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Lead levels in milk samples of lactating mothers in Al –Muthanna province in Iraq

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Abstract
The objective of this study was to assess the levels of lead (Pb) in the human milk samples of healthy lactating women who were living in Al- Muthanna province in Iraq and to investigate the effect of region (urban and rural) and mother's age on the Pb concentration. Pb levels were measured by flame atomic absorption spectrometry. The total samples were 70 milk samples at different stages of lactation) from 5 days to 56 weeks postpartum). Pb levels of milk samples were found to be (6 .81 ± 1.31) µg/dl. The concentrations of Pb in human milk of lactating women in urban areas were higher than rural areas. There was a positive correlation between the concentration of lead in milk samples and mother's age ($P < 0.05$). Considering the high level of Pb in breast milk in this study, it is important to identify the possible sources of this heavy metal in maternal environment.

Introduction:-
Lead (Pb), a known toxic element, is a public health problem due to its adverse effects, mainly those affecting the central nervous system in the most vulnerable populations, such as pregnant, lactating women, and children. In the absence of a safe exposure limit of children to Pb and because of its ability to accumulate in the body for a long time, a great interest in the evaluation of the adverse effects of this metal in low concentrations has emerged (Schnaas,2006; Dursun,2008). Multiple health effects have been associated with Pb exposure, including systemic effects (e.g. gastrointestinal effects,

anemia, hypertension and hearing loss), effects on the nervous system (e.g. on behavior and cognition), on development, and on the reproductive system, as well as genotoxicity, carcinogenicity and social effects (ATSDR, 1999).

Dietary sources of breast milk serve as primary sources of calories and nutrients in infants and children. Human breast milk is recommended as the exclusive food for the first 6 months of life, and continuing, along with safe, nutritious complementary foods, up through 2 years (Heinig, 1998; Gartner *et al.,* 2005), but unfortunately also a route of excretion for some toxic substances including Pb. Pb reaches into breast milk through passive transfer; this depends on three major characteristics: polarization of the chemical at body pH, lipid solubility, and molecular weight (Robert, 1994; Chen *et al.,*2006).The daily permissible intake estimated by Namihira *et al.* (1993) for infant is 5 µg/kg/day of breast milk .

Materials and Methods:-

Samples collection:-

Seventy milk samples which were obtained from healthy lactating mothers whose infants were inpatient in Al-Samawah feminine and children teaching hospital of Al-Muthanna province in their reproductive age ranged between 14-40 years, with different period, of lactation ranging from 5days to 21months. Samples were grouped based on region of urban samples vs. rural samples and age < 25 years samples vs. ≥ 25 yearssamples.The breast milk samples were obtained by manual suckling between 10 Am and 11 Am during the day. The mothers provided 3 ml of milk directly into sterilizedtubes. All samples were frozen immediately after collection and kept at (−20 °C) until they were analyzed.

Determination of lead (Pb) concentration:-

Breast milk samples (0.5 ml) taken for the analysis wastransferred into sterilized beaker. Three milliliters of 65 % nitric acid (HNO3) and 0.5 ml of 30 % hydrogen peroxide (H_2O_2) were added on to the samples and digested in a microwave. The digested samples were quantitatively transferred and diluted to 5.0 ml with triply

distilled water.The concentrations of lead were determined by using flame atomic absorption spectrometry (FAAS) (Gürbay *et al.,* 2012).

Statistical analysis:-

Statistical analysis was carried out using SPSS/20 (statistical package of social system). all quantitative data were analyzed using the analysis variance (ANOVA). (F-test) was used for comparison between averages of the data at values of $P < 0.05$(Oqaili & Samer, 1998).

Results and discussion:

The lead (Pb) concentrations in 70 human milk samples are presented in table (1). The means ± standard deviation (SD) of Pb concentrations in human milk was 6 . 81 ± 1.31µg/dl with range 3.24 - 10.12µg/dl.

The current study revealed that the mean of Pb concentrations in human milk in this study **was higher than the** acceptable Pb levels (0.2 - 0.5µg/dl) as reported by world health organization (WHO) (WHO,1989).Also it was higher than other results of previous studies reported elsewhere. In the Saudi Arabia **the mean levels of Pbwere3.167** µg/dl (Al-Saleh *et al.,* 2003).**In Iran the mean Pb level was**1.03 ± 0.47 µg/dl **(**Rahimi *et al.,* **2009).**

However, the **mean of Pb level in this study** was similar to that found in Mexico) 6.18(µg/dl)Namihira *et al.,*1993(.On the other hand, in many studies, it has been found that breast milk Pb levels were higher than the above-mentioned values. Among these, Guidi *et al.* (1992) reported that the **mean Pb level** as 12.6 µg/dl and high levels found in Turkey (39.14±26.90) µg/dl (Gürbay *et al.,* 2012).

These broad variations in breast milk Pb levels might have originated from environmental,geographic, nutritional, occupational conditions, and individual habits including cosmetics used as well as analytical and instrumental factors. It has been informed that long-term exposure of a mother to contaminated environments causes mobilization of Pb from skeletal stores(Gulson *et al.,* 1998).

This high figure reported by the present study, gives as clue that there are innumerable sources of

Pb in our environment and it's difficult to avoid exposure to lead (Yaish *et al.*,1993),leaded petrol driven vehicles of the main sources of Pb **pollution in the environment (Al-**Naimi, 1984). There are also other sources of lead pollution in Iraq, which included battery industry, printing presses and paints **(Hana & Bassam, 1983;** Kanboor & Yas,**1985), this emission not only pollute air, but also settled on soil and in buildings, where people come into contact (Oskarsson *et al.*, 1996), since all the above mentioned countries prohibited the use of leaded gasoline for more than a decade , also their strong industrial legislation and safety program made the occupational source of exposure to lead and environmental exposure much less than before (WHO,1993).** The sources of Pb exposure are numerous; ceramic and pottery glazed with lead, electronicworks welding and soldering, jewelry making and repairing, certain hair dyes, automobilerepairs etc. (ATSDR, 1999).

Table(1): lead concentrations (µg/dl) in human milk from lactating
women

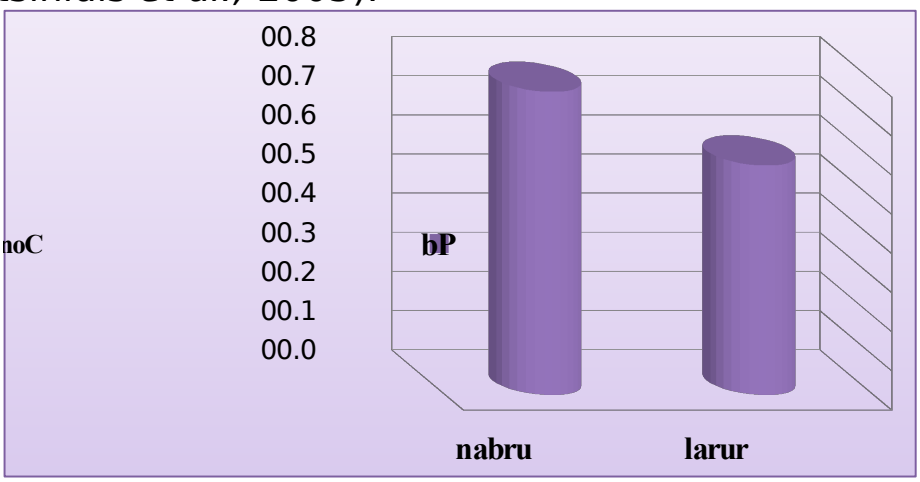
	No	**Pb Mean ± SD in µg/dl(range)**
Region		
Urban	35	7.75±0.99 (6.58 – 10.12)
Rural	35	5.87±0.81 (3.24 – 7.15)
Age		

< 25 years	35	6.28±1.08 (3.24 – 7.50)
≥ 25 years	35	7.33±1.32 (5.69 – 10.12)
Total	70	6.81 ± 1.31 (3.24 – 10.12)

Regarding, theresults of groupcomparison classified according to region and mother's age and relation to Pb content in human milk were presented in table (1). In the presentstudy, the mean concentration of Pb in human milk of lactating women in urban areas was higher than rural areas as shown in figure (1). This difference was statically significant at ($P < 0.05$).

This rise in urban areas may be due to the higher pollution sources included higher in traffic emission (vehicle exhaust particles, tire wear particles, weathered street surface particles, brake lining wear particles), industrial emission (power plants, coal combustion, metallurgical industry, auto repair shop, chemical plant, etc.), domestic emission, waste disposal, a weathering of building and pavement surface(Zhou *et al.,*2008; Faiz *et al.,*2009).

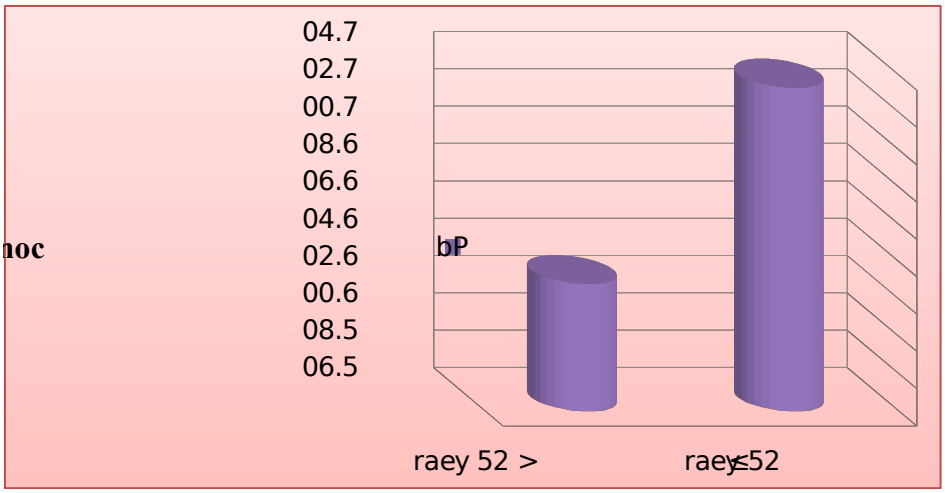
The previous studiessupported the view that women living in the urbanareas with heavy road traffic and industrial activity have Pb concentrations higher than women leaving in rural areas (Younes *et al.,*1995; Frkovic *et al.,* 1997; Leotsinidis *et al.,* 2005).



Figure(1): Concentration of Pbµg/dl in human milk according to region.

In the present study, the mean concentration of Pb in women aged < 25 years was lower than women aged ≥

25 yearsas shown in figure (2),may be due to bioaccumulative features of lead (Dorea, 2004). This difference was statically significant at ($P < 0.05$).
Younes *et al.* (1995) reported that the Pb concentration was significantly lower in milk samples obtained from mothers aged < 20 years compared to mothers aged > 36 years, Rahimi *et al.* (2009) reported that the mean concentration of Pb in women age < 30 years was lower than women aged > 30 years.



Figure(2):Concentration of Pb µg/dl in human milk .according to mothers'age

Conclusion:-

- It was found that Pb level was above the acceptable Pb levels that reported by (WHO).
- The mean concentration of Pb in human milk of lactating women in urban region was higher than rural region.
- A positive association was found between Pb and age.

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مستوى الرصاص في حليب الأمهات المرضعات في محافظة المثنى في العراق

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الخلاصة
هدفت الدراسة الحالية للكشف عن مستويات الرصاص في عينات الحليب البشري من النساء المرضعات الاصحاء اللاتي يعشن في محافظة المثنى في العراق ومعرفة تأثير المنطقة (الريف والحضر) وعمر الام على تركيز الرصاص. حيث تم قياس مستوى الرصاص بواسطة جهاز الامتصاص الذري الطيفي أللهبي في 70عينة من الحليب في مراحل مختلفة من الرضاعة من 5أيام إلى 56أسبوع بعد الولادة. اذ وجدت الدراسة بأن مستويات الرصاص في عينات الحليب كانت 6 .81 ± 1.31µg/dl.حيث أكدت الدراسة على ان تركيز الرصاص في عينات الأمهات اللواتي يعشن في المناطق الحضرية اعلى مما في المناطق الريفية. ومن خلال النتائج المستحصلة تبين وجود علاقة ايجابية بين تركيز الرصاص في العينات واعمار الامهات. وبالنظر إلى ارتفاع مستوى الرصاص في عينات الحليب في هذه الدراسة،فمنا لمهم تحديد المصادر المحتملة لهذا العنصر الثقيل في بيئة الأمهات.