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**Lead Poisoning Among Children in Northern  
Governorate, Gaza Strip**

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**Lead Poisoning Among Children in Northern**

**Governorate, Gaza Strip**

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## Abstract

Sources of lead exposure are various and different according to the country and place where the study took place. Many of hot points present in the Northern Governorate such as factories of lead batteries recycling, auto body repair shops, garages, stone kohl and others. Despite its bad effects on health yet, a few studies took place in Palestine to deal with such environmental and health problem. The study is aimed to determine the prevalence of lead poisoning among children in Northern Governorate of Gaza Strip, to assess the relationship between blood lead level of those children and related risk factors and to postulate recommendations for possible reduction of blood lead level. The study is cross-sectional with data collection via 232 questionnaire interview. The follow up study occurred after selection of 46 child randomly, then blood sample was drawn from each of the target children to measure their blood lead levels using lead care instrument at the Environmental Protection and Research Institute-Gaza (EPRI). The study took place in five primary health care clinics at Jabalia, Beit-Lahiya and Beit-Hanoun. The study population was 232 child visiting the above-mentioned clinics for treatment or follow up. Out of them 46 children were selected randomly for blood lead analysis. The response rate for filling the questionnaire was found to be 92.8%. Mean age of target children was  $51.3 \pm 13$  months, maximum age was 72 months, while minimum age was 27 months. The majority of children 37 (80.4%) were found to have BLL below  $5 \mu\text{g}/\text{dl}$ . Those have BLL between  $5-9.9 \mu\text{g}/\text{dl}$  were 8 (17.4%), Only one child (2.2%) was found to have BLL of  $13 \mu\text{g}/\text{dl}$ .

Elevated BLL of children was found to be significantly associated with some occupational exposures of the child sponsor such as removal of paint or varnish while inhabitants still in the dwelling, working in Brass/Copper foundry work or plating, renovating homes and soldering electric parts. Other occupational exposures such as lead batteries recycling work, auto body repair work, plumbing and pipefitting and house spraying or spray painting have no significant correlation with the elevated blood lead level.

Child habits like sucking fingers, eating soil or dirt and biting own nail were also shown to be correlated significantly with their elevated blood lead level.

Other habits like putting toys in children's mouth, eat or play with newspaper or magazines and play with jewelry, bullets, fish sinkers or electronic items were found to have no significant association with elevated blood lead level.

On the bases of the current results many recommendations could be postulated hoping that they may help to reduce the hazards of lead exposure to our children.

## الملخص العربي

### تسمم الأطفال بالرصاص في محافظة الشمال - قطاع غزة

يهدف هذا البحث إلى دراسة تسمم الأطفال من عمر سنتين و حتى ست سنوات بعنصر الرصاص في محافظة شمال قطاع غزة. و تجدر الإشارة إلى أن مصادر التعرض للرصاص كثيرة و متنوعة بتنوع البلد و المكان الذي تتم فيه الدراسة. ففي قطاع غزة هناك بؤر عديدة من المحتمل أن تكون مصادر لتعرض الأطفال للرصاص مثل: ، مصانع تعبئة البطاريات و إعادة استخدامها، الكراجات، وورش تصليح هياكل السيارات كحل الحجر و غيرها. و بالرغم من خطورة التعرض للرصاص فان القليل جدا من الأبحاث تمت لدراسة تلك المشكلة في فلسطين. و الباحث هنا يأمل أن يسלט الضوء علي تلك المصادر لتجنب أطفالنا خطر التعرض للرصاص و الدراسة تهدف إلى تحديد مدى انتشار التسمم بالرصاص بين الأطفال في محافظة شمال قطاع غزة - تقييم العلاقة بين مستوي الرصاص في دم الأطفال و العوامل ذات العلاقة بالتعرض للرصاص ، و من ثم إيجاد طرق للوقاية و تقديم التوصيات اللازمة لتقليل الآثار الصحية و البيئية الناتجة من التعرض لمادة الرصاص.

الدراسة دراسة وصفية تحليلية و قد تم استخدام 232 استبيان مع المقابلة الشخصية كأداة لجمع المعلومات و بعدها تم اختيار 46 طفلا عشوائيا لتحليل عينات الدم لهم بواسطة جهاز التحليل في معهد أبحاث و حماية البيئة. و تمت الدراسة في عيادات الرعاية الأولية وعددها 5 في كل من جباليا و بيت لاهيا و بيت حانون. عينة الدراسة تضم مائتين و اثنين و ثلاثين طفلا 232 من بين الأطفال الذين يترددون علي عيادات الرعاية الأولية بالمناطق المذكورة . كانت نسبة الاستجابة للمء الاستبيان 92.8% و كان المتوسط العمري "  $51.3 \pm 13$  شهرا ' و قد بلغ عمر أكبر الأطفال سنا 72 شهرا و أصغرهم 27 شهرا. و أظهرت النتائج أن طفلا واحدا و بنسبة 2.2% كان مستوي الرصاص في دمه أعلي من 10 ميكروجرام /100سم<sup>3</sup> و كان مستوي الرصاص في دم أغلبية الأطفال 37 (80.4) % أقل من 5 ميكروجرام / 100سم<sup>3</sup> بينما كان 8 أطفال و بنسبة (17.4%) ذوي مستوي رصاص يتراوح ما بين 5.9 - 9 ميكروجرام / 100سم<sup>3</sup> .

لقد وجد أن مستوى الرصاص المرتفع في دم بعض الأطفال له علاقة ملحوظة ببعض ما يتعرض له أولياء أمور هؤلاء الأطفال أثناء عملهم والتي تشمل إزالة الطلاء عن الدرجات أو المواد الخشبية بينما سكان البيوت لا يزالون في بيوتهم و العمل في سباكة النحاس الأصفر أو الأحمر و تجديد البيوت و لحام القطع الكهربائية بينما المهنة الأخرى مثل صنع البطارية الرصاصية و إعادة تصنيعها ، تصليح رادياتور السيارات، تصليح هيكل السيارات ، السباكة أو تمديدات المواسير و أعمال الطراشة و الدهان ليس لها علاقة ملحوظة بمستوى الرصاص في دم الأطفال. كما أن بعض العادات لدى الأطفال كمص الأصابع ، أكل التراب و قرض الطفل لأظافره لها علاقة ملحوظة بمستوى الرصاص المرتفع في دمائهم. بينما بعض العادات الأخرى مثل وضع دمي أو أجسام مطلية في فم الطفل ، أكل أو اللعب بالجراند أو المجلات ، و اللعب بالمجوهرات أو طلاقات الرصاص أو ثقالات شبك صيد الأسماك أو أية إلكترونيات ليس لها علاقة ملحوظة بمستوى الرصاص في دم الأطفال.

و لقد أماطت تلك الدراسة اللثام عن الأهمية القصوى لتجنيد أطفالنا خطر التعرض للرصاص من أجل تقليل - إن لم يكن التخلص كلية - من أخطار التعرض والتسمم بالرصاص و الذي يصيب جميع أجهزة الجسم ، مما يتسبب بخسائر مادية و اقتصادية وصحية كبيرة.

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# Chapter (1)

## Introduction

Lead poisoning can have serious and even fatal consequences at any age, but young children are especially vulnerable. Lead is an environmental toxicant that may deleteriously affect the nervous, hematopoietic, endocrine, renal, and reproductive systems (ATSDR, 1993). Lead exposure in young children is particularly serious because children absorb lead more readily than do adults and because the developing nervous systems of children are more susceptible to the effects of lead. Blood lead levels as low as 10µg/dl can adversely affect the behavior and development of children (CDC, 1991). Permanent effects on physical, behavioral and cognitive development may result

Lead is a normal constituent of the earth's crust, with trace amounts found naturally in soil, plants, and water. If left undisturbed, lead is practically immobile. However, once mined and transformed into man-made products, which are dispersed throughout the environment, lead becomes highly toxic. Solely as a result of man's actions, lead has become the most widely scattered toxic metal in the world. Unfortunately for people, lead has a long environmental persistence and never loses its toxic potential, if ingested. The lead dispersed through gasoline exhausts, smelter emissions and peeling paint, etc. never fully disappears from our environments nor has man evolved a good biological system to offer any protection from it. In the course of evolutionary time, the global contamination of this highly toxic metal into man's environment has been a very short and recent period (Herbert, 1998).

## **Justifications**

Lead is environmental contaminant that threatens the health of all children.

Lead poisoning remains the most common and societal devastating environmental disease of young children.

Children are exposed to lead from multiple sources such as paint, gasoline, solder, batteries and stationary sources via multiple pathways such as air, dust, dirt, water and food.

Millions of US children from all geographical areas and socioeconomic strata have blood lead level high enough to be associated with adverse health effects (ATSDR, 1988).

A study carried out in EPRI revealed that 17.2% of the children sampled in Gaza Strip had BLL  $>10\mu\text{g/dl}$ , the source of lead contamination was the neighboring battery plant (Choudari et al., 2002 and Safi et al., 2003).

## **Aim of study**

To study lead poisoning among children in Northern Governorate-Gaza Strip and risk factors among them.

## **Objectives**

The present work is aimed to:

- 1) Find out environmental sources of lead that may contribute in increasing blood lead level of children
- 2) Assess blood lead level of children in North Governorate -Gaza Strip.
- 3) Declare the association between blood lead level and different factors and habits that contribute in blood lead increase.

## Research Questions

- Is lead exposure a real threat to children in Northern Governorate?
- Is blood lead level a real problem in Northern Governorate?
- Is BLL among children in Northern Governorate similar to that reported in the Literature particularly in the developing countries?
- Which risk factors is a potential one for elevated BLL?
- Does child habit and behaviour associate with elevated BLL?
- Does parents' occupation participate to elevate their children BLL?

## Operational Definition

The most current CDC guidelines (October 7, 1991) set the lead poisoning at a confirmed blood lead level greater than or equal to 10 µg/dl.

## Context of the study

The Gaza Strip is a narrow band of desert -like land along the eastern Mediterranean coast. It lies along Egypt south and Mediterranean Sea West. It is about 45 km long and 6.5 to 12 km wide( Benvensti and Khayat, 1990). It was apart of the British Mandate of Palestine from 1917-1948. Gaza Strip was under the control of Egypt after the Arab-Israeli war in 1948. Israel occupied it as a sequent of the Six- Day war (Benvensti and Khayat, 1990). There are five districts in Gaza strip: North, Gaza, Mid zone, Khan-Younis and Rafah.

The population in Gaza Strip has been estimated to be 1,196,591, out of which 603,615 (50.4%) are males, (49.9%) Of Gaza Strip population are under 15 years and (19.6%) of them are under 5 years old, (Ministry of Health, MOH, 2002).

The birth rate in Gaza Strip was found to be 28 per thousand, the infant mortality rate is 22.9 ‰ and the population growth is around 2.6% (MOH, 2002).

## Chapter (6)

### Conclusion and recommendations

#### Conclusion

A cross sectional study was undertaken in Northern Governorate of Gaza Strip: Jabalia, Beit Lahyia and Beit Hanoun primary health care clinics. The aim was to determine the prevalence of lead poisoning among children aged 2-6 years and to test if there is a relationship between blood lead level of selected children and related risk factors as well as to introduce recommendations for the decision makers.

A total number of 232 child was included in the study, their mean age was  $51.3 \pm 13$  months, with maximum of 72 months and minimum of 27 months. Out of them 46 children were chosen randomly to evaluate their blood lead level. Half of children were males, 56.5% of children have BLL less than  $3 \mu\text{g/dl}$ , 11 (23.9%) have BLL between  $3-4.9 \mu\text{g/dl}$ , 8 (17.4%) of them were found to have BLL between  $5-9.9 \mu\text{g/dl}$  and only one child showed BLL of  $13 \mu\text{g/dl}$ .

Elevated BLL of children was found to be significantly associated with some occupational exposures of the child sponsor such as removal of paint or varnish while inhabitants still in the dwelling, working in Brass / Copper foundry work or plating, renovating homes and soldering electric parts. Other occupational exposures such as lead batteries recycling work, auto body repair work, plumbing and pipefitting and house spraying or spray painting have no significant correlation with the elevated blood lead level.

Child habits like sucking fingers, eating soil or dirt and biting own nail were also shown to be correlated significantly with their elevated blood lead level. Other habits like putting toys in children's mouth, eat or play with newspaper or magazines and play with jewelry, bullets, fish sinkers or electronic items were found to have no significant association with elevated blood lead level.

The study identified the possible sources of lead exposure for our children and the ones in relation to their blood lead level.

Control of lead exposure in developing countries will require additional efforts to properly target interventions to account for the particular condition in which exposure takes place. Further research will be needed to identify sources of lead and the populations at risk of exposure. Interventions will need the allocation of financial resources to support targeted screening activities, educational programs and regulatory and enforcement actions. Interventions will also require identification and engaging of different stakeholders. The identification and engagement of stakeholders is a key activity for any intervention development. Decisions that are made in collaboration and with the active participation of stakeholders will be more effective.

## **Recommendations**

Lead is a poison that affects virtually every system in the body. It is particularly harmful to the developing brain and nervous system of children. The risks of lead exposure are well known from previous studies of children themselves and are not extrapolated from data on laboratory animals or high-dose occupational

exposures. Concerning strategies to eliminate lead poisoning, effort must be based on six principles of action, namely; **prevention, interdisciplinary approach, coordination at all levels, public awareness and community involvement, priority based research, and life cycle management.** On the light of results emerged from our study, the following recommendations are postulated:

**1-** Educational and awareness programs to be introduced to child sponsors about sources of lead, risk factors of lead exposure and its impact on human health.

**2-** Public awareness on hazards of lead poisoning is an important element of the environmental protection process, so the decision-makers can put that vital issue in consideration and conduct programs to cover all levels of personnel.

**3-** Children are preferable to be kept away from areas of the home where lead-related materials are used, home renovation should take place while inhabitants are out side the home.

**4-** Lead-exposed householders are adviced take bath at work site whenever possible, should take off their shoes, wash up completely and take off contaminated clothing before entering the home. The lead-exposed laundry should be washed separately from regular family laundry.

**5-** Parents can lower the possibility of children swallowing paint chips by not allowing their children to chew or mouth these painted surfaces.

**6-** Parents are invited to keep an eye on children while playing outside home against possibility of lead exposure, to establish sport yards as much as we can to give our children a chance to play in safe places.

**7-** It is suitable to establish Petrol stations as well as auto radiator repair workshops far away from the dwelling zone. Car and battery repair can be performed in garages not in house yard. Unleaded gasoline should be used to reduce lead from automobile exhaust emissions.

**8-** Use of traditional and folk remedies as stone kohl for both child and mother can be avoided.

**9-** Use of ceramic-ware bottles, wrapping sandwiches with newspapers or magazines not recommended. Wash children hands frequently before eating or handling food is recommended.

**10-** Health professionals, in conjunction with Ministry of Health and other health agencies should help develop risk assessment questionnaires that supplement the standard questions recommended by the CDC.

**11-** Suitable treatment to children with blood lead levels greater than 25 µg/dl to be provided. Nutritional control should be practiced to supply calcium, iron and vitamin C to food children whenever necessary in order to decrease lead absorption.

**12-** Further research is needed for blood lead level analysis for all Palestinian children aged 2-6 years mainly those at risk for lead exposure.