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ARABIC SUMMARY

INTRODUCTION

Lead is a neurotoxic agent. In reviewing older literature on lead intoxication one can find description of lead encephalopathy and of lead palsy, these manifestations were frequent when the intensity of lead exposure was considerably high. However, in modern days due to the remarkable improvement of occupational hygiene and certain changes in industrial processes, the intensity of lead exposure substantially diminished, which is reflected on lower exposure and changes in clinical picture.

Long term absorption of small amounts of lead has been shown to cause neurologic injury such as slowing of conduction velocity in adults [Baloh 1979- Ashby 1980- Seppalainen 1980-Bordo 1982- and Jeyaratnam 1985].

It has been known and widely accepted that, increased lead absorption is associated with non specific subjective symptoms such as "tiredness, sleep disturbance, irritability and nervousness [Lillis 1977, Fishbein 1980, Massoud 1982 and Baker 1982].

Number of studies reported some association between lead exposure and neuropsychological disorders as hyper-

activity or mental retardation including learning disorders in children [Baloh 1975-Winneke 1982-R.G. Lansdown 1974-and Hansen 1985].

Recent reports have shown that, even exposure to lead at levels that were previously believed to be quite safe, may exert toxic effects upon the nervous system resulting in minimal brain dysfunction which can be detected by certain tests of behaviour [Hanninen 1978, Philippe - Grandjean 1978, Valciukas 1978, 1981, 1982, Baker 1984, Jeyaratnam 1985].

Therefore it was found interesting to study changes in behaviour among Egyptian Workers occupationally exposed to low concentration of lead.

The Objectives of this Study are :-

- 1- To study objectively, by means of psychometric tests the psychological status of apparently asymptomatic lead exposed workers in Egypt.
- 2- To compare the psychometric test scores of lead exposed workers with those of matched control unexposed workers.

- 3- To study possible correlation between lead induced biochemical changes and both psychometric test scores and the occurrence of psychiatric symptoms.
- 4- To assess the value of psychometric tests for the early detection of neurotoxicity during periodic medical examination of lead exposed workers in Egypt.

Review of Literature

Lead was among the earliest metals used by man Hippocrate "370 B.C." described a severe attack of colic in a man who extracted metals and was probably the first of the ancients to recognize lead as the cause of symptoms. In (1713) Ramazini noted that potters who worked with lead often showed its noxious effects "at first tremors appear in the hands, soon they are paralysed. [Hunter 1974].

Lead enters the human body mainly through inhalation of vapours, fumes, dust or mist. Or swallowing of the lead compounds trapped in the upper respiratory tract or introduced into the mouth on food, tobacco, tools, fingers or other objects. [Patty 1963].

Lead is a poison which in varying doses, interferes with all biochemical and physiological systems in man. When the intake of lead exceeds the amount which can be excreted by respiration or through urinary or fecal clearance, the excess amount is stored in various parts of the body e.g.: hard tissue (bone, hair, teeth...) and soft tissue (brain, kidney, bone marrow.....). [Thompson 1971].

In a steady state situation the lead intake approximates the lead output and the skeleton contains approximately 80% to 90% of the total body lead burden [Baloh 1974]. The danger of lead stored in the long bones lies in the fact that much of the production of haemoglobin is initiated at this location, lead interferes with the enzyme systems involved in heme production, incorporation of iron into heme by reticulocytes and globin synthesis in erythrocytes [Repko 1979]. So, the lead effects lead to decreased δ -amino-levulinic acid in serum and urine, and suppression of coproporphyrinogen oxidase enzyme leads to accumulation of protoporphyrin in erythrocytes and increased coproporphyrin in urine [I.L.O. 1983]. Lead affects the ferrochelatase enzyme and depress its action resulting in decreased content of haemoglobin, but due to release of haem suppression-which provides the negative feedback-on the activity of aminolevulinic acid synthase; the body compensate to this effect [Lee 1981]. So, in lead poisoning measurements of this heme precursors in blood and urine provides a sensitive index of a metabolic effects of increased lead absorption [Baloh 1974].

There are two general categories of laboratory tests used in the detection of increased lead absorption:

- measurement of tissue lead content, and
- measurement of tissue metabolic effects.

There is no single quantitative tissue determination that can adequately define the lead body burden, and there is no single metabolic measurement that characterizes all the metabolic effects of increased lead burden, two tests should be used simultaneously for the diagnosis of lead intoxication in lead workers, one test should be designed to indicate internal dose [tissue lead content] and another to indicate metabolic effects. [Alessio et al 1974).

- **Body lead burden can be measured by:-**

- **Blood lead level:**

It is the most reliable means of measuring the extent of exposure. A good correlation exists between lead levels in blood and lead levels in the atmosphere.

[Williams 1969].

- Urine lead level :**

It is actually a measure of the amount of lead removed from the blood, it-in-general-correlate well with blood

lead levels [R.W. Ellis 1966, Repko 1979, *Massoud 1978] Moderate lead absorption will give rise to an increase of 100-150 ug/L, and an excess of 200 ug/L is indicative of harmful exposure [Tsuchiya 1979].

Urine lead after provocative chelation :

This test consists of the administration of a standard dose of calcium ethylene diamine tetra acetic acid [Calcium EDTA] and collection of a 24-hour urine sample for lead content, in adults without known excess lead exposure the upper limit of lead excretion after chelation is approximately 600 ug/day. The use of this test requires close clinical supervision [Baloh 1974).

Hair lead and tooth lead:

Lead concentration in teeth and hair have been used as indicators of long term exposure, their lead content reflects the sum total of exposure up to the time of removal, but the information is inadequate for assessing their usefulness and reliability [Baloh 1974, W.H.O. 1977 and Tsuchiya 1979].

As mentioned before, the tissue metabolic effects of lead can be measured by the determination of lead

effect on the haem biosynthesis. The inhibition of coproporphyrinogen oxidase enzyme activity increases the concentration of coproporphyrin in urine. Tole et al (1973) noted that the estimation of coproporphyrin excretion is the second most reliable test of lead effect when blood lead is the criterion of absorption [Repko 1979], it is highly correlated with lead excretion and δ -amino levulinic acid in urine [Bruin 1967, Sheila 1968, and Massoud 1978]. Coproporphyrin excretion in urine starts increasing at approximately 35-40 ug lead/100 ml blood [Tsuchiy 1979], the normal range according to Fernandez, Henry and Goldenberg (1966) is from 0 to 161 ug Coproporphyrin/day.

Estimation of aminolevulinic acid dehydratase activity in blood is quite useful as a diagnostic measurement, after a Worker's first exposure to lead, the aminolevulinic acid dehydratase activity decreases rapidly without any appreciable time lag parallel to the increase in blood lead concentration [Hernberg 1972]. According to Tola 1972 and Aronson 1974, when exposure to lead ceases amino - levulinic acid dehydratase activity progressively returns to normal parallel to blood lead level [Aronson 1974], thus it does not indicate any former exposure that cannot be detected from an elevation of lead in blood, also,

its routine use is limited by technical problems [Alessio 1974].

Increased δ -aminolevulinic acid excretion in urine has been observed at blood levels of 40-50 ug/100 ml in many studies [Hernberg et al 1970, Haeger Aronson 1971, Tsuchiya et al 1975]. In occupational health, amino-levulinic acid excretion level in urine more than 10 mg/L is regarded as a warning signal [Zielhuss 1975].

The development of new red blood cells occurs due to lead intoxication, thus immature cells are released, when these cells are processed for microscopic viewing and counting they take on a stippled appearance which is not characteristic of healthy cells, these stippled cells can be taken as an indicator of the extent of impairment due to lead (Baloh 1974), this test is a less valid indicator for increased lead absorption than the other parameters (Bruin 1967) and it is complicated and time consuming (Aronsen 1971).

Lead anemia is described less frequently in recent reports than in the past, this is probably due to the fact that past occupational exposures to lead were higher than they are today [Tsuchiya 1979]. There is agreement that more than a slight decrease of haemoglobin

will not usually occur below blood lead level =80 ug/100 ml [Zielhuis 1971]. In any individual, the haemoglobin level if not measured periodically does not say very much about the risk for health [W.H.O. 1977].

In 1975 the W.H.O. mentioned the following criteria for selecting tests for occupational health practice:

- Should not involve undue expenditure of time, equipment & staff.
- Should not be inconvenient to worker.
- Should be early reversible predictor before overt health risks are impending.
- Should not be liable to ready contamination with lead.
- There should be a quantitative relationship with exposure and with health risk, and if possible, with high validity and with a steep doseresponse curve [W.H.O. 1975].

When the absorption of lead occurs too fast for elimination or deposition in the bones, or when lead in the bones is metabolized back into the blood stream, the lead may be deposited in the soft organs especially the kidneys, the liver and the brain [Thompson 1971].

The renal cells bind the lead in lead protein complex in the form of an intranuclear inclusion body which is isolated in the nucleus of the cell, followed by degenerative changes in the proximal tubules. All the functional and morphological changes are reversible in cases of relatively short term lead exposure [Mahaffey 1977 and Repko 1979] but the long term exposure gives rise to the development of irreversible functional and morphological renal changes [Lilis 1968, Tsuchiya 1979, Repko 1979 and Hammond 1980].

Damage to the liver is frequently reported. In cases of lead poisoning resulted in disturbance of albumine/globuline ratio [Hafeiz et al 1982 & Tsuchiya 1979].

Increased lead absorption may give rise to effects on both the central and peripheral nervous systems, the literatures have identified neurobehavioural patterns which demonstrate the effects of lead intoxication on the following functional categories:

- 1- neuro muscular functions.
- 2- Intellectual functions (learning, memory and intelligence) and
- 3- psychological functions (subjective, personality and social behaviour) [Repko 1979].