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Effect of Traffic on Lead Absorption Among Children

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تأثير حركة المرور على مستوى امتصاص الرصاص عند الاطفال

الخلاصة:

تم اختيار ٢٢٠ طفلا (٦-١٢ سنة) من مدارس مركز مدينة بغداد التي تتميز بالكثافة المرورية العالية لغرض قياس مستوى الرصاص في الدم وفعالية انزيم (ALAD)، كما تم قياس تراكيز الرصاص في هواء المدارس المشمولة بالدراسة. لقد اجريت الدراسة لمعرفة مستوى امتصاص الرصاص (المنبعث من عوادم المركبات) عند اطفال مركز مدينة بغداد. لقد بينت الدراسة وجود ارتفاع معنوي في مستوى الرصاص وانخفاض معنوي في فعالية انزيم (ALAD) في دم الاطفال في مركز مدينة بغداد مقارنة بـ ٩٦ (٦-١٢ سنة) من مدارس منطقة ريفية (مجموعة سيطرة) حيث كثافة المرور واطئة جداً. الدراسة بينت ايضا ان مستوى الرصاص في دم الاطفال القاطنين مركز مدينة بغداد لم يتطابق مع بعض المواصفات المعتمدة للمستوى الطبيعي وكذلك كانت فعالية انزيم (ALAD) دون المستوى الطبيعي.

SUMMARY:

Two hundreds and twen.., children living in Baghdad center who were exposed to high traffic density were examined for blood lead level (pb- B), and erythrocytes aminoleveulinic acid dehydratase activity (ALAD). In addition atmospheric lead concentration (pb- A) was measured. The study was carried out to evaluate the effect of traffic on lead absorption among children.

The findings revealed that these children had significantly higher pb- B ($p<0.01$) and lower ALAD($p<0.001$) in comparison with a group of 96 children living in the Baghdad rural areas where the traffic density was extremely low. The findings also showed, that pb- B for children living in the city center had exceeded some of the recommended permissible limits.

INTRODUCTION:

Lead is ubiquitous in nature; air, soil and water. A progressive slow increase of lead concentration in the biosphere had associated industrialization. It was followed by the most rapid rise in the twentieth century, due to the introduction of lead derivatives into the gasoline.

Unfortunately children are particularly sensitive to poisoning,[1-4], Marlowe[5] believed that childhood exposure to lead routinaly encountered in the environment for below those associated with clinical symptoms, is associated with a spectrum of behavioral alterations. These involve Psychometric intelligence, auditory, visual and language processing. fine motor performance, quantitative electroencephography and classroom behavior. Urban children are at high risk. Lead released into the air from automobile exhaust is thought to be responsible for increased lead absorption in these children, especially children living near the major road ways[6,7]. Therefore the present study was carried out to evaluate the effect of traffic on the lead absorption among children living in the center of Baghdad City.

MATERIAL AND METHODS:

Two hundred and twenty elementary school children (132 male and 88 females) ranging in age from 6 to 14 years were choosen for the purpose of this study. Children whose residence were far from the school, or those with a history of personal or family exposure to lead were not included. Children were selected from five areas including Al- Rashad Street (No=72), Al- Kifah Street (No= 40), Al- Kholafa Street (No= 48), Al- Saadoon Street (No= 36) and Haifa Street (No= 24). These areas were characterized by high traffic density and congestion.

A comparative group of 96 children (48 males and 48 females) was investigated in the Baghdad rural areas where the traffic density is extremely low. These were Al- Madin (No = 24), Al- Tarmiah (No = 24), Al- Yousfiah (No = 24) and Al- Rashdiah (No = 24).

Five ml of blood specimens were obtained by venipuncture. The samples were transferred into disposable heparinized tubes for pb- B, and ALAD determination. Road side environment air samples were collected for determination of pb- A from the same schools investigated. Low flow- rate static sampler with maximum flow rate of 6 m^3/24 hrs. was used.

Blood lead analysis was done by using Pye Unicam Atomic absorption flame spectrophotometer[8]

All samples were run in duplicates and the mean values were used. ALAD in whole blood was estimated by the recommended colorimetric method of Burch and Siegel 1971[9]

Student's t-test was used to find the statistical difference between two means[10]. The correlation coefficients (r) were used to find the correlation between different parameters studied[11].

RESULTS:

The mean pb- B and ALAD of children living in the center and rural areas with the **pb-A** of these areas are shown in Table I. pb- B was significantly higher in children of Baghdad center ($p<0.01$) than in the children of rural areas while the ALAD was significantly lower ($p<0.001$). The mean atmospheric lead concentration was significantly higher in the center than that in the rural areas ($p<0.001$).

The frequency distribution of pb- B and ALAD are presented in Fig. 1 and 2. They show that 83% of children living in the center had pb- B between 10- 20 ug/ 100 ml while 33% of children living in rural areas had pb- B between 10- 20 ug/ 100 ml. The ALAD was between 100- 200 u/ ml RBC in 93% of the children living in the center while 1% only of the children living in rural areas had ALAD between 100- 200 u/ ml RBC.

A significant negative correlation was found between ALAD and pb- B in

Table 1. Mean values of blood lead levels (pb-B)) and & - aminoleveulinic acid dehydratase (ALAD) in children and atmospheric lead concentration.

		pb.B (ug/100 ml)		ALAD (u/ml RBC)		pb.B (ug/m 3)		No. of air sample
Area	No	Mean	SD	Mean	SD	Mean	SD	
Baghdad Center	220	15.8 ±	4.5	158 ±	28	5.8 ±	0.77	6
Baghdad rural	96	8.8 ±	2.0	246 ±	33	0.4 ±	0.06	4
P		<0.01		<0.001		<0.001		

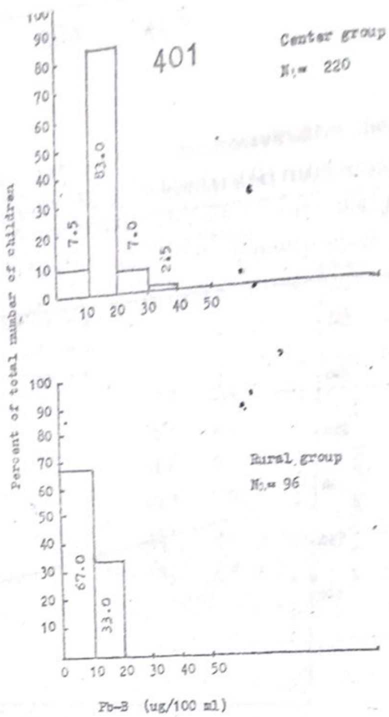

Fig. 1- Frequency distribution of blood lead le' al for elementary school ch:idren living in Baghdad center and rural areas.

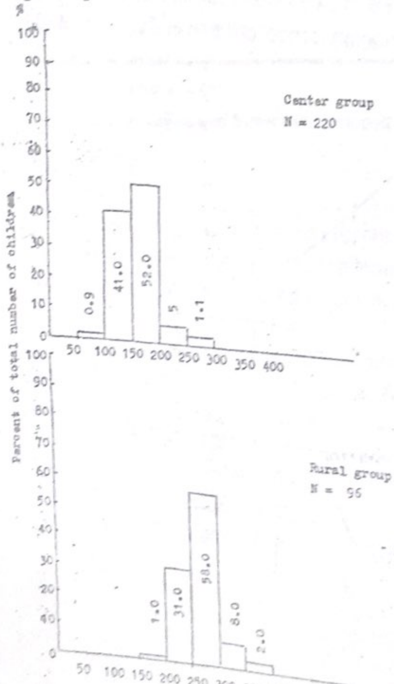

Fig. 2- Frequency distribution of - aminoleveulinio- acid dehydratase activity for elementary school children living in Baghdad center and rural areas.

children living in Baghdad center (r 0.37, p 0.01). A similar correlation was found (r 0.56), p 0.01) for children living in the rural areas, (Fig 3 and 4). No significant difference in the mean pb B and ALAD was found between the groups of children from different schools in Baghdad center or rural areas, (Table 2)

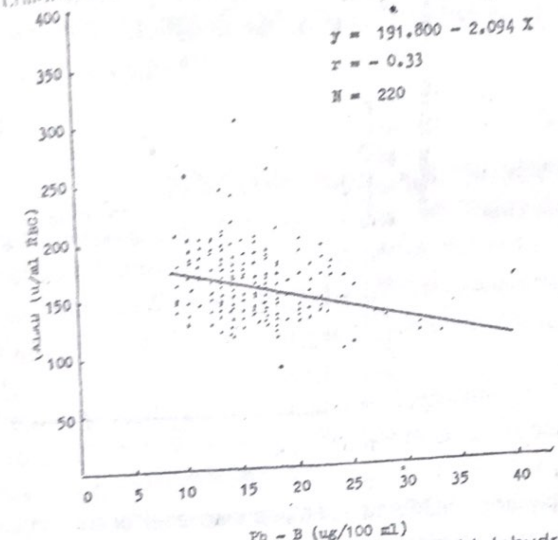

Fig. 3- Relationship between - aminoleveulinic acid dehydratase activity and blood lead level for elementary school children in Baghdad center.

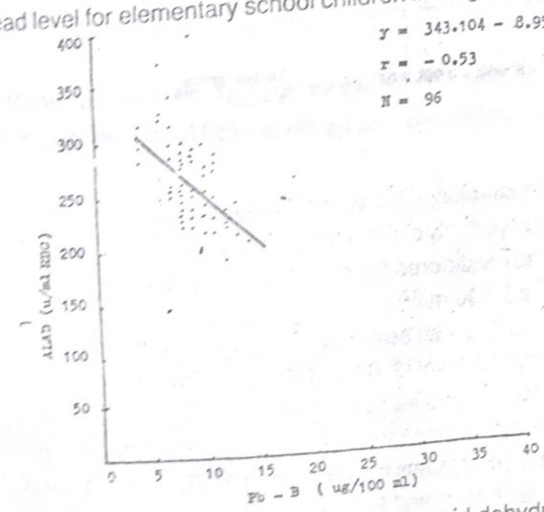

Fig. 4- Relationship between - aminoleveulinic acid dehydratase activity and blood lead level for elementary school children in Baghdad rural areas.

Table 2. Blood lead level and -aminoleveulinic acid dehydratase in children from different schools in center and rural areas.

Area	No	pb B (ug/ 100 ml) Mean	SD	ALAD (U/ml RBC) Mean	SD
Baghdad center					
Al-Rashed - 1*	24	15.3	2.4	169	23
Al-Rashed - 2*	48	15.1	4.5	155	20
Al-Kifah	40	15.8	2.2	155	26
Al-Saadoun	36	14.7	5.3	162	34
Al-Kholafa	48	15.1	3.8	150	33
Hifa	24	16.7	2.9	171	18
P		>0.05		>0.05	
Baghdad rural					
Al-Madien	24	10.0	1.8	244	29
Al-Tarmiah	24	8.2	1.4	284	31
Al-Yousfiah	24	8.4	1.2	261	34
Al-Rashdiah	24	7.4	2.1	266	24
P		>0.05		0.05	

* **Two schools in Al-Rasheed Street were included in the study.**

DISCUSSION:

For proper interpretation of the present results, three criteria were considered to assess the acceptability of the detected pb- B levels. The center for Disease Control (CDC) has considered the current definition of an elevated pb- B level in children as < 25 ug/ 100 ml[12].

In the present study, it has been found that 8 out of 220 children living in the center had elevated pb- B level (3. 6%) while none of the children living in Baghdad rural areas showed elevated pb- B level.

In 1977 the European Economic Communities (EEC)required that 50% of children should have pb-B levels not exceeding 20 ug/ 100 ml, 90% with levels not exceeding 30 ug/ 100 ml and 98% with levels not exceeding 34 ug/ 100 ml [13]. In Baghdad center, 83. 6% of children investigated had pb- B levels not exceeding 20 ug/ 100 ml., 99. 6% levels not exceeding 30 ug/ 100 ml and 100% not exceeding 35 ug/ 100 ml while in Baghdad rural areas 100% of children showed pb- B levels not exceeding 20 ug/ 100 ml. The 1978 Judgement of the Environmental Protection Agency (EPA) has considered the maximum safe mean pb- B for a population of young children to be 15 ug/ 100 ml and that at this level 99. 5% of children would be below 30 ug/ 100 ml[13]. Our findings showed that the mean pb- B level was 15. 8 ug/ 100 ml and 98. 1% of the children were below 30 ug/ 100 ml in Baghdad center against 8.8 ug/ 100 ml and 100% of children below 30 ug/ 100 ml in Baghdad rural area. This presentation indicates that the pb- B for children living in the center did not fulfil two of three createria reported above.

The values of ALAD were correspondent to the pb- B levels obtained in these children. U. S. CPA[14] reported that the inhibition of ALAD starts at pb- B of 10 ug/ 100 ml. Our findings confirmed that and showed a significant inverse correlation between the mean ALAD and pb- B in both groups of children (center and rural). Morever, Zelhius and Verberh[15] considered 50% reduction in ALAD as an indication of lead toxicity. In the present study only one child living in Baghdad Center, showed such low percentage of reduction (62 u/ ml RBC).

Regarding lead in air, the EEC has proposed a monthly median level of pb- A not more than 8 ug/ m^3 in areas particularly exposed to motor traffic i.e. near a motor way[13].

The mean pb- A in Baghdad center was 5.9 $\pm$ 0. 77. These level was lower than that proposed by the EEC. But, it should be mentioned that in the present study the static sampler used for pb- A estimation operated continously for 3 days and therefore our results did not represent a monthly median level. However it must be stressed that adults exposed to such pb- A for only few hours (such as traffic men or taxi drivers) might not be affected greatly while residents of the center who spend the whole day exposed to such concentration (especially children) may be at real risk. The lower levels of pb- A in Baghdad rural areas (0.44 $\pm$ 0.07) were approximate to the values obtained in non urban areas (1-3 ug/ m^3) or most cities covered by National Air Surviellance network[16]. This finding clearly indicates that the traffic in Baghdad city is the major cause of atmospheric pollution with lead. The elevated pb- B among elementary school children living in the center in comparison to those living in rural areas emphasised this finding. Both groups of children have the same source of water supply and similar pattern of food habits and in both areas there were no industrial sources of lead pollution. To maintain an acceptable blood lead level for children living in Baghdad center, we recommend either the use of lead free gasoline or the surviellance network.

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