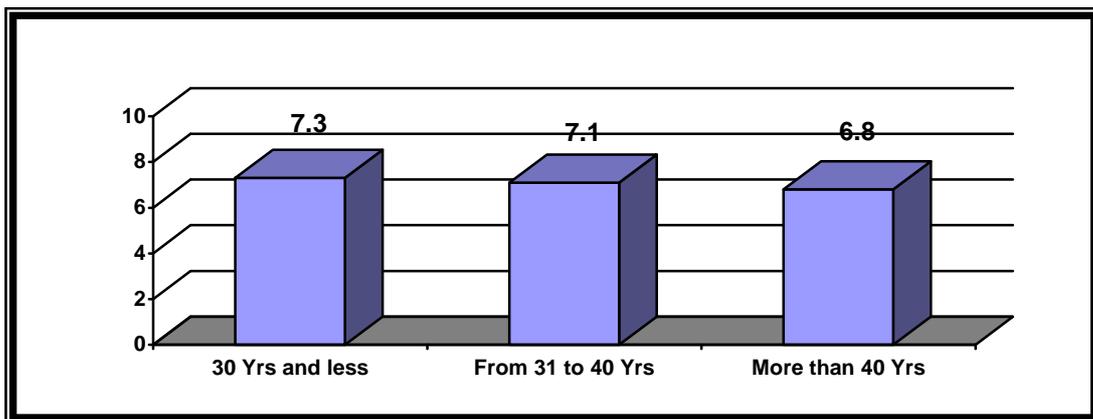


Figure (5.4): Mean of awareness level according to age

Table (5.7): Difference in awareness level of noise pollution according to age.

	Items	N	Mean	Std		Sum of Squares	df	Mean Square	F	Sig.
Age	30 Yrs and less	53	7.3	1.6	Between Groups	8.3	2	4.1	1.867	0.158
	From 31 to 40 Yrs	39	7.1	1.5	Within Groups	326.2	147	2.2		
	More than 40 Yrs	58	6.8	1.3	Total	334.5	149			
	Total	150	7.1	1.5						

Std: Standard Deviation
N : Number

As shown in table 5.7, the age of the shop workers was categorized into three groups. There were differences among age groups and awareness level, but these differences were not statistically significant (p-value equal 0.158).

According to Scheffe test the difference of awareness level was for the first group (30 years and less) where the mean equals 7.3, followed by the second group (31 to 40) where the mean was 7.1. These results indicate that, the first group (30 and less) was more educated than other groups, the cause of this could be due to the new curriculum which contains some environmental concepts.

Figure 5.2, also illustrates that the study was the major source of noise pollution knowledge for the shop workers. These results agree with the results of a study conducted in Nigeria, which found that, the most frequent source of information was school with 69%, followed by media with 54.5 %, friends were 34.5%, books were 32% and parents with 24% (Olaosun and Egbewale, 2007).

5.2.5.3.2 Awareness level of noise pollution according to education years

To measure the differences in awareness level of noise pollution among shop workers according to their education years, the mean, standard deviation and one-way ANOVA test were used to explore if the awareness level of noise pollution differs due to the education years.

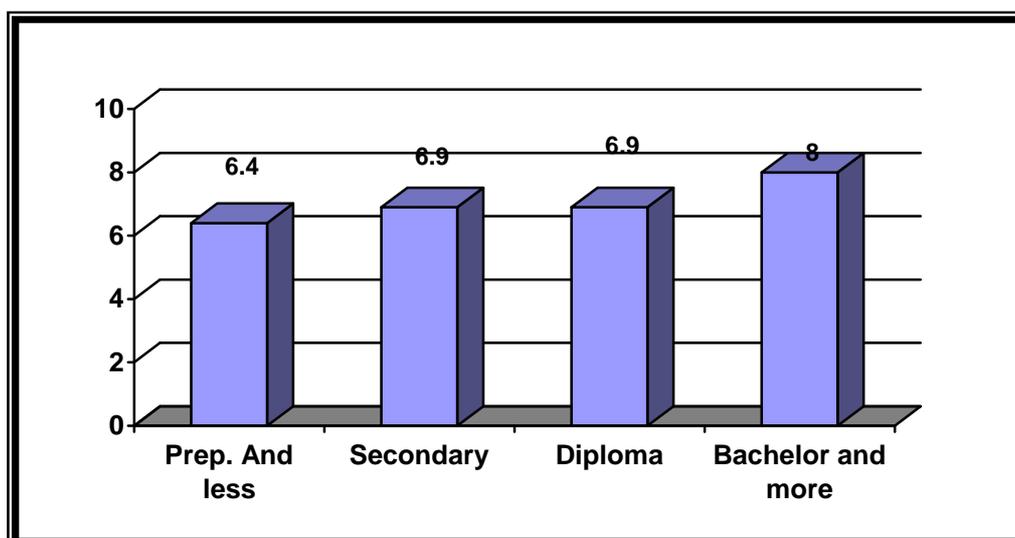


Figure (5.5): Awareness level of noise pollution according to the education years

Table (5.8): Difference in awareness level of noise pollution according to education years

	Items	N	Mean	Std		Sum of Squares	df	Mean Square	F	Sig.
Education	Prep. and less	36	6.4	1.3	Between Groups	47.2	3	15.7	8.001	0.0001
	Secondary	58	6.9	1.5	Within Groups	287.2	146	1.9		
	Diploma	19	6.9	1.4	Total	334.4	149			
	Bachelor and above	37	8.0	1.4						

As shown in table 5.8 and figure 5.5, the education years of the shop workers were categorized into four groups. There were differences among the means of these groups and awareness levels of noise pollution. These differences reached a statistically significant level (P- value equal 0.0001). The mean of awareness level of preparatory years and less group was 6.4, while the mean of secondary and diploma were similar and equal 6.9, and the higher mean was for bachelor and above group with a mean of 8.

According to Scheffe test, there were differences between the first group (prep. and less), and the fourth group (Bachelor and above), these differences were statistically significant at p value equals 0.0001 and also there were differences between the second group (secondary) and the fourth group, these differences were statistically significant at P value equal 0.006 .

5.2.6 The health effects of noise pollution among shop workers in Gaza city

The effects of traffic noise on people can cause auditory or non-auditory effects; the results of these effects may be hearing impairment, hearing loss, headache, annoyance, hypertension, heart problems, sleeping problems or discomfort during work.

Table (5.9): Distribution of shop workers according to the effects of noise pollution

Item	No.	%
Medical problem in the sense of hearing		
Yes	44	29.3
No	106	70.7
Years of complaining of this disease		
5 Yrs and less	36	83.0
More than 5 Yrs	8	17.0
Total	44	100.0
Mean = 3.9 , MD=3.0 Std=2.9		
Doctor visit		
Yes	35	23.3
No	115	76.7
Total	150	100.0
Degree of hearing is affected somewhat		
Yes	54	36.0
No	96	64.0
Total	150	100.0
Asking to raise the voice to hear well		
Always	20	13.3
Sometimes	62	41.3
No	68	45.3
Total	150	100.0
Annoyance due to noise pollution		
Always	126	84.0
Sometimes	21	14.0
No	3	2.0
Total	150	100.0
Chronic diseases		
Hypertension	15	10.0
Diabetes	1	0.7
No any chronic disease	134	89.3
Total	150	100.0

Complaining during shop working		
Headache	60	40.0
Worry	10	6.7
Irritable	19	12.7
Headache and Worry	15	10.0
Worry and Irritable	9	6.0
All complaints	37	24.7
Total	150	100.0
Sleep problems		
Yes	44	29.3
No	106	70.7
Total	150	100.0
Sleeping hours		
Less than 8 hours	84	56.0
8 hours	53	35.3
More than 8 hours	13	8.7
Total	150	100.0
Mean = 7.1 , MD=7.0 Std=1.4		
Noise pollution effects on sleep		
Yes	69	46.0
No	81	54.0
Total	150	100.0
Discomfort due t noise pollution during working		
Yes	134	89.3
No	16	10.7
Total	150	100.0
The last 12 months noise pollution affects you		
Little	4	2.7
Middle	24	16.0
Severe	122	81.3
Total	150	100.0
Feature of the effect		
Difficult sleeping	8	5.4
Lack of concentration	30	20.1
Headache	20	13.4
Nervousness	92	61.1
Total	150	100.0

As shown in table 5.9, about 36 % of the shop workers reported that, the degree of their hearing is affected somewhat, therefore 23.3 % of them (150) visited doctors due to this problem. About 29.3 % (44 shop workers) had medical problems in the sense of hearing. About 83 % of them (44) complaining of this disease since 5 years and less, and only 17 % of them (44) since more than 5 years. Also table 5.9, shows that, about 13.3 % of them (150) reported that, they always ask people to raise their voice to be heard well, while 41.3 % of the shop workers sometimes ask the people to raise their voice to be heard, and about 45.3 % do not ask the people to raise their voice to be heard. This means that, more than half (54.6 %) of the shop workers ask people to raise their voice to be heard well, in spite of only 29.3% them had medical problems in the sense of hearing. Also this indicate that, the places of their shops are noisy.

As illustrated in table 5.9, about 84 % of the shop workers reported that, they always get annoyed due to exposure to noise pollution, while 14 % of them reported that, they sometimes get annoyed, and only 2 % of them do not. The result of the study survey in Delhi indicated that, a very large proportion of respondents feel that noise interferes with inter-personal communication and causes annoyance (Sigh and Davar, 2004).

Another form of annoyance was discomfort during working day as shown in table 5.9, where about 89.3 % of workers reported that, they feel discomforted due to exposure to noise pollution, and only 10.7 % of them said that, they do not feel discomforted due to exposure to noise pollution.

According to a recent research by the WHO, noise pollution has been found to be one of triggers leading to heart disease. In the United Kingdom alone, 101,000 people died of coronary heart disease in 2006, the study suggests that 3,030 of these heart deaths were caused by chronic noise exposure. Nevertheless, as shown in table 5.9, no one were complaining of heart diseases, while 10 % of respondents complain of hypertension and only 0.7 % of them complain of diabetes mellitus. The difference between this study and the WHO's study results may be due to the exposure period and intensity of noise.

Table 5.9, shows the complaints of the shop workers during working, where 40 % of them complained of headache, 6.7 % were worried, 12.7 % were irritable, 10 % were worried and headache , 6 % were worry and irritable while 24.7 % of them were complaining of headache, worried and irritable. These results agree with the results of a study was conducted in Malaysia, where headache was the most health effect of noise pollution and a lot of people attributed that to the excessive noise pollution which increases headache and stress (Yosoff and Ishak, 2005).

The sleeping hours were categorized into three groups, less than 8 hours, 8 hours and more than 8 hours. Table 5.9, shows that 56 % of the shop workers sleep less than 8 hours, 35.3 % sleep 8 hours, while 8.7 % sleep more than 8 hours. About 46 % of them reported that noise pollution affects their sleep and 54 % of them said that noise pollution does not affect their sleep. Also as shown in table 5.10, only 29.3 % reported that they have sleeping problems.

To measure the noise effects on the shop workers, a question was asked about the effects in the past 12 months. The degree of these effects in the past 12 months were severe for 81.3 %, middle for 16 % and little for only 2.7 % of workers. As shown in figure 5.6, the feature of these effects were 5.4 % as difficult sleeping, 20.1 % as lack of concentration, 13.4 % as headache and 61.1 % as nervousness. In spite of nervousness being the major noise effect, this is not the problem but the main problem was the feature of nervousness, where a lot of shop workers had problems with the drivers when unnecessarily use of the horns.

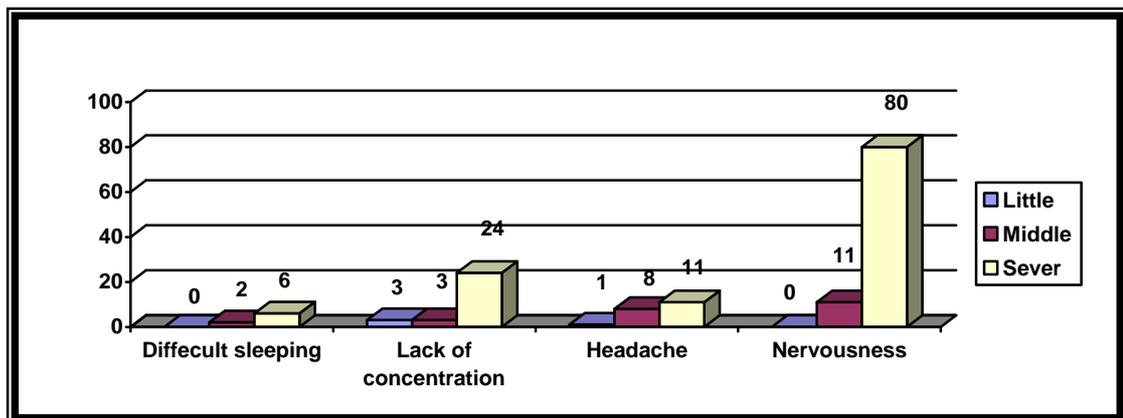


Figure (5.6): Distribution of the degree of noise pollution effects (annoyance) and its features.

5.2.7 Results of the study questions related to the effects of noise pollution

5.2.7.1 The effects of noise pollution

To determine the effects of noise pollution among the shop workers in the Gaza city, descriptive statistics including mean, and standard deviation of correct answers scores were calculated to illustrate the current effects of noise pollution among the shop workers. Fourteen questions about the effects of noise pollution were asked to the shop workers, but only seven questions were identified to reflect the effects of noise pollution. Out of the 7 points (marks) reflecting the effects of noise pollution among the shop workers, the mean and standard deviation were 3.8 points and 1.3 respectively.

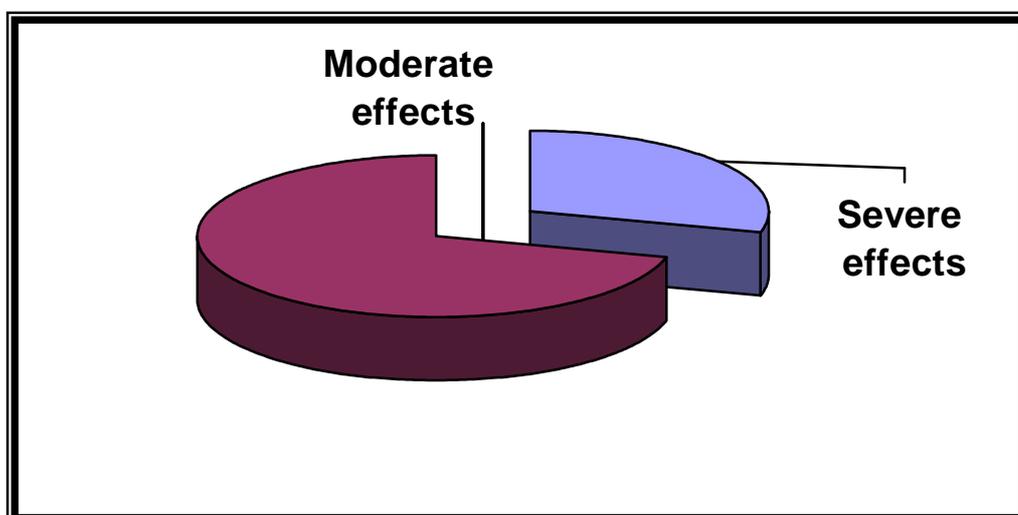
5.2.7.2 The effects degree of noise pollution

The effects of noise pollution among shop workers were divided into two degrees as moderate and severe. The shop workers with moderate effects are those who have 2 to 4 points, while severe effects are those who have 5 to 7 points.

Table (5.10): Number and percentage of the effects of noise pollution among the shop workers

Item	Degree	Frequency	Percent
The effects of noise pollution	Moderate	106	70.7
	Sever	44	29.3
Total		150	100 %

As shown in table 5.10 and figure 5.7, about 70.7% of the shop workers have moderate effects of noise pollution and about 29.3% of the shop workers have severe effects. These results indicate that, about one third of the shop workers have severe effects of noise pollution.



Figure(5.7): Percentages of the moderate and severe effects of noise pollution among the shop workers in Gaza city

5.2.7.3 The relation between the effects of noise pollution and age of shop workers, working hours and working years

In this part, the researcher used independent t-test and one-way ANOVA to present the differences between the effects of noise pollution as dependent variable and age, working hours and working years as independent variables.

5.2.7.3.1 The effects of noise pollution according to the age of shop workers

The differences between the effects of noise pollution and the age of the shop workers were determined by using the mean, and the one-way ANOVA test to show if these differences are significant or not.

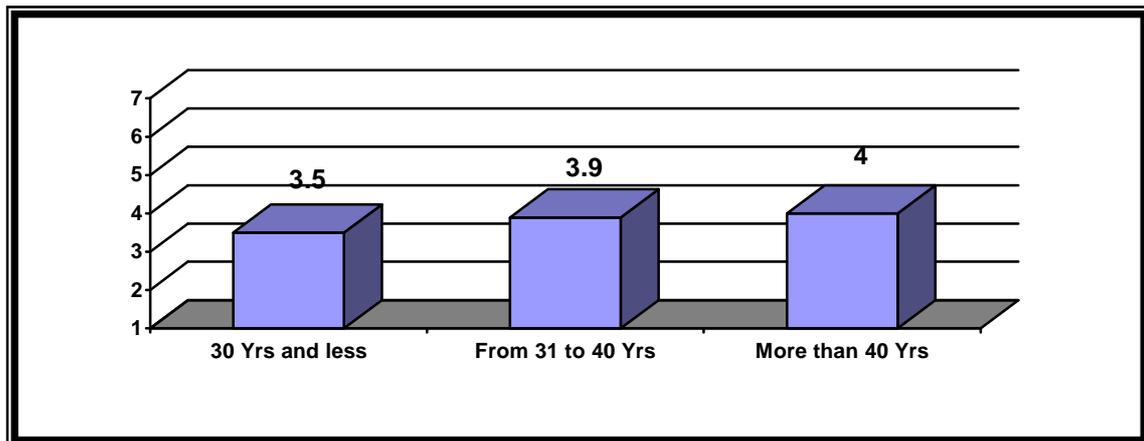


Figure (5.8): The effects of noise pollution according to the age groups

Table (5.11): Differences of the noise pollution effects according the age groups

	Item	N	Mean	Std		Sum of Squares	df	Mean Square	F	Sig.
Age	30 Yrs and less	53	3.5	1.2	Between Groups	7.336	2	3.668	2.179	.1170
	From 31 to 40 Yrs	39	3.9	1.2	Within Groups	247.498	147	1.684		
	More than 40 Yrs	58	4.0	1.4	Total	254.833	149			
	Total	150	3.8	1.3						

According to table 5.11, there are differences between age groups and the effects of noise pollution, but these differences are not statistically significant, (p-value = 0.117).

In Delhi, Sigh and Davar (2004), found that, the effect of noise pollution is not similar among various age groups. This agrees with the results of the study that, the effects of noise pollution is not similar among the age groups of shop workers as illustrated in figure (5.8).

5.2.7.3.2 The effects of noise pollution according to working hours per day

As shown in table 5.12 below, the working hours per day of the shop workers were divided into two groups (≤ 8 hours and >8 hours). To measure the differences of the effects of noise pollution on the shop workers according to their working hours per day, the mean, standard deviation and t-test were used to explore if the effects of noise pollution differs due to working hours per day.

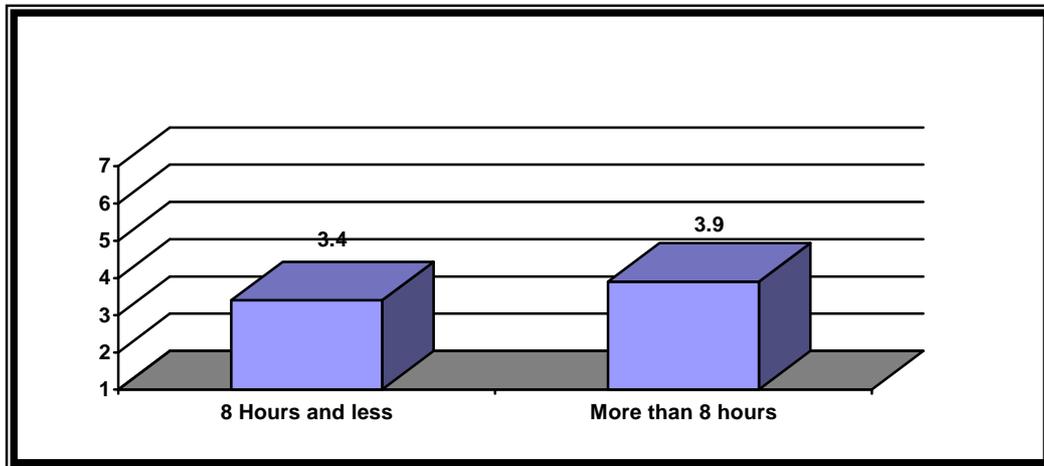


Figure (5.9): The effects of noise pollution according to working hours

Table(5.12): The effects of noise pollution according to working hours per day

	No.	Mean	Std	Df	t	Sig.
8 Hours and less	38	3.4	1.3	148	-1.209	0.050
More than 8 hours	112	3.9	1.3	64.471		

As shown in table 5.13, there are differences between the working hours per day and the effects of noise pollution. These differences are statistically significant, (t equal -1.209 and p-value equal 0.050). The persons who work more than 8 hours have more effects than those who work 8 hours and less.

5.2.7.3.3 The effects of noise pollution according to working years

Figure (5.10), shows the mean of noise pollution effects on shop workers according to the working years

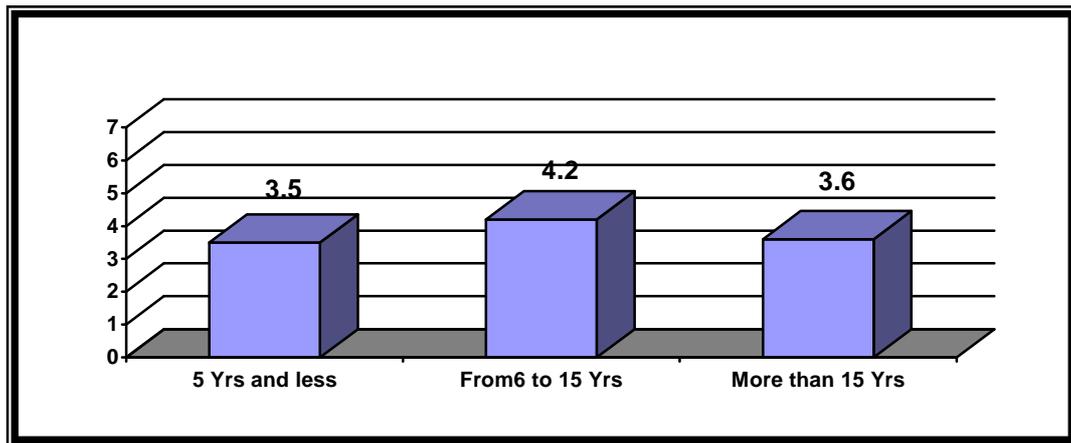


Figure (5.10): The effects of noise pollution according to the working years

As shown in table 5.13 below and figure 5.10, the working years of the shop workers were divided into three groups (≤ 5 years, 6 to 15 years and >16 years). To measure the differences of the effects of noise pollution among the shop workers according to their working years, the mean, standard deviation and one-way ANOVA test were used to find out if the effects of noise pollution differs due to working years or not.

Table (5.13): The effects of noise pollution according to working years

	Items	N	Mean	Std		Sum of Squares	df	Mean Square	F	Sig.
Years of shop working	5 Yrs and less	67	3.5	1.4	Between Groups	15.841	2	7.921	4.872	.0090
	From 6 to 15 Yrs	58	4.2	1.2	Within Groups	238.992	147	1.626		
	More than 16 Yrs	25	3.6	1.3	Total	254.833	149			
	Total	150	3.8	1.3						

There are highly statistically significant differences between the working years of the shop workers and the effects of noise pollution, (p-value equal 0.009, and F = 4.872).

According to Scheffe test the differences were between the first group(5years and less) and the second group(6 to 15 years), where the means were 3.5 and 4.2 respectively.

The results indicate that, the second group(6 to 15) was more effected than the other two groups. This indicates that the effect of noise pollution is in line with the changing in Gaza strip since 1994, where this change leaded to increase and rapid population growth followed by increasing of traffic volume.

Chapter (6)

Conclusion and Recommendation

In this chapter the researcher provides the main conclusions of this study as well as some recommendation for decision makers related to the research topic, that may help them to give attention for noise pollution based on the results of the study. Recommended studies for further investigation are also provided in this chapter.

6.1 Conclusion

At present, there is no specific and detailed legislation to control the noise pollution in Gaza strip. There is no standard to deal with noise emanating from the activities of industrial, commercial, and residential areas. In Gaza city, due to poor planning and road construction, the problem of noise pollution is being aggravated day after day. Therefore, there was an urgent need to carry out this study in the city to evaluate the road traffic noise pollution and its effects on the shop workers in the city of Gaza. The study gave a fair good idea about the noise pollution at different zones in Gaza city by using two types of studies (traffic noise measurements and a perception survey) .

6.1.1 Traffic noise measurements

The purpose of this part of the study was to quantify the noise levels which were generated from road traffic and comparing these level with the WHO's standard. Nineteen locations were selected to reflect the traffic noise level in the city. Eighteen locations were selected to cover the crowded areas and one location as a quiet area. The measurements of noise levels were performed by using a sound level meter, it was held on special stand 1.5 meters above the ground.

Also the vehicles flow to the locations was counted manually to answer some of the research questions. The measurements were carried out during four days per week. These days are Saturday, Monday, Wednesday, and Friday. The measurements were taken two times daily, from 7:30 to 8:30 in the morning and from 2:00 to 3:00 in the afternoon in the rush hours. The study demonstrated that, at the eighteen crowded locations, the daily continuous equivalent noise levels(Leq.) were higher than the permissible noise level according to the WHO standard. The highest mean of the Leq(hr) was 77.8 dB(A) in the evening of workdays with standard deviation 4.4, while the lowest mean of the Leq(hr) was 66.1 dB(A) in the morning of Friday with standard deviation 4.9. Even though the daily lowest Leq(hr) was 66.1 dB(A) it exceeded the permissible noise level. These results clearly demonstrate that there is a serious problem of noise pollution on the shop workers in the study locations. The noise level in the 19th location (Count Bernadotte street) was below the permissible limit and it was more quieter than the silence zones in this study. The study also demonstrated that, there was a relationship between the number of vehicles flow and the noise levels, and there were differences between the weekdays and the noise, these differences reached statistical significance.

6.1.2 The perception study

The purpose of this part of the study was to determine the awareness level of noise pollution and its effect on the shop workers in Gaza city. One hundred fifty face-to-face interview questionnaires were filled by the researcher from 12 locations. Forty two items were divided into four parts in the questionnaire.

These parts were socio-demographic data, awareness of noise pollution data, times and places of high levels of noise while the forth part was about the effects of noise pollution. The study demonstrated that, in spite of about one third of the shop workers had bachelor and above university degrees, more than half of them reported that they had not any idea about noise pollution. The results showed that, there was a misconception about the meaning of noise pollution by the shop workers and there was not any attention from the Palestinian media for noise pollution. It is concluded that the awareness level of noise pollution among the shop workers was moderate. The study illustrated that, there is no a relationship between the awareness level of the shop workers and their ages, but there is a relationship between the awareness level and education years, while there are differences that among education degrees that reached statistical significance at p-value 0.0001.

Due to high noise level, some health effects on the shop workers in Gaza city had been identified. The study illustrated that, 29.3 % of the shop workers had hearing impairments, and about 83 % of them reported that, they felt these impairments since 5 years and less. Most of workers reported that, they always get annoyed due to exposure to high noise level, while 40 % of them complained of headache during working time, and about half of them reported that noise pollution affects their sleeping. The results demonstrate that, about 70.7 % of the effect was moderate, while 29.3 % was severe. It is concluded that, the main health effects on the shop workers in Gaza city are hearing impairment, headache, discomfort, annoyance, and sleeping problems.

Finally the researcher concluded that, noise pollution is a serious and neglected issue in Palestine, mainly in Gaza Strip. It is time for NGOs, the media, and the Government of Palestine to work together to reduce the problem, and increase the quality of life in this country. As many of the sources of noise pollution are unnecessary and could be reduced fairly easily and at little cost, there is no excuse for further delaying on action. Given the magnitude of the problem, and of the human suffering that results, we can no longer afford to neglect the issue of noise pollution. For the health, sanity, and well-being of the population, and for the future of our children, it is time that we all take this problem seriously, and begin implementing solutions. Whether as individuals, NGO staff, high graduate students or members of the media, we can and must take specific steps to reduce the problem of noise pollution.

6.2 Recommendations

6.2.1 study recommendations

In order to solve the problems related to the noise pollution in Gaza city, the following are proposed:

- Setting national standards of noise pollution
- Improve traffic management and control
- Place large signs banning honking to avoid noise pollution in public places.
- Categorization the city of Gaza into four zones(silence, residential, commercial, and industrial zone) by the municipality of Gaza.
- National standards may be specified for different noise levels according to categorization of zones.
- Protection of the population from community noise and considering it as an integral part of the Palestinian government policy of environmental protection.
- Planting trees on both sides of the roads as noise pollution reduction.
- Improving the streamlining of roads and parking system in the city.
- Raising of population's awareness about noise pollution

6.2.2 Recommendation for future research

- Further research is necessary to determine the health effects of noise pollution on the people who reside in the same locations of the study.
- Further research is necessary to evaluate the road traffic noise pollution in other governorates in Gaza strip.
- Further research is necessary to determine the effects of noise pollution on the drivers in Gaza strip.
- Further research is necessary to determine the effects of noise pollution on the traffic policemen in Gaza strip.
- Further research is necessary to evaluate noise level in the health and educational institutions and its effects on students and patients.

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Annexes

Annex 1

Map of Palestine



Map of Gaza strip



Noise level standards for some countries

Country	Industrial Area	Commercial Area	Residential Area	Silence Zone
	<u>Day / Night</u>	<u>Day / Night</u>	<u>Day / Night</u>	<u>Day / Night</u>
Australia(1)	65 / 55	55 / 45	45 / 35	45 / 35
Australia(2)	65 / 65	60 / 60	50 / 40	45 / 35
Canada(1)	60 / 55	60 / 55	55 / 45	-
Canada(2)	65 / 60	65 / 60	55 / 45	-
India	75 / 70	65 / 55	55 / 45	50 / 40
Israel	70	55	50	45
Japan	60 / 50	60 / 50	50 / 40	45 / 35
Mauritius	60 / 55	60 / 50	60 / 50	-
U.S.(1)	75 / 75	65 / 65	60 / 60	-
U.S.(2)	65 / 65	65 / 65	65 / 55	-
U.S.(3)	70	62	55 / 50	-
U.S.(4)	80 / 75	65 / 60	55 / 50	-
U.S.(5)	60 / 55	60 / 55	55 / 50	-
U.S.(E.P.A.)	70	60	55	45

Source: (Regulation and Control. Rules, 2000).

Annex 4

Palestinian National Authority
Ministry of Health
Helsinki Committee



السلطة الوطنية الفلسطينية
وزارة الصحة
لجنة هلسنكي

Date: 15/8/2008

التاريخ: ٢٠٠٨/٨/١٥

Name: Shadi Ishtaiwi

الاسم: شادي اشتيوي

I would like to inform you that the committee
has discussed your application about:

نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم
حول:-

Evaluation of Road Traffic Noise Pollution and Its Effects on Shop Workers in Gaza City

In its meeting on August 2008
and decided the Following:-

و ذلك في جلستها المنعقدة لشهر أغسطس ٢٠٠٨
و قد قررت ما يلي:-
الموافقة على البحث المذكور عالياً.

To approve the above mention research study.

Signature

توقيع

Member

عضو
محمد اسحاق

Member

عضو
عبدالله



Conditions:-

- ❖ Valid for 2 years from the date of approval to start.
- ❖ It is necessary to notify the committee in any change in the admitted study protocol.
- ❖ The committee appreciate receiving one copy of your final research when it is completed.

Gaza Etvam – Telefax 972-7-2878166

The Palestinian
National Authority
Municipality of Gaza



السلطة الوطنية الفلسطينية

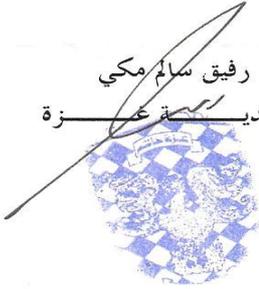
بلدية غزة

لـ ن يهـ مـه الأـ مـر

يرجى العلم بأن الطالب / شادي إشتيوي يدرس بكلية الصحة العامة بجامعة القدس للحصول على درجة الماجستير في الصحة العامة ومن متطلبات الدراسة عمل بحث علمي لقياس مستوى الضوضاء في أماكن مختلفة من مدينة غزة والبلدية تسمح له بإجراء البحث الميداني ونرجو تسهيل مهمة الباحث .

وأقبلوا التحية ،،،،

م. رفيق سالم مكي
رئيس بلدية غزة



مرفق /صورة عن كتاب الجامعة

Sound level meter type 7188 Mip-oy



Sound level meter type " Peak Tech 8000 "



Measuring sheet

Date / /2008 Day..... Time.....

Location name Location number

Type of location Number of vehicles that were interred the
measuring location during the measuring period (1 hour)

| Noise level |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | | | | | | |

Maximum:

Minimum:

Average:

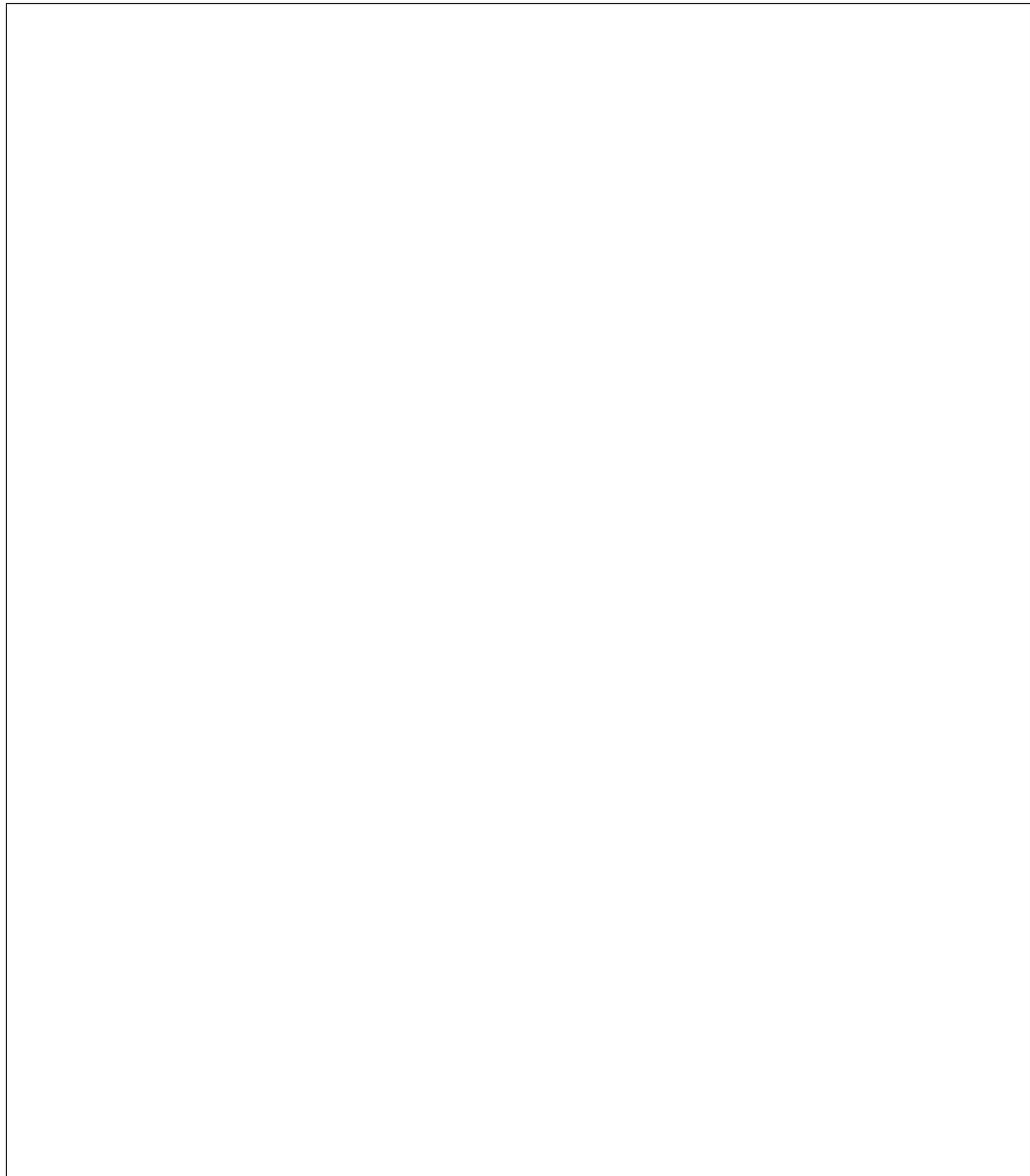
Std. Deviation:

Annex 9

Accounting sheet of vehicles

Date / /2008 Day.....

Location number Time.....



Total number of vehicles.....

11- Loud voice is considered a problem for you?

a- Yes

b- No

12- Had you ever heard or read about noise pollution in cultural or scientific bulletins?

a- Yes

b- No

If no skip to question 14

13- The source of the knowledge about noise pollution is

a- Study b- Radio c- TV d- Newspaper e- Others, _____

b-

14- Do you think that noise pollution has health consequences on human being?

a- Yes

b- No

c- Don't know

15- From your perspective, what are the most common health consequences of noise pollution?

a- Headache

b- Low concentration

c- Hearing problems. d-

Sleeping problems.

e- Heart problems

16- Is there any governmental or non-governmental institutions that help in raising the public awareness about noise pollution and its reduction?

a- Yes

b- No

c- Don't know

17- Failure to follow traffic regulations and instruction is considered among the reasons of noise pollution?

a- Yes

b- No

c- Don't know

18- Lack of separation between commercial, educational, and industrial areas is considered among the possible reasons of noise pollution?

a- Yes

b- No

c- Don't know

b-

19- Neglecting the noise pollution problems during the construction of streets and buildings is also considered among the possible reasons of noise pollution?

a- Headache b- Anxiety c- Tension d- (a&b) e- (b &c) f- (a,b,c)

37- Do you suffer from any problems in sleeping?

a- Yes b- No

38- What are the total number of your daily sleeping hours _____

39- Do you think that noise pollution may affect your sleeping patterns?

a- Yes b- No

40- Noise pollution is a cause of discomfort and restlessness for you during your work

a- Yes b- No

41- During the last 12 months, traffic noise annoyed you

a- Never b- Little c- Moderate d- Highly

42- If you were annoyed by traffic noise, then this annoyance occurred as

a- Sleeping difficulties b- low concentration c- headache d- nervousness

Thank you for your participation

بسم الله الرحمن الرحيم

جامعة القدس

كلية الصحة العامة

عزيزي المشارك

السلام عليكم ورحمة الله وبركاته

يقوم الباحث بإعداد بحث لنيل درجة الماجستير في الصحة العامة - تخصص صحة البيئة. والرسالة بعنوان

" تقييم مستوى التلوث الضوضائي الناتج عن حركة المرور و أثره على العاملين في المحلات التجارية في مدينة غزة"

الرجاء التكرم بالإجابة عن عبارات هذا الاستبيان، وذلك بوضع دائرة حول الإجابة التي تمثل وجهة نظرك نحو كل عبارة من العبارات الواردة.

إنني اقدر وأثمن وقتكم لذا استأذنكم بتخصيص عشر دقائق تقريبا لإتمام هذا العمل.

ولا يسعني إلا أن أتقدم لكم بأسمى عبارات الشكر و الامتنان، لتعاونكم في إنجاح هذا البحث وأفيدكم علما بان ما استدلون به من إجابات لن يطلع عليها سوى الباحث ولن تستخدم إلا لأغراض البحث العلمي.

وانه من وراء القصد

والسلام عليكم ورحمة الله وبركاته

مع فائق الاحترام والتقدير

الباحث/ شادي اشتيوي

من فضلك اجب عن الأسئلة الآتية

أولاً: معلومات شخصية وديموغرافية

- 1-العمر.....
- 2- سنوات الدراسة.....
- 3-نوع المحل
1- يحتوي على آلات أو أدوات تصدر أصوات 2 - لا يحتوي على آلات أو أدوات تصدر أصوات
- 4- مكان إقامة المحل.....
- 1 - سوق 2- شارع عام 3- بجانب مؤسسة تعليمية 4- بجانب مؤسسة صحية
- 5-سنوات العمل في هذا المحل.....سنة
- 6-عدد ساعات العمل في اليوم.....ساعة
- 7- هل هناك تدابير لتنظيم حركة المرور في الشارع؟
1 - نعم 2- لا
- 8- مكان السكن
1- قرية 2- مخيم 3- مدينة
- 9- نوع السكن
1- باطون 2- اسبست

ثانياً: أسئلة تحدد درجة المعرفة بالتلوث الضوضائي

- 10-هل سمعت عن التلوث الضوضائي
1- نعم 2- لا
- 11-هل تعتقد أن الصوت العالي يعتبر مشكلة
1- نعم 2- لا

12-هل قرأت أو سمعت أي نشرة علمية أو ثقافية تتكلم عن التلوث الضوضائي

1- نعم
2- لا

لو كان الجواب نعم اجب عن سؤال رقم 13

13-ما هو مصدر هذه المعرفة

1 - الدراسة 2-راديو 3-تلفزيون 4-جريدة 5- مصادر أخرى.....

14- هل تعتقد أن التلوث الضوضائي له آثار سلبية على الإنسان
1-نعم 2- لا 3- لا ادري

15 - باعتقادك ما هي أكثر الأضرار الصحية التي يسببها التلوث الضوضائي
1- صداع 2- عدم التركيز 3- مشاكل سمعية 4- مشاكل في النوم 5- مشاكل في القلب

16- هل يوجد مؤسسات حكومية أو غير حكومية تعمل على توعية الناس بموضوع التلوث الضوضائي وطرق التقليل منه.
1- نعم 2- لا 3- لا ادري

17-هل تعتقد أن من مسببات التلوث الضوضائي عدم إتباع قوانين و تعليمات حركة السير
1- نعم 2-لا 3-لا ادري

18- هل تعتقد أن من مسببات التلوث الضوضائي عدم وجود فصل بين المناطق التجارية و التعليمية و المؤسساتية.
1- نعم 2-لا 3-لا ادري

19- هل تعتقد أن من مسببات التلوث الضوضائي عدم اخذ موضوع التلوث الضوضائي بعين الاعتبار عند إنشاء المباني و الشوارع.
1- نعم 2- لا 3-لا ادري

20- هل تعتقد أن من مسببات التلوث الضوضائي عدم المعرفة بموضوع التلوث الضوضائي وأثاره على الصحة
1 - نعم 2- لا 3-لا ادري

21- هل تعتقد أننا في غزة نحتاج إلى وضع قوانين و تعليمات للحد من التلوث الضوضائي
1- نعم 2- لا 3-لا ادري

ثالثاً: أسئلة تحدد أماكن وأوقات التلوث الضوضائي

22- حدد مستوى الضوضاء في منطقة إقامة المحل

- 1- مرتفع جدا 2- مرتفع 3-هادئ نوعا 4- هادئ جدا

إذا كان الجواب 1 أو 2 اجب عن السؤال 23 و 24

23 - ما هي أكثر مصادر الصوت العالي (التلوث الضوضائي) أثناء تواجدك في المحل حسب اعتقادك.

- 1- حركة السيارات 2- حركة المشاة 3-ماكينة صناعية 4- مصادر أخرى.....

24- ما هي أكثر الأوقات التي يكون فيها التلوث الضوضائي أعلى مستوى

- 1 - صباحا (وقت الذهاب للعمل) 2- ما بعد الظهر (وقت العودة) 3-العصر 4- ما بعد المغرب

25- حدد مستوى الضوضاء في منطقة سكنك

- 1- ضوضاء جدا 2- ضوضاء 3-هادئ نوعا 4- هادئ جدا

إذا كان الجواب 1 أو 2 اجب عن السؤال 26 و 27

26- برأيك ما هي أكثر المصادر للصوت العالي (التلوث الضوضائي) أثناء تواجدك في البيت

- 1- حركة السيارات 2- حركة المشاة 3-ماكينة صناعية 4- مصادر أخرى.....

27- برأيك ما هي أكثر الأوقات يكون فيها التلوث الضوضائي أعلى مستوى

- 1- صباحا (وقت الذهاب للعمل) 2- ما بعد الظهر (وقت العودة) 3- العصر 4- ما بعد المغرب

28- هل تشعر بأنه يوجد فرق بين مكان السكن ومكان العمل من ناحية الضوضاء

- 1- الضوضاء في العمل أكثر من البيت 2- العمل اقل من البيت 3- لا فرق

رابعاً : أسئلة حول الآثار السلبية للتلوث الضوضائي

29- هل تعاني من مشاكل مرضية في حاسة السمع

- 1- نعم 2- لا

لو كان الجواب نعم اجب عن سؤال 30

30- كم سنة تعاني من هذا المرض.....سنة

31- هل سبق أن زرت طبيب السمعيات

- 1- نعم
2- لا

32- هل تشعر بأن درجة السمع متأثرة نوعا ما

- 1- نعم
2- لا

33- عندما تتحدث مع أي شخص هل تطلب منه أن يرفع صوته حتى تسمعه جيدا

- 1- دائما
2- أحيانا
3- لا

34- هل التلوث الضوضائي يسبب لك انزعاجا

- 1- دائما
2- أحيانا
3- لا

35- هل تعاني من

- 1- ارتفاع في ضغط الدم
2- سكري
3- مشاكل في القلب
4- لا أعاني من أي أمراض مزمنة

36- أثناء تواجدك في المحل هل تعاني من

- 1- صداع
2- قلق
3- توتر
4- (1و2)
5- (2و3)
6- (1و2و3)

37- هل تعاني من مشاكل في النوم

- 1- نعم
2- لا

38- كم ساعة تنام في اليوم

39- هل تعتقد أن التلوث الضوضائي يؤثر على طبيعة نومك.

- 1- نعم
2- لا

40- هل التلوث الضوضائي يسبب لك عدم ارتياح أثناء العمل.

- 1- نعم
2- لا

41- في غضون 12 شهرا الماضية في تقديرك إلى أي مدى ضايقتك ضوضاء السيارات

- 1- قطعيا لا
2- قليلا
3- وسط
4- إلى درجة كبيرة

42- إذا كانت قد ضايقتك ضوضاء السيارات، فكيف كان شكل المضايقة

- 1- صعوبة في النوم
2- صعوبة التركيز في العمل
3- صداع
4- عصبية

انتهت الأسئلة

No horn signs



"تقييم مستوى التلوث الضوضائي الناتج عن حركة المرور و أثره على العاملين في المحلات التجارية في مدينة

غزة"

الطالب: شادي مصطفى اشتوي

إشراف الدكتور: خالد قحمان

ملخص:

في الوقت الذي يتزايد فيه اهتمام العالم بموضوع التلوث الضوضائي يعتبر هذا الموضوع من المواضيع التي لا تلقى اهتماما في قطاع غزة . فالضوضاء هي الأصوات غير المرغوب في سماعها و ليس لها معنى، فمشكلة التلوث الضوضائي من أهم مشاكل المدن المزدحمة، ومدينة غزة تعتبر من أكثر مدن العالم ازدحاما بالسكان لذلك كان هناك حاجة ماسة لتقييم التلوث الضوضائي في مدينة غزة. و تعتبر هذه الدراسة الأولى من نوعها في مجال التلوث الضوضائي في قطاع غزة لذا تعد ذات أهمية خاصة في التعرف على مستوى التلوث الضوضائي في مدينة غزة إلى حين توفر دراسات أخرى شاملة لقطاع غزة.

ولتحقيق أهداف الدراسة، قام الباحث باستخدام نوعين من أدوات البحث و هما قياس مستوى الضوضاء بواسطة جهاز مقياس الضوضاء، و استبانته لتحديد مستوى الوعي والإضرار الصحية. وقد تم إجراء هذه الدراسة في 19 نقطة قياس في مدينة غزة، حيث اختيرت 18 نقطة لتغطي المناطق المزدحمة في المدينة و اختيرت نقطة واحدة من المناطق الهادئة. وقد أجريت عملية القياس بواقع ساعتين يوميا 7:30-8:30 صباحا و 2:00-3:00 ما بعد الظهر. وقد تم تعبئة 150 استبانته من أصل 164 زيارة و كانت نسبة الاستجابة حوالي 91.5%. و قد أظهرت النتائج أن مستويات الضوضاء في ال 18 نقطة في كلا الوقتين قد تعدت المستويات المسموح بها حسب معيار الصحة العالمية، بينما كان مستوى الضوضاء في النقطة ال 19 في المعدل المسموح به لمنظمة الصحة العالمية. وقد بينت التحاليل الإحصائية انه توجد علاقة ذات دلالة إحصائية بين مستوى الضوضاء و عدد المركبات حيث يزداد مستوى الضوضاء مع زيادة عدد المركبات. وأظهرت النتائج أن العاملين في المحلات التجارية كانوا على علم بسبب الضوضاء حيث أفاد 98.7% منهم أن السبب يعود لحركة المركبات بينما أوضحت النتائج أن 54% منهم كان لديهم فهم خاطئ بمعنى التلوث الضوضائي، و أوضحت النتائج أيضا أن 97.3% منهم أفادوا بان التلوث الضوضائي له أضرار صحية. و أوضحت أيضا أن الأضرار الصحية الناتجة من التعرض للتلوث الضوضائي كانت مختلفة حيث كان حوالي 29.3% منهم يعانون من مشاكل في درجة السمع وأن 46% منهم أشاروا إلى أن طبيعة نومهم تتأثر نتيجة التعرض للتلوث الضوضائي، بينما أفاد 40% منهم بأنهم يعانون من صداع أثناء العمل.

و بناءً على نتائج الدراسة يوصي الباحث بالتوجه نحو التقليل من مستوى التلوث الضوضائي و ذلك من خلال وضع معيار وطني خاص بالضوضاء، والعمل على تنظيم و متابعة حركة السير و ذلك من خلال وضع إشارات تمنع استخدام الزامور في الأماكن الحساسة مثل المؤسسات التعليمية و الصحية. و يوصي الباحث أيضا بزيادة الدراسات المتعلقة بالتلوث الضوضائي