WHO/CEHA SPECIAL STUDY/APPLIED

RESEARCH

ON

LEAD EXPOSURE OF THE POPULATION OF HIGH RISK AREAS IN AMMAN WITH FOCUS ON CHILDHOOD EXPOSURE

MINISTRY OF HEALTH
ENVIRONMENTAL HEALTH DIRECTORATE
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2. SUMMARY

This Study was conducted by a team of investigators form the Ministry of Health, Ministry of Education and Department of Statistics, Jordan . The study was sponsored by the World Health Organization / Regional Center for Environmental Health Activities (CEHA) . The study aimed to assess the risk of lead exposure of children at high risk areas in Amman .

The study covers sampling of blood for lead concentration determination in school children living at Downtown City of Amman and at Al-Shmasani .

Results of blood Sampling were supported by results of ambient air monitoring program implemented by Air Monitoring Division / Environmental Health Directorate .

The study indicated that air pollution by lead emitted by vehicles operated with leaded gasoline is contributing in elevating lead concentration in the blood of children living at Downtown City of Amman in comparison to those living at Al-Shmaisani . Males were more affected than females .

3. OBJECTIVES AND RATIONAL

3.1 Environmental Health Problem Description & Necessity

Since 1994, Environmental Health Directorate (EHD) started its monitoring program on selected air pollutants in specific areas in Amman . Lead was included in this program since the beginning . It was investigated at Downtown City of Amman (Al-Husseini Mosque Station) as a heavily traffic-congested area, and at Al-Shmaisani (Ain-Jalout School Station) as a relatively clean residential area .

Lead was given this importance due to the fact that the majority of automobiles in Jordan are operated with leaded gasoline .

Although lead content is considered to be low in the jordanian gasoline, 0.1-0.2 g/l , (M. Nasralla , Assignment report on air quality monitoring program in Jordan 12-28 Nov . 1996); still we think that it may be a valid question to be considered , especially at certain locations where topographical, geographical as well as climate conditions may be factors of pronounced effect in this regard .

The Downtown City area is heavily, almost continuously congested with traffic movement, as mentioned above , and has a high commercial activity at the same time. Residential spots are occurring in this area and increasingly extending to the peripheries .

The area is surrounded with mountains and hills from all directions .

These conditions may support fears about the accumulation of lead dust and the existence of exposure risk . Results of air monitoring program emphasized these fears . Table (1) shows these results .

Table (1)
Annual total lead concentration in ambient air in Amman during the period 1994-1999 ; $\mu g/m^3$

Station \ Year		1994	1995	1996	1997	1998	1999
Al-Husseini Mosque Station	Concentration	0.186	0.195	0.219	0.107	0.124	0.136
	No.of Samples	80	103	58	57	85	92
Ain Jalout School Station	Concentration	0.084	0.099	0.082	0.022	0.058	0.052
	No.of Samples	55	97	24	48	83	96

Among all exposed population categories children must have special attention . They exist in the area either as permanent residents or temporarly . This study will assess the blood lead exposure level of children living in this area.

3.2 Objectives of Study

General Objective :

The general objective of this study is to determine the extent to which children are exposed to total lead at Downtown City of Amman .

Specific Objectives :

This study is aiming to :

1- **determine lead concentration in blood of children living in an exposed area for lead emissions (Downtown City of Amman) .**
2- **compare lead concentration in blood between children males and females, in the exposed area .**
3- **compare lead concentration in blood between children living in an exposed area and children living in a relatively cleaner area (Al-Shmaisani).**

3.3 Relevance of Study

Ministry of Health (MOH) is considered the official institution responsible for protecting the public health . Due to the rapid increase in automobile ownership, and due to the use of leaded gasoline in Jordan , lead is being emitted from vehicle exhausts to the atmosphere causing air pollution .

Downtown City of Amman is suffering from vehicle exhaust emmissions. Residents in this area are subjected to risks of air pollutants including lead .
What worsens the problem , is the geographic nature of the area causing air to stay stagnant which enhances accumulation of pollutants and/or further consequences of the problem .
Children are considered as a sensitive group. Hence, they are expected to be more affected with this pollutant .
The need for quantifying children's exposure for lead, is considered a necessity to protect their health . Therefore this study was designed to investigate this problem .

3.4 Fields of Application of Study Results

Study results will show whether children are exposed to an environmental risk caused by living in a polluted area with lead emissions from vehicles or not, and if they are exposed to such risk, results will clarify the magnitude of it . There might be a necessity for certain mitigation measures including the consideration of pollution prevention or pollution control approaches . The need for medication may be considered if necessary, also .

3.5 Critical Review of Relevant Literature

3.5.1 General

Lead metal has been known for at least 6000 years (1) . Lead poisoning was recognized for more than 2000 years . Clinical symptoms were described by Hypocrate in old Greece . These symptoms include anaemia, colic , neuropathy, sterility, coma , and convulsions (2) .

Lead has a melting point of 327.5 ˚c and a boiling point of 1740 ˚c at atmospheric pressure . It is highly resistant to corrosion, but is soluble in nitric and hot sulfuric acid (3).

Major uses of lead are in lead acid batteries , cables, pigments, gasoline additives, solder , ammunition , plastic stabilizers and steel products (4,5) .

3.5.2 Routes of Exposure

Air, food and water are the major potential exposure pathways for man (3,5,6).

Levels of lead found in the air vary widely throughout the world and depend upon the degree of industrial development, urbanization and life style factors . Lead intake from air, can vary from less than 4 µg/day to more than 200 µg/day(5) .

Most of the lead in the ambient air is in the form of submicron sized particles . An inhaled quantity of lead will be either absorbed into the body directly through the lungs, or cleared by the lungs and absorbed through the gastrointestinal tract after swallow (3) .

Man's exposure to lead through water is generally lower in comparison to lead via food or air (3,7) .

The most important pathway of lead enters the food chain is through air deposits to cause contamination of plants as well as soil to be absorbed by plants (3) .

For infants and children, lead in dust and soil often constitutes a major exposure pathway for intake by ingestion. Lead levels in dust depend on such factors as age and conditions of housing, the use of lead-based paints, lead in gasoline and urban density (5) .

3.5.3 Health Effects on Humans

In conditions of low level and long term lead exposure such as found in the general population , the most critical effects are those on haem biosynthesis erthropoiesis , the nervous system and blood pressure (3).

Development of anaemia can occure at the formation of red blood cells in the bone marrow, and at the destruction of red blood cells in the peripheral circulation (8) .

Exposure to high lead levels cause acute encephalopathy in association with other manifestations of poisoning . The classical signs and symptoms of which are ataxia , convulsions, confusion, papilledema , headache and coma (9,10) .

The effect of lead on the heart is indirect and occurs via the autonomic nervous system, it has no direct effect on the myocardium. Collective evidence showed a weak association between blood lead concentration and systolic or diastolic blood pressure (3,5) .

3.5.4 Lead Exposure, and Health Effects on Children

A child's environment is full of lead. Children are exposed to lead from different sources (such as paint, gasoline and solder) and through different pathways (such as air, food, water, dust and soil), and they develop elevated levels of lead in their bodies and may suffer from various health and developmental problems . lead is a poison that affects virtually every system in the body. It is particularly harmful to the developing brain and nervous system of the fetuses and young children. [11]

Very severe lead exposure in children (blood lead levels 380 µg/dl)can cause coma, convulsions, and even death . Lower levels cause adverse effects on the central nervous system, kidney, and hematopoietic system[11]. Blood lead levels as low as 10 µg/dL are associated with decreased intelligence development[12,13] , reading and learning disabilities , attention deficit disorder and decreased neuro-behavioral development . As a result childhood lead poisoning is associated with lower educational achievement, higher rates of school dropout and increase behavioral problems. Many other effects begin at low blood lead levels (<10 µg/dL) including decreased stature or growth [14,15,16] decreased hearing equity[17] , and decreased ability to maintain a steady posture [18] .

Prenatal exposures have been associated with slower sensory-motor and delayed early cognitive development[19,20,21] . Children's greater vulnerability arises because children are both more exposed to contaminants present in the environment and more physiologically susceptible to certain environmental toxicants. Children breathe more air , drink more water, and consume more food as a percentage of their body weight than adults. This relatively greater rate of intake means that children receive higher doses of contaminants present in the air, food, and water . They are more susceptible because of the immaturity of their biochemical and physiological functions. Certain organs may not be fully developed and thus more vulnerable to injury .

Young children of urban minority and low income families and of color go without adequate medical care . Poor economic conditions also breed poor nutrition ; without dietary elements (such as calcium and iron) the body's absorption of lead will increase .

Lead poisoning is silent : most poisoned children have no symptoms. The vast majority of cases, therefore , go undiagnosed and untreated . Lead poisoning is widespread. It is not solely a problem of inner city or minority children. No socio economic group, geographic area or racial or ethnic population is spared . Levels continue to be a particular problem among socially and economically deprived children. Poor people are more likely to live in substandard housing and be near industry and heavy traffic, to be exposed to lead dust brought home by lead workers and to be nutritionally deprived and therefore susceptible. Screening programs for lead exposure are therefore paramount and a blood test should be performed in individual cases at the least suspicion , and medical treatment of poisoned children avid remained important until eliminating of environmental sources .

Blood lead levels at least as low as 10 µg/dL can adversely affect the behavior and development of children , the 1985 intervention level of 25 µg/dL is therefore, being revised downwards to 10µg/dL , and community prevention activities should be triggered by blood lead levels > or = 10µg/dL. All children with blood levels > or = 10 µg/dL to 14 should receive individual case management, medical evaluation and environmental investigation and remedication should be done for all children with blood levels > or = to 20 µg/dL [(22)] .

3.5.5 Lead Poisoning Prevention

Lead poisoning is one of the most common and preventable pediatric health problems . Primary prevention need to identify and remove sources of exposure to lead before children are harmed. One important activity for public health agencies is to use the data collected from screening and surveillance to develop a primary prevention plan .

3.5.6 Literature Review

In Jordan , a comparative study was conducted in 1996 to determine the blood lead level in the non-occupationally

exposed Jordanian population in accordance to age and sex. The sample size was 746 and the sample was taken depending on statistical basis to be representative sample for the Jordanian community . The arithmetic mean for blood lead level in the whole sample was 2.18 µg/100ml ± 1.96 which was lower than the other means determined by international studies . There was no statistical significant difference between male and female blood lead levels. However , a statistically significant association was found between blood lead level for those under 5 years old and those aged 5-15 years and 15-25 years old. Such low blood lead level in Jordanian citizens is attributed to low air pollution lead level in the Jordanian environment and low levels of food pollution in lead [(23)] .

In Egypt, extensive environmental sampling survey was conducted in Cairo in 1996 to estimate the magnitude and extent of children's exposure to lead through various environmental media in the Greater metropolitan area . Results were used to estimate the blood lead levels in young children in June 1997. Modeling results based on data collected in Cairo indicate that approximately 64 % of young children (ages 0-6) may have blood lead levels higher than 10µg/dL, and approximately 14% may have levels higher than 20µg/dL . The actual average blood levels are likely to be higher in some group of children. The research has shown that blood lead levels as low as 10µg/dL are associated with learning disabilities and lowered IQ. Blood lead levels of 10µg/dL and higher are cause for concern, and levels of 20µg/dL and higher justify actions to reduce the sources of exposure [(24)] .

In Australia , the relationship of lead in breast milk to lead in blood, urine and diet of the infant and mother was studied and results show statistically significant relationships for some of the variables of isotope ratios and lead concentrations between breast milk, blood urine and diet for infants and mothers. The major sources of lead in breast milk are from the maternal bone and diet. Selected studies show a linear relationship between breast milk and maternal whole blood, with the percentage of lead in breast milk compared with whole blood of <3 % in subjects with blood lead levels ranging from 2 to 34µg/dL . Breast-fed infants are only at risk

if the mother is exposed to high concentrations either from endogenous sources or exogenous sources [25] .

In New Jersey, USA, a study was conducted to examine changes in residential dust lead content and its relationship to blood lead in preschool children. The geometric mean blood lead concentrations are 10.77 and 7.66 µg/dL for the defined hot and cold periods respectively ($p<0.05$) showing the highest levels in the hottest months of the year (June, July and August) Suggesting that the seasonality of blood lead levels in children is related to the seasonal distributions of dust lead in the home . In addition, the outdoor activity patterns indicate that children are likely to contact high leaded street dust or soil during longer out door play periods in summer, i.e. children receive the highest dust lead exposure indoors and outdoors during the summer, when they have the highest blood lead levels due to increased exposure to lead in dust and soil [26] .

In Sweden, the impact of lead in soil and dust on blood lead concentrations in young children and the risk of health effects were investigated in an urban and mining area of Sweden. The blood lead concentrations (total range 9-77 µg/dL) indicated a low risk for lead induced health effects . Lead in soil, (i.e <10-5,000 µg/g) and in dust (i.e., <1-316 µg/g) had little effects on blood lead concentrations, given the present conditions and present concentration range especially in the mining area. Urban children had significantly higher blood lead concentrations than the children in the mining area, despite higher concentrations of lead in soil in the mining area . In the urban children, blood lead concentrations were influenced by parental smoking and lead in dust at day-care centers. Several factors in the swedish community may explain the relatively low blood lead levels found in the present study. These include :-

- **climatological factors which lead to low actual exposure to soil and dust .**
- **the custom of taking off shoes when entering a home or day care center .**
- **the banning of leaded paint in the early 1920 .**
- **and the fact that leaded gasoline has been almost totally phased out [27] .**

In Mexico city a cross-sectional study was conducted to identify exposure factors contributing to lead poisoning in school children in Mexico city. Blood lead levels were measured, the geometric means (GM)for private and public schools were : GM = 8.76 µg/dL , 95%,CI=9.1-10.5 ; GM 11.5 µg/dL ,95%,CI=9.4-13.5 . Lead levels were higher among children from public schools who are male between 6 and 8 years of age , in first and second grade, whose mothers have a profession, who use glazed earthen ware utensils, and who live near glazed earth ware shops or factories[28] .

In Taiwan, a study to investigate the long-term effect of increased lead absorption on intelligence of children in kindergarten A which was near a lead recycling plant in Taiwan where air and soil outside the plant were seriously contaminated by lead, and the children had low intelligence quotients (IQ) in comparison with IQ of children in another kindergarten B which was 5 km far from the plant . Following the initial study, kindergarten A school children moved 2km from the lead recycling plant and 28 children in each group were followed successfully 2.5 years later . Blood lead, intelligence quotient and intelligence quotient- related factors were reassessed . The results showed that the average blood lead level of the exposed pupils dropped 6.9 µg/dL and the average intelligence quotient increased 11.7 points compared with the results of the initial study. The average blood lead level of the reference group decreased by 1.7 microgram/dL, whereas the average intelligence quotient increased by 4.2 points . The difference between the two groups disappeared during the follow up . The authors concluded that intelligence quotient impairment, caused by a mild sub-clinical elevation of blood lead (i.e., no more than 30 µg/ dL) for a period of 1-3 years in 3 to 5 years olds is at least partially reversible .

In Poland , study was conducted to estimate the blood lead concentrations in school children of Upper Silesian Industrial Zone, in order to estimate the mean blood lead concentration and its range in children aged 7 years residing in urban non-point source impact area of Katowice Voivodship, and to examine potential determinants of increased blood lead concentration in these children. The geometric mean and standard deviation of blood lead level was 7.94 ± 1.48 µg/dL (range 4.0-38.0 µg/dL) . Blood lead level equal to or larger than 15 µg/dL was found in 8.1% of children, and blood lead level equal to or larger than 10µg/dL in 27.8 % of children . The findings of the study indicate that children living in urban area of

Upper Silesian Industrial Zone are at risk of over exposure to lead in environment, and justify the implementation of population – based screening program targeting children in younger age groups in the region [30] .

The magnitude of lead exposure in school children from Jakarta was assessed by analyzing blood lead concentrations and biomarkers of heme bioynthesis. A total of 131 children from four public elementary schools in Jakarta (two in the southern district and two in the central district) were enrolled in the study. To evaluate lead pollution in each area, soil samples and tap water were collected . The mean blood lead concentration was higher in the central district than in the southern district (8.3± 2.8vs. 6.9± 3.5 µg/100ml ; $p<0.05$); 26.7% of the children had lead levels greater than 10 µg/100ml. In 24% of the children, zinc protoporphyrin concentrations were over 70 µmol/mol hemoglobin ; in 17% of the samples, hemoglobin was less than 11 g/100 ml . All other values were within the physiological range. Blood lead concentration and hematological biomarkers were not correlated . Analysis of tap water revealed lead values under 0.01 mg/1 ; lead contamination of soil ranged from 77 to 223 ppm. Data indicate that Indonesian children living in urban areas are at increased risk for blood lead levels above the actual acceptable limit . Activities to reduce pollution (e.g., reduction of lead in gasoline) and continuous monitoring of lead exposure were strongly recommended .

4. EXPERIMENTAL DESIGN & METHODOLOGY

4.1 Summary of Methodology

The major steps of the method followed in this study are :

1- Selection of students in the basic schools to be the community of the study.This selection was adopted because it covers the childhood age ranging from (6) to (14) years .

2- Selection of schools covered in the study is based on satisfying the requirement of including exposed schools (Downtown City) and non-exposed schools (Al-Shmaisani) . This selection was made by concerned directorate in the Ministry of Education (M.O.E) through the representative of (M.O.E) in the research team .

3- Distribution of a questionnaire on eligible students in each included school. The questionnaire consists of two parts : the first part contains a briefing to the students family about the sudy .It also aims at getting written consent or disagreement for participation of the student in the study . The student is accepted or discarded as a sample in the study according to the response of his/her family .

The second part contains demographic data: age, sex father's and mother's occupation status and nature .

Previous exposurure to other sources of lead (Kohl) in early childhood , and any recent exposure to lead other than the polluted ambient air lead were taken into consideration in the questionnaire .

The total number of distributed questionnaires was(647),and was governed by limitation of the budget .

Annex (1) shows name of included schools, number of distributed questionnaires , and number of approvals in each school.

4- Collection of questionnaires from students and segregation of approvals /non-approvals .Approvals with previous or recent exposure to lead (e.g Kohl , and other sources of lead exposure other than ambient air pollution) were excluded from the

study. Collected approvals were equal to 67% of distributed questionnaires.

5- Tabulating the available data for each school to reflect sex and age distribution of students .
The same procedure was followed with approvals collected from schools . Annex (2) shows these tables .

6- Determination of the sample size and names of students who responded with approvals , and were not discarded .This determination was made by the Department of statistics based on the presented data above , The sample size came to be (243) units (students).

7- Collection of blood samples from the students in schools, transporting and preserving them in the laboratory.

8- Analysis of blood samples for lead content in the Environmental Health Directorate Laboratory.

9- Statistical analysis of results.

10- Preparation of the final report.

4.2 Special Study Design

A previous study was conducted by Ministry of Health and Royal Medical Services in (1996) to determine the blood lead concentration in the Jordanian population .
This was found to be equal to 2.18 µg/100ml (23) .
This study was especially designed to investigate the blood lead concentration in childrens living in an exposed area.
A descriptive cross sectional comparative study was conducted in selected basic schools in exposed and non exposed areas .

4.2.1. variables

It is intended to find the lead concentration in the blood of children from both sexes and falling in the age group ranging (6-14) years old and living in an exposed area (at Downtown City of Amman) and comparing the results with those obtained from children having similar characteristics but living in a cleaner area (Al-Shmaisani) .
This study's aim was to assess the portion of leaded dust coming out mainly from gasoline operated vehicles that is absorbed by children living at Downtown City .

4.2.2 Respondents / Subjects

As mentioned earlier , after the decision was taken that students in the basic school are the community of the study , work was started by selecting proer sites of schools .

At Downtown City , schools were selected at prince Moh'd Str. , Wadi-Sorour, Ras El-ain, the lower portion of Jabal amman , Al-Mahattah and Jabal El-Joufah.
All these schools are located in a heavily traffic congested area.
At Al-shmaisani area , schools were selected at sites located to the north and to the south of Jamal Abdul -Naser Circle .These sites are considered to be relatively clean and of less exposure for traffic congestion .

4.2.3 Sampling Design

The main objective of sampling design is to have a representative sample from the community of the study to know the concentration of lead in the blood of children at the age of (6-14) years (basic schools) in both exposed area and non-exposed area (control area) for males and females .

4.2.3.1 Frame of the Study

The research team got the frame of students including the name and its address , after that, they distribute a questionnaire to the target population in each school . The questionnaire includes a written permission from the student's family to take a blood sample from the student . The list of names of those who agreed were prepared and used as a sampling frame for this study .

4.2.3.2 Sample Size

Using the results of the previous study carried out in the field , the sample size was estimated to be at around (3%) coefficient of variation (C.V.) , so the suggested sample size was about (240) students.

4.2.3.3 Sample Design Procedure

The frame was divided into four strata as shown in table (1) below.

Table (1)
Frame of the study and its strata.

Stratum	Strata	No.of students
1	Male in exposed area	137
2	Female in exposed area	154
3	Male in Control area	34
4	Female in control area	71
Total		396

Due to the available number of students in each stratum , there was a suggested allocation of sample among strata as follows : stratum number (1) and stratum number (2) were (80) students from each . A(40) students from each for the third and fourth strata. Due to the limited number of the sampling units in the third stratum , the sample size was adjusted in stratum number (3) and stratum nuber (4) . The final distribution of sampling units covered in this study was as shown in table (2) below .

Table (2)
Strata of the frame and number of sampling students covered

Strata No.	Number of Sampling units (students) covered
1	81
2	82
3	34
4	46
Total	243

A systematic random sampling was implemented for each stratum after ordering students by school and by age in each school to provide good distribution of sample by age and school at stratum level .

4.2.4 Sampling Procedure

Blood samples were collected , using lead free syringes , into heparinized lead free vacutainers. Samples were transported using ice boxes to the laboratory (32)

4.3 Research Instruments

- **250 ml glass bottles**
- **5 ml polypropylene lead free syringes**
- **5 ml heparinized lead free vacutainers .**
- **Ice box**
- **Vortex mixer**
- **Laboratory glassware**
- **Flame /flameless atomic absorption spectrophotometer type Shimadzu Model AA-680**
- **Lead free nitric acid 66%**
- **Deionized water**
- **Lead stock standard 1000 mg/l**

4.4Analytical Procedures

4.4.1 Sample Preservation

Blood samples were stored frozen at –20 ºC for a period not exceeding three days (32) .

4.4.2 Sample Digestion and Preparation

Blood samples were defrosted . A 0.5 ml of blood sample was transferred into a glass tube and diluted to 2.5 ml using 1% Triton x-100 solution .Samples were well mixed using vortex mixer . Deionized water blanks for each batch of samples were prepared in the same manner .

4.4.3 Sample Analysis

Blood samples were analyzed using Graphite Furnace Atomic Absorption Spectrophotometer with control correction working under the conditions mentioned below . 2.5,5.0 , 10.0 ,15.5 , 20.0 µg/l standard lead solutions were prepared from the commercially available stock lead standard using deionized water . The previously prepared working standards were used for plotting the calibration

curve . Concentration of lead in the digested samples was determined automatically by the data processor of the equipment . Results were expressed in µg/100ml .

Equipment conditions

Lamp source	**Hollow cathode lamp**
Wave length	**283.3 nm**
Current	**5mA**
Slit width	**1.0 nm**

Graphite furnace heating program

Stage 1	**Temp 120 ºC**	**Time 20 sec.**
Stage 2	**Temp 300 ºC**	**Time 20 sec.**
Stage 3	**Temp 2300 ºC**	**Time 3 sec.**
Stage 4	**Temp 0 ºC**	**Time 10 sec.**
Stage 5	**Temp 2500 ºC**	**Time 2 sec.**

4.5 Statistical Analysis

Data was analyzed to test the significance between strata by running the one way ANOVA test .

5. RESULTS

5.1 Blood Results

Sample individual results are presented in annex (3) .
Names of students were omitted for ethical reasons , and substituted by coding with a statistical number .
After the tabulation of data and weighing the sample ,results at stratum level were as shown in table (1) below .

Table (1)
Results of statistical manipulation of data at stratum level

Stratum No.	Averag lead conc.in blood, µg/100ml	Coefficient of variation, % (C.V.,%)	95% confindence interval	
			Lower limit, µg /100ml	Upper limit, µg/100ml
1	5.664	4.23	5.194	6.133
2	4.024	3.66	3.735	4.313
3	2.124	0.00	2.124	2.124
4	2.049	0.395	2.033	2.065
Total	3.931	2.6	3.731	4.131

The C.V. is 2.6 % , which means that the precision of the sample is high . The highest lead concentration is at the first stratum (exposed area, males) , then the second stratum (exposed area, females) , followed by males in the control area and the lowest one is females in control area.

To test the significant difference between strata , the one way ANOVA was run , and calculated F was (29.859) , which means that there was statistically significant difference between one or more strata . To specify the significant difference , the least significant difference (LSD) was applied , and results were as shown in table(2) below .

Table(2)
Results of (LSD) between indicated strata

Comared Strata	Result
Between exposed area and control area	Significant
Between males and females in exposed area	Significant
Between males and females in control area	Non significant

Results show clearly that there is a significant difference between exposed and control areas . In the exposed area , there is a significant difference between males and females. On the other hand , no

significant difference between males and females at the control area was observed .

5.2 Air results

Although it was not mentioned in the submitted proposal of the study , to sample air , it was stated in the contractual service agreement .

However , it was intended at a very early stage to sample air at the nose level of the public pedestrians in the street . But it came to be a difficult job to provide needed approvals for erecting the equipments . Problems of providing protection, security , and power supply emerged , too.

To over come this problem , we can consider results of air sampling program carried out by Air Monitoring Division in (EHD) .

Applying proper statistical manipulations to data in table (1) /chapter (3) and table (3) below , it is obvious that there is a significant difference between air lead concentration at Downtown City and air lead concentration at Al-Shmaisani.

Table(3)
Total lead concentration in ambient air in Amman during the period (January-June) 2000, µg/m³.

Station	No.of samples	Average lead conc., µ g/m³
Al-Husseine Mosque Station	45	0.o47
Ain Jalout School Station	39	0.042

Table(1) /Chapter 3
Annual lead concentration in ambient air in Amman during the period 1994-1999 , µg/m³ .

Year / Station	1994	1995	1996	1997	1998	1999

Al-Husseine Mosque Station	**Concentration**	**0.186**	**0.195**	**0.219**	**0.107**	**0.124**	**0.136**
	No.of samples	**80**	**103**	**58**	**57**	**85**	**92**
Ain-Jalout School Station	**Concentration**	**0.084**	**0.099**	**0.082**	**0.022**	**0.058**	**0.052**
	No.of Samples	**55**	**97**	**24**	**48**	**83**	**96**

6. DISCUSSION

By examining the results of lead concentration in blood at both studied areas , and the conducted statistical manipulation , it is apparent that:

- **Lead concentration in blood of children at Downtown City of Amman (the exposed area) is higher than that of children at Al-Shmaisani (the control area).**
- **Lead concentration in blood of male children in the exposed area is higher than that of female children in the same area.**
- **Although lead concentration in blood of male children in the control area is higher than that of females children in the same area , but still this difference is not appreciable .**

These findings seem to be logic because :

- **Lead conentration in ambient air in the exposed area , emitted mainly from leaded – gasoline operated vehicles is higher than that in the control area.**
- **Male's activity , and hence, males intake of air , is greater than that of females .**

- **Male's length of stay in the ambient ,and hence , length of exposing for air pathway of lead pollution , is longer than that for females .**

7. CONCLUSIONS

Based on the results of this study , the following conclusions can be drawn:

- **Vehicles operated with leaded gasoline are contributing appreciably to lead concentration in ambient air at Downtown City of Amman .**
- **Vehicles operated with leaded gasoline are of less effect of contribution to lead concentration in ambient air at Al-Shmaisani area in comparison with that at Downtown City .**
- **It is evident that lead concentration in ambient air is contributing appreciably in elevating lead concentration in blood of children living at Downtown City of Amman in comparison with those living at Al-Shmaisani .**
- **Males are suspected to be affected by contaminated air with lead more than females .**

8. RECOMMENDATIONS

Based on results and conclusions of the study , it is recommended to :

1- adopt a clear policy to reduce lead pollution in ambient air at Downtown City of Amman .
Organizing traffic volume and movement in the area and/or gradual phasing out of leaded gasoline are examples to solve the problem .

2- adopt and to enforce the concept of healthy schools when selecting sites of them ,and , may be, a relocation decision of schools in exposed areas has to be considered .

3- follow up with proper medical actions for students found to have high blood lead concentration .

4- adopt a national guidelines for limits of lead concentration in blood for childrens as well as for adults to protect the public health.

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Annex (4)
BUDGET

1- CEHA/WHO Contribution

Allocated amount of US$4000 , distributed as follows :

1- Buying consumables and required accessories for sampling and analysis equipments US$ 1285.

2- Report printing , photocopying and hard covering final report US$500.

3- Incentive for team members, driver and accountant US$ 2215.

2- Ministry of Health Contribution

Ministry of Health has contributed in kind through allowing the utilization of analysis equipments during the study , and through providing transportation for the team during field investigation and sample collection , also six out of eight team members are Ministry of Health employees .

Annex (5)
STUDY TEAM &DUTIES

Env. Eng. Salah Al-Heyari Main Supervisor&Coordinator (Team leader) (Ministry of Health)

Dr.Na'elah Al –Jawhary Supervision of Sampling &data analysis (Ministry of Health)

Mr.Khamees Rhaddad Sample design & Statistical analysis (Department of Statistics)

Chemist Maher Shehadah Field investigator & facilitator (Ministry of Health)

Dr.Moh'd Bani-Younus Field facilitator (Minstry of Education)

Chemist Akram Salahat Chemical laboratory analysis (Ministry of Health)
Technician Wesal El-Basheer Chemical laboratory analysis (Ministry of Health)
Technician Nabeelah Makkawi Collection of samples (Ministry of Health)

Meetings of team members were held when necessary to discuss work plans and progress .

ملخص دراسة

"تعرض الاطفال للرصاص في المناطق عالية الخطورة في عمان"

١- قام فريق من الباحثين من وزارة الصحة ، وزارة التربية والتعليم ودائرة الاحصاءات العامة باجراء الدراسة المذكورة .

٢- درست منطقة وسط البلد ومنطقة الشميساني بواسطة دراسة بعض المدارس الاساسية في هاتين المنطقتين .

٣- تم تحديد عينة من الطلاب في المدارس المشمولة بالدراسة بحيث كانت ممثلة للاعمار (٦-١٤) سنة ولكلا الجنسين.

٤- جمعت عينات دم من عينة الطلاب المختارة وحللت لتحديد تركيز الرصاص فيها .

٥- دعمت نتائج تحليل الدم بنتائج مراقبة نوعية الهواء التي يقوم بها قسم رقابة الهواء في مديرية صحة البيئة في المنطقتين المذكورتين أعلاه .

٦- أخضعت جميع النتائج للمعالجة الاحصائية .

٧- خلصت الدراسة الى الاستنتاجات التالية .

أ- تساهم المركبات العاملة بالبنزين الذي يحتوي على الرصاص بجزء معتبر من تركيز الرصاص في الهواء في منطقة وسط البلد

ب- مساهمة المركبات العاملة بالبنزين الذي يحتوي على الرصاص في تركيز الرصاص في الهواء في منطقة الشميساني أقل منها في منطقة وسط البلد .

ت- هناك دليل على أن تركيز الرصاص في الهواء في منطقة وسط البلد يساهم بشكل معتبر في رفع تركيز الرصاص في دم الاطفال القاطنين في تلك المنطقة مقارنة بأقرانهم القاطنين في منطقة الشميساني .

ث- الاطفال الذكور أكثر عرضة للتأثر بتلوث الهواء بالرصاص من الاطفال الاناث .

٧-خلصت الدراسة الى التوصية بمايلي:

أ- تبني سياسة واضحة لخفض تلوث الهواء في منطقة وسط البلد.
تنظيم كثافة المرور و/ أو الاقلاع التدريجي عن استخدام البنزين الذي يحتوي على الرصاص هي أمثلة لحل هذه المشكلة .

ب- تبني وتفعيل مفهوم المدارس الصحية عندما يتم اختيار موقعها ، وقد يلزم التفكير بقرار نقل المدارس الواقعة في المناطق المعرضة .

ت- متابعة الطلاب الذين وجدت لديهم تراكيز عالية من الرصاص باتخاذ الاجراءات الطبية الملائمة .

ث- تبني دلائل استرشادية وطنية لحدود تركيز الرصاص في الدم للأطفال والبالغين لحماية الصحة العامة .

بسم الله الرحمن الرحيم

وزارة الصحة

الموضوع: دراسة تحديد مستوى الرصاص في الدم

السيد الفاضل ولي أمر الطالب/الطالبة: .....

السلام عليكم ورحمة الله وبركاتة وبعد ،،،

يقوم فريق من وزارة الصحة ومن وزارة التربية والتعليم بإجراء دراسة ميدانية على طلاب المدارس في عدة مناطق من عمان لتحديد مستوى الرصاص في الدم حيث يحتاج ذلك إلى أخذ

عينة دم من ابنكم / ابنتكم.

يرجى منكم التكرم بالموافقة على اخذ عينة دم من قبل لجنة مختصة في وزارة الصحة وبإشراف طبي

بوجود طبيبة من الصحة المدرسية . وتعبئة الاستبيان المرفق.

يرجى في حالة الموافقة على مشاركة ابنكم/ابنتكم للدراسة المشار إليها أعلاه أن يتم وضع إشارة

(✔) تحت كلمة نعم كما هو مبين أدناه.

وإعادته مع ابنكم/ابنتكم وسوف يتم إعلامكم بنتيجة التحليل لعينة الدم من خلال المدرسة لاحقاً.

شاكرين لكم حسن تعاونكم ...

هل توافقون على مشاركة ابنكم/ابنتكم في الدراسة : نعم

( )

إسم ولي الأمر: .....

التوقيع: .....

التاريخ: .....

وزارة الصحة

استبيانة مستوى الرصاص في الدم لدى الأطفال

التاريخ: / /١٩٩٩

اسم الطفل: .....

اسم المدرسة: .....

جنس الطفل: ١ ٢ ١- ذكر ٢- أنثى

ضع إشارة (x) في المربع المخصص للعمر:

١٤	١٣	١٢	١١	١٠	٩	٨	٧	٦	٥

معلومات تخص العائلة:

مهنة الوالد:

مهنة الوالدة:

مهنة الأخوة العاملين:

معلومات تخص الطفل:

هل استعمل الطفل مادة الكحل في السابق:
هل يستعمل الطفل مادة الكحل حالياً:

معلومات تعبأ بواسطة فريق العمل:

اسم جامع المعلومات: **اسم جامع العينة:**
تاريخ التحليل: / /١٩٩٩ **نتيجة التحليل:( ) مكغم/١٠٠ مليلتر**

مدارس المرحلة الأساسية في مديرية التربية و التعليم لمنطقة عمان الأولى المشمولين ضمن دراسة تحديد مستوى الرصاص في دم الطلاب و الطالبات

مـــــــدارس الذكـــــــور			
مدارس منطقة وسط البلد	الرقم		مدارس منطقة الشميساني	الرقم
سمير الرفاعي الأساسية ت/٤٦٢٤٦٠١ الموقع:ش الأمير محمد اسم المدير: غازي غنام عدد الاستبيانات: ٤٥ عدد الموافقات: ٣٥	١		يعقوب هاشم ت/ ٥٦٧١١٠٦ الموقع:عرجان/طريق مدارس العروبة اسم المدير:سميح جعافرة عدد الاستبيانات:٣٥ عدد الموافقات:٢٠	١

الأمير محمد الأساسية ت/ ٤٧٧٢٢٨٧ الموقع: سقف السيل وادي السرور/مقابل سينما الحمراء اسم المدير:إبراهيم العزايزة عدد الاستبيانات:٥٦ عدد الموافقات: ٤٩	٢				
العبدلية الأساسية ت/ ٤٦٣٧٧٧٠ الموقع:جبل عمان/الدوار الأول اسم المدير:سعود فرّاج عدد الاستبيانات:٥٢ عدد الموافقات: ١٣	٣				

مـدارس الإنـــــاث

مدارس منطقة وسط البلد			مدارس منطقة الشميساني			ال
الشميساني الغربي ت/ ٥٦٧٩٦٣٢ الموقع:الشميساني– مقابل ديوان الخدمة المدنية اسم المدير:ازدهار الحديدي عدد الاستبيانات:٣٢ عدد الموافقات: ٢٩	١		أروى بنت الحارث الأساسية (ت/ ٤٦٣٧٤٦١ الموقع:أول طلوع جبل عمان اسم المدير:جهاد سرحان عدد الاستبيانات:٤٤ عدد الموافقات: ٢٤	٢	سمير الرفاعي المختلطة ت/ ٤٦٢٤٨٨٦ الموقع : ش. الأمير محمد اسم المدير: إقبال القطب عدد الاستبيانات:٤٥ عدد الموافقات:٤٥	
الإسراء الأساسية ت/ ٥٦٩٩٠٦٨ الموقع:منطقة عرجان خلف وزارة الداخلية	٢		بيت المقدس الأساسية ت/ ٤٧٧٢١٤٤ الموقع:رأس العين/جانب بنك المؤسسة المصرفية	٤	عائشة بنت طلحة الأساسية ت/٤٦٤١٠٤٠ الموقع:بجانب مستشفى عاقلة اسم المدير: فاطمة مستريحي	

اسم المدير:شمسة احمد عيسى عدد الاستبيانات:٦٥ عدد الموافقات: ٥٦		اسم المدير: أسماء سليمان عدد الاستبيانات: ٣٥ عدد الموافقات: ٣٥		عدد الاستبيانات:٢٠ عدد الموافقات: ٢٠	
الأميرة رحمة بنت الحسن ت/ ٥٦٧٨٥٢٦ الموقع:مقابل البنك العربي اسم المدير:حليمة الحيارى عدد الاستبيانات:٦٠ عدد الموافقات: لا يوجد	٣	صفية أم المؤمنين الأساسية ت/٤٨٩٢٧٥٤ الموقع:المحطة/باتجاه ماركا اسم المدير: نهى الخطيب عدد الاستبيانات:٣٦ عدد الموافقات:٣٢	٦	مدرسة المهاجرين الأساسية ت/٤٦١١٤٤٧ الموقع:المهاجرين العلوي اسم المدير: مكرم ياسين عدد الاستبيانات:٣٥ عدد الموافقات:٢٦	
		سلمى بنت عميس ت/ ٤٧٧٦٨٦١ الموقع: جبل الجوفة اسم المدير:نجاح العطيوي عدد الاستبيانات:٤٢ عدد الموافقات:٢٠	٨	شفاء بنت عبد الله الأساسية ت/ ٤٩٠٢١٠٣ الموقع:المحطة/بجانب الجسر اسم المدير:صباح الصباح عدد الاستبيانات:٤٥ عدد الموافقات:٢٧	

جدول رقم (١)العدد الإجمالي .لفئة الطلاب المشمولة في الدراسة وتوزيعه حسب سنوات العمر (٦-١٤)سنه وحسب الجنس .

ا	العدد الكلي	العمر	الجنس	٦	٧	٨	٩	١٠	١١	١٢	١٣	١٤	ملاحظات (ت)
شارع الأمير محمد	٣٥٠	٣٥٠	ذكر	–	٣٦	٤٢	٥٠	٧٣	٦٤	٤٨	٣٧	–	٤٦٢٤٦٠١
المدير/ غازي غنا			أنثى	–	–	–	–	–	–	–	–	–	--------
شارع الأمير محمد	٢٩٤	٤١	ذكر	٢٥	١٤	٢	–	–	–	–	–	–	٤٦٢٤٨٨٦
المديرة/ إقبال الق		٢٥٣	أنثى	١١	٦٤	٦٣	٩	٣٩	٣٢	١٨	٢٧	–	---------
سقف السيل- قر	١٨٠	١٥٦	ذكر	٦	٢٩	١١	٢٣	٢٤	١٨	٢٦	٢٠	٢٣	٤٧٧٢٢٨٧
عاطف جريسات		–	أنثى	–	–	–	–	–	–	–	–	–	----------
سقف السيل- قر	١٧٩	١٧٩	ذكر	٧	٢٠	٢٠	٢٩	١٦	٢١	٢٢	٢٥	١٩	٤٧٧٢٢٨٧
إبراهيم العزايزه		–	أنثى	–	–	–	–	–	–	–	–	–	---------
جبل عمان –	٢٣٠	٢٣٠	ذكر	–	–	–	–	–	٩٧	١٠٨	٢٥	–	٤٦٣٧٧٧٠
السرفيس.المدير/		–	أنثى	–	–	–	–	–	–	–	–	–	----------

٤٧٧٦٨٦١	–	–	–	–	–	–	٧١	٥٠	٤٠	ذكر	١٦١	١٦١	جبل الجوفه
----------	–	–	–	–	–	–	–	–	–	أنثى	–		المديرة / نجاح الع
٤٩٠٢١٠٣	–	–	–	–	٢	٣٤	٥٧	٥٤	١٥	ذكر	١٦٢	١٦٢	المحطة بجانب ال
----------	–	–	–	–	–	–	–	–	–	أنثى	–		المديرة / صباح ال
٤٦٤١٠٤٠	–	–	–	–	–	–	–	–	–	ذكر	–	٢٩٥	جبل عمان – بجا
----------	–	–	١	٣٦	٥١	٤٥	٤٠	٥٧	٦٥	أنثى	٢٩٥		المدير / فطنة الم
٤٦٣٧٤٦١	–	–	–	–	٦	٥٩	٣٢	٤٦	٣٩	ذكر	١٨٢	١٨٢	أول طلوع جبل عم
----------	–	–	–	–	–	–	–	–	–	أنثى	–		المديرة/ هيلدا أبو
٤٨٩٢٧٥٤	–	–	–	–	–	–	٨	١٢	٩	ذكر	٢٩	٧٤	المحطة – باتجاه
----------	–	–	–	٨	٩	١١	٤	٨	٥	أنثى	٤٥		المديرة / نهى الخ
٤٦١١٤٤٧	–	–	–	–	–	–	–	–	–	ذكر	–	١٥٨	جانب راس العين
----------	١	٣	٢٢	٣١	٢٥	٢٧	١٦	٢٣	١٠	أنثى	١٥٨		المديرة / مكرم يا
٤٧٧٢١٤٤	–	–	–	–	–	–	–	–	–	ذكر	–	٢٥٠	راس العين / بجانب
----------	–	–	٦٥	٧٨	٧٩	٢٨	–	–	–	أنثى	٢٥٠		المصرفية – المدير
٤٦٣٧٤٦١	–	–	–	–	–	–	–	–	–	ذكر	–	٢٥٤	اول طلوع جبل عم
----------	–	–	–	–	–	٨٤	٦٠	٥٦	٥٤	أنثى	٢٥٤		المدير/ جهاد الس

ملاحظات	١٤	١٣	١٢	١١	١٠	٩	٨	٧	٦	العمر الجنس		العدد الكلي
٥٦٧١١٠٦	–	١٢٥	١٢١	١١٧	١٠٧	١٠٤	٧٤	–	–	ذكر	٦٤٨	٦٤٨
----------	–	–	–	–	–	–	–	–	–	أنثى	–	
٥٦٧٩٦٣٣	–	–	–	–	٢٩	٤٧	٣٠	٣٧	١٦	ذكر	١٥٩	٧٣٨
--------	٥	٧٧	٨٨	٩٨	٧٠	٥٧	٥٣	٩١	٤٠	أنثى	٥٧٩	
٥٦٩٩٠٦٨	–	–	–	–	–	–	٣٣	٣٥	٣٦	ذكر	١٠٤	٥١٩
--------	٥٠	٨٠	٧٠	٥٠	٥٠	٣٥	٢٥	٢٧	٢٨	أنثى	٤١٥	

جدول رقم (٢) العدد الاجمالي لفئة الطلاب المشمولة في الدراسة و الموافقين على المشاركة فيها وتوزيعه حسب سنوات العمر (٦-١٤)سنه وحسب الجنس .

ملاحظات (ت)	غير موضح العمر	١٤	١٣	١٢	١١	١٠	٩	٨	٧	٦	العمر الجنس	العدد الإجمالي
٤٦٢٤٦٠١	٤	٣	٦	٤	٨	٥	١	٢	٢		ذك ٣٥	٣٥
											أنثى	
٤٦٢٤٨٨٦				١		١	١		٢	٣	ذكر ٨	٤٦
			١	٦	٨	١٠	٢	٥	٤	٢	أنثى ٣٨	
٤٧٧٢٢٨٧		٨	١٠	٥	٥	٦	٦	٤	٥		ذكر ٤٩	٤٩
											أنثى	
٤٦٣٧٧٧٠			١	٧	٥						ذكر ١٣	١٣
											أنثى	
٤٧٧٦٨٦١	٤					١	٣	٣	٥	٤	ذكر ٢٠	٢٠
											أنثى	
٤٩٠٢١٠٣						٢	٥	١٣	٧		ذكر ٢٧	٢٧
											أنثى	
٤٦٤١٠٤٠											ذكر	٨
				٣	٥						أنثى ٨	
٤٦٣٧٤٦١						٣	٤	٤		١	ذكر ١٢	١٢
											أنثى	

٤٨٩٢٧٥٤	٤						١	٢	٢	ذكر	٩			٣٢
	١٣			١	٣	٢	٢	٢		أنثى	٢٣			
٤٦١١٤٤٧										ذكر				٢٦
			١	٥	٥	٣	٥	٣	٢	أنثى	٢٦			
٤٧٧٢١٤٤										ذكر				٣٥
			٣	١٤	٩	٧	٢			أنثى	٣٥			
٤٦٣٧٤٦١														٢٤
					١	٢	٣	٦	٥	٧	أنثى	٢٤		

ملاحظات		١٤	١٣	١٢	١١	١٠	٩	٨	٧	٦	العمر الجنس		العـ الإجـ
٥٦٧١١٠٦			١	٥	٥	٦	٢	١			ذكر	٢٠	٢٠
											أنثى		
٥٦٧٩٦٣٢						١	٤			١	ذكر	٦	٢٩
		٢	٤	٥	٣	١	٦	١	١		أنثى	٢٣	
٥٦٩٩٠٦٨							١	١	٤	٢	ذكر	٨	٥٦
		٢	١٢	٦	٥	٤	٨	٤	٦	١	أنثى	٤٨	

نتائج دراسة تعرض الأطفال للرصاص فى المناطق عالية الخطورة فى عمان

اسم المدرسة:الإسراء **المنطقة:الشميساني**

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل
	٢.٣٠	٦	١	٤	أنثى	١
	١.٤٠	٧	٢	٤	=	٢
	٠,٥٠	٧	٤	٤	=	٣
	١,٦٠	٧	٥	٤	=	٤
	٠.٦	٨	٨	٤	=	٥
	١.٨	٨	١٠	٤	=	٦
	١.٦	٨	١١	٤	=	٧
	٠.٧٥	١٣	٤٤	٤	=	٨
	٥.٠٠	٩	١٣	٤	=	٩
	١.٨٥	٩	١٥	٤	=	١٠

١١	=	٤	٧	٨	٢.٥	
١٢	=	٤	١٦	٩	٣.٣٠	
١٣	=	٤	١٨	٩	١.٦٥	
١٤	=	٤	١٩	٩	٢.١٥	
١٥	=	٤	٢١	١٠	٣.٢	
١٦	=	٤	٢٢	١٠	٣.٣٠	
١٧	=	٤	٢٤	١١	٣.٨٥	
١٨	=	٤	٢٥	١١	١.٨٥	
١٩	=	٤	٢٧	١١	٣.٤٥	
٢٠	=	٤	٢٨	١١	٢.٤	
٢١	=	٤	٣٠	١٢	٣.٣٥	
٢٢	=	٤	٣٢	١٢	٢.٥	
٢٣	=	٤	٣٣	١٢	١.٧٥	
٢٤	=	٤	٣٥	١٣	٢.٧٥	
٢٥	=	٤	٣٦	١٣	٠.٥	
٢٦	=	٤	٤١	١٣	١.٧٥	
٢٧	=	٤	٤٢	١٣	١.٥	
٢٨	=	٤	٤٥	١٣	٢.٠٠	
٢٩	=	٤	٣٩	١٣	٢.١٥	
٣٠	=	٤	٤٧	١٤	١.٢	
٣١	=	٤	٣٨	١٣	٠.٧٥	

	١.٢	١٤	٤٨	٤	=	٣٢
	٤.٠٠	٦	١	٣	ذكر	٣٣
	٠.٧	٦	٢	٣	=	٣٤
	٢.٦٠	٧	٣	٣	=	٣٥
	١١.٥	٧	٤	٣	=	٣٦
	٢.٢٥	٧	٥	٣	=	٣٧
	٢.٦٠	٧	٦	٣	=	٣٨
	٢.٩	٨	٧	٣	=	٣٩
	٢.٧٥	٩	٨	٣	=	٤٠

اسم المدرسة : يعقوب هاشـم المنطقة : الشميساني

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	الرقم الإحصائي	العمر	الطبقة	الجنس	الرقم المتسلسل
	٢.٤٩	١	١٣	٣	ذكر	٤١
	١.٩٥	٢	١٢	٣	=	٤٢
	١.٥	٣	١٢	٣	=	٤٣
	٢.٥٥	٤	١٢	٣	=	٤٤
	٢.٦٥	٥	١٢	٣	=	٤٥
	٢.٧٥	٦	١٢	٣	=	٤٦

	١.٣	٧	١١	٣	=	٤٧
	٢.٥	٨	١١	٣	=	٤٨
	١.٦٥	٩	١١	٣	=	٤٩
	١.٢٥	١٠	١١	٣	=	٥٠
	٠.٥٥	١١	١١	٣	=	٥١
	٠.٦٤	١٢	١٠	٣	=	٥٢
	١.٠٠	١٣	١٠	٣	=	٥٣
	١.١٥	١٤	١٠	٣	=	٥٤
	٠.٩٠	١٥	١٠	٣	=	٥٥
	٠.٥٥	١٧	١٠	٣	=	٥٦
	٠.٧٠	١٨	٩	٣	=	٥٧
	١.١	١٩	٩	٣	=	٥٨
	٠.٧	٢٠	٨	٣	=	٥٩

اسم المدرسة : الشميساني الغربي المنطقة: الشميساني

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل
	٢,٧١	١٠	١	٣	ذكر	٦٠
	٢,٣٥	٩	٢	٣	=	٦١
	١,٦١	٩	٣	٣	=	٦٢
	٣,١٢	٩	٤	٣	=	٦٣
	١,٢٥	٩	٥	٣	=	٦٤

	١,٤٢	٦	٦	٣	=	٦٥
	٠,٣٦	١٤	٢	٤	أنثى	٦٦
	١,٧٣	١٢	٧	٤	=	٦٧
	٣,٤٧	٦	٨	٤	=	٦٨
	٢,٥٠	١٢	١٠	٤	=	٦٩
	٠,٧٣	١٤	٤	٤	=	٧٠
	٢,٣٢	١٣	٥	٤	=	٧١
	١,٩١	١٠	١٤	٤	=	٧٢
	١,٢٣	١٢	١١	٤	=	٧٣
	٠,٩٣	١١	١٣	٤	=	٧٤
	٣,٨٦	٩	١٦	٤	=	٧٥
	٢,٧٤	٩	١٧	٤	=	٧٦
	٢,١١	٩	١٩	٤	=	٧٧
	١,٥٢	٩	٢١	٤	=	٧٨
	٢,٤١	٨	٢٢	٤	=	٧٩

اسم المدرسة : عائشة بنت طلحة الأولى المنطقة: وسط البلد

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل
	٣,٢١	١١	٢	٢	أنثى	٨٠
	٤,٢٥	١١	٤	٢	=	٨١
	٣.٨١	١٢	٨	٢	=	٨٢

	٤,١١	١٢	٦	٢	=	٨٣

اسم المدرسة :أروى بنت الحارث /المنطقة: وسط البلد

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل

	٦.٢٢	١٠	٢	٢	أنثى	٨٤
	٣,١٥	١٠	٣	٢	=	٨٥
	٢,٤١	٩	٥	٢	=	٨٦
	٤,٢٤	٧	١٧	٢	=	٨٧
	٣,١٢	٨	٧	٢	=	٨٨
	٨,٤٥	٨	٩	٢	=	٨٩
	٣.٠٠	٦	٢١	٢	=	٩٠
	٣,١٢	٧	١٣	٢	=	٩١
	٧,٥٢	٧	١٥	٢	=	٩٢
	٤,٢٤	٦	١٩	٢	=	٩٣
	٣,٥١	٦	٢٢	٢	=	٩٤
	٥,٢٤	٦	٢٤	٢	=	٩٥
	٢,١٦	٨	١١	٢	=	٩٦

اسم المدرسة : العبدلية /المنطقة: وسط البلد

الرقم المتسلسل	الجنس	الطبقة	الرقم الإحصائي	العمر/سنة	النتيجة/رصاص مكغم/١٠٠ملل	ملاحظات
٩٧	ذكر	١	٥	١١	١١,٤٥	
٩٨	=	١	٣	١٢	٤,٢٥	
٩٩	=	١	٧	١٢	٥,٢١	
١٠٠	=	١	٩	١١	٦,١١	
١٠١	=	١	١١	١١	٧,٢١	
١٠٢	=	١	١٣	١١	٦,٢١	
١٠٣	=	١	١٢	١١	١٣,١٥	ح١-بدون بديل
١٠٤	=	١	١	١٣	٦,٦٢	ح٢-بدون بديل

اسم المدرسة : عائشة بنت طلحة الثانية / المنطقة: وسط البلد

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل
	٤,٣١	١٠	١	١	ذكر	١٠٥
	٢,١٦	٨	١٠	١	=	١٠٦
	٧,٦٤	١٠	٣	١	=	١٠٧
	٦,٤٥	٩	٧	١	=	١٠٨
	١٣,٧٥	٩	٥	١	=	١٠٩
	١٢,٤٨	٦	١٢	١	=	١١٠

اسم المدرسة : سمير الرفاعي المختلطة / المنطقة: وسط البلد

الرقم المتسلسل	الجنس	الطبقة	الرقم الإحصائي	العمر/سنة	النتيجة/رصاص مكغم /١٠٠ملل	ملاحظات
١١١	أنثى	٢	٢٨	٩	٩,٢٥	
١١٢	=	٢	٣٤	٨	٨,٠٨	
١١٣	=	٢	٣٨	٧	٤,٧٣	
١١٤	=	٢	٣٢	٨	٥,٣٥	
١١٥	=	٢	٣٠	٩	٧.٧٠	
١١٦	=	٢	٢٥	١٠	٦,٨٣	
١١٧	=	٢	٢٣	١٠	٤,٨٧	
١١٨	=	٢	٢١	١٠	٥,٩٢	
١٢٠	=	٢	١٧	١٠	٦,٠٨	
١٢١	=	٢	١٩	١٠	٤.٤٠	
١٢٢	=	٢	١٥	١١	٤,٧١	
١٢٣	=	٢	١٣	١١	٥,٣	
١٢٤	=	٢	١٢ *	١١	٦,٢٠	ح- بديل(٣٦)
١٢٥	=	٢	١	١٣	٥,١	
١٢٦	=	٢	٥	١٢	٧,٧٠	
١٢٧	=	٢	١١	١١	٧,٧٠	
١٢٨	=	٢	٩	١١	٧,٨٠	
١٢٩	=	٢	٧	١٢	٣,٢٥	
١٣٠	=	٢	٣	١٢	٦,٩٠	

	٧.٠٠	٧	١	١	ذكر	١٣١
	٥,٨٠	٦	٣	١	ذكر	١٣٢
	٥,٣٠	١٠	٢٦	٢	أنثى	١٣٣
	٦,٨٠	٦	٦	١	ذكر	١٣٤
	٦.٣٣	٦	٨	١	ذكر	١٣٥

ملاحظات	النتيجة/رصاص مكغم /١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل
عينة زائدة	٦.٦٣	٨	٣٣	٢	أنثى	١١٩

اسم المدرسة : سمير الرفاعي الأساسية / المنطقة: وسط البلد

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل
	٩.٩٠	١٠	٦	١	ذكر	١٣٦
	٦.٦٠	٧	٢	١	=	١٣٧
	٦.٥٠	٨	٤	١	=	١٣٨
	٥.٦٠	١٠	٨	١	=	١٣٩
	٨.٤٠	١٠	١٠	١	=	١٤٠
	١٢.٥٠	١١	١٢	١	=	١٤١
	٧.٧٠	١١	١٥	١	=	١٤٢
	٧.٨٠	١١	١٧	١	=	١٤٣
	٨.٥٠	١١	١٩	١	=	١٤٤
	٤.٢٠	١٢	٢٣	١	=	١٤٥
	٤.٨٠	١٣	٢٨	١	=	١٤٦
	٧.١٠	١٣	٣٠	١	=	١٤٧
	٦.٨٠	١٤	٣٢	١	=	١٤٨
	١١.٩٠	١٤	٣٤	١	=	١٤٩
	٦.٨٠	١٢	٢١	١	=	١٥٠

	٧.٢٠	١٢	٢٥	١	=	١٥١

اسم المدرسة : سلمى بنت عميس / المنطقة: وسط البلد

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل
	٤.٥٠	٦	٣	١	ذكر	١٥٢
	٨.٢٠	٧	٥	١	=	١٥٣
	٧,٣٠	٧	٧	١	=	١٥٤
	٨,٣٠	٧	٩	١	=	١٥٥
	٥,٢٠	٨	١١	١	=	١٥٦
	٢٢,١٠	٩	١٨	١	=	١٥٧
	٧,٧٠	٨	١٦	١	=	١٥٨
	٣,٨٠	٨	١٣	١	=	١٥٩
	٤,٢٠	١٠	٢٠	١	=	١٦٠

اسم المدرسة : الأمير محمد الأساسية (١) المنطقة: وسط البلد

الرقم المتسلسل	الجنس	الطبقة	الرقم الإحصائي	العمر/سنة	النتيجة/رصاص مكغم/١٠٠ملل	ملاحظات
١٦١	ذكر	١	٢	٧	٢,٤٤	
١٦٢	=	١	٢٤	١١	١,٧٤	
١٦٣	=	١	١١	٩	٣,٩٠	
١٦٤	=	١	٣٠	١٢	٤,٨٠	
١٦٥	=	١	٣٢	١٣	٦,٨٠	
١٦٦	=	١	٣٤	١٣	٦,٣٠	
١٦٧	=	١	٤١	١٤	٣,٠١	
١٦٨	=	١	٤٣	١٤	٣,٩٠	
١٦٩	=	١	٤٥	١٤	٣,٨٠	

اسم المدرسة : المهاجرين / المنطقة: وسط البلد

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل
	٣,٦١	١٢	٦	٢	أنثى	١٧٠
	٣,٨٢	١٢	٤	٢	=	١٧١
	٠,٩٥	١١	٨	٢	=	١٧٢
	٢,٧٠	١١	١٠	٢	=	١٧٣
	٢,٠٦	١٠	١٢	٢	=	١٧٤
	١,٧٠	١٠	١٤	٢	=	١٧٥
	٢,٤٠	٩	١٦	٢	=	١٧٦
	٢,٧١	٩	١٨	٢	=	١٧٧
	٢,٧٣	٨	٢٠	٢	=	١٧٨
	٢,٢٥	٧	٢٤	٢	=	١٧٩

	٣,١٦	٦	٢٦	٢	=	١٨٠
ح – بديل(٢٢)	٢,٩٥	٧	٢٣	٢	=	١٨١
ح– بديل(٢)	٥,١٤	١٣	١	٢	=	١٨٢

العينات (رقم /٢,٢٢) - غير متوفرة

اسم المدرسة : بيت المقدس الأساسية / المنطقة : وسط البلد

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل
	٣,٣٨	٩	٢	٢	أنثى	١٨٣
	٢,٧٢	١١	١٣	٢	=	١٨٤
	١,٩١	١٠	٦	٢	=	١٨٥
	٢,٧٢	١٠	٨	٢	=	١٨٦
	١,١٠	١٠	٩	٢	=	١٨٧
	١,٦٠	١١	١١	٢	=	١٨٨
	١,٧٥	١١	١٥	٢	=	١٨٩
	١,٧١	١١	١٧	٢	=	١٩٠
	٢,٤٨	١٢	١٩	٢	=	١٩١

	١,٤١	١٢	٢٣	٢	=	١٩٢
	٢,١٣	١٢	٢٥	٢	=	١٩٣
	٣,٩٢	١٢	٢٧	٢	=	١٩٤
	٤,٩١	١٢	٢٩	٢	=	١٩٥
	٢,٦٨	١٢	٣١	٢	=	١٩٦
	٤,٤٥	١٣	٣٣	٢	=	١٩٧
	٢,٢٥	١٣	٣٥	٢	=	١٩٨
	٢,٧٣	١٢	٢١	٢	=	١٩٩
	٢,٢٠	١٠	٤	٢	=	٢٠٠
ح–بدون بديل	٠,٢٤	١٢	٢٨	٢	=	٢٠١

اسم المدرسة : صفية أم المؤمنين / المنطقة: وسط البلد

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل
	٢,٤٣	٦	٢	١	ذكر	٢٠٢
	١,٧٨	٧	٤	١	=	٢٠٣
	٣,٣٣	٧	٧	١	=	٢٠٤
	٢,٦٨	٦	٢	٢	انثى	٢٠٥
	٣,٨٦	٨	٤	٢	=	٢٠٦
	٤,٩٣	٨	٥	٢	=	٢٠٧
	٢,٩١	٨	٧	٢	=	٢٠٨

	٤,٢٢	٩	٩	٢	=	٢٠٩
	٣,٩٤	١٠	١١	٢	=	٢١٠
	٦,٢١	١٠	١٣	٢	=	٢١١
	٤,٤٦	١٠	١٤	٢	=	٢١٢
	٢,٧٣	١١	١٧	٢	=	٢١٣
	٢,٧١	١١	١٩	٢	=	٢١٤
	٣,٩	١١	٢١	٢	=	٢١٥
	٣,٤٢	١٢	٢٣	٢	=	٢١٦

اسم المدرسة : شفاء بنت عبد الله / المنطقة: وسط البلد

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل
	٢,٨٥	١٠	٢	١	ذكر	٢١٧
	١,٨٥	٩	٤	١	=	٢١٨
	٢,٧١	٩	٦	١	=	٢١٩
	٣,٣٤	٨	٩	١	=	٢٢٠
	٢,٥٩	٨	١١	١	=	٢٢١

	٣,٦١	٨	١٣	١	=	٢٢٢
	١,٧٢	٨	١٧	١	=	٢٢٣
	١,٩٠	٨	١٥	١	=	٢٢٤
	٥,٢٣	٧	١٩	١	=	٢٢٥
	٤,٦٣	٧	٢٤	١	=	٢٢٦
	٣,٢١	٧	٢١	١	=	٢٢٧
	٢,٢٦	٧	٢٦	١	=	٢٢٨

اسم المدرسة : الأمير محمد الأساسية (٢) /المنطقة: وسط البلد

ملاحظات	النتيجة/رصاص مكغم/١٠٠ملل	العمر/سنة	الرقم الإحصائي	الطبقة	الجنس	الرقم المتسلسل
	٣,٨٧	٧	٤	١	ذكر	٢٢٩
	٤,٧١	٨	٦	١	=	٢٣٠
	٣,٣٩	٨	٨	١	=	٢٣١

	١,٧٦	٩	١٣	١	=	٢٣٢
	٣,٩٣	٩	١٥	١	=	٢٣٣
	٣,٠٦	١٠	١٧	١	=	٢٣٤
	٣,١١	١٠	١٩	١	=	٢٣٥
	٥,٤٢	١١	٢١	١	=	٢٣٦
	٣.٠٠	١٢	٢٦	١	=	٢٣٧
	٥,٥٦	١٢	٢٨	١	=	٢٣٨
	٣,٦٣	١٣	٣٧	١	=	٢٣٩
	٤,٤٥	١٣	٣٩	١	=	٢٤٠
	٢,٥٩	١٤	٤٧	١	=	٢٤١
	٣.٦٤	١٤	٤٩	١	=	٢٤٢
	٢.٥٩	١٦	١٠	٣	=	٢٤٣

***(ح) تعني احتياط

10. ANNEXES

10.1 Annex (1)

10.2 Annex (2)

10.3 Annex (3)