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Effect of Lead Acetate on The Weight And Length of Fetus of Treated Dams

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INTRODUCTION :- The heavy metal intoxication and consequently embryo foetotoxicity is a renowned and considerable aspect in the field of reproductive toxicology. In the present era, industrial revolution generates a large number of environmental pollutants causing huge damage to vital body organs . Every year, industry produces about 2.5 million tons of lead throughout the world hence lead has wide distribution in the environment. Most of the lead is used for batteries, cable coverings, plumbing, ammunition, and fuel additives in many developing countries so it contaminate the air , drinking water and soil which is significantly hazardous for human being who are commonly exposed by way of inhalation of polluted air and ingestion of dust, soil and water . Lead is considered as pediatric heavy metal poisoning[1] . Lead posses a substantial threat to pregnant mother and their developing foetuses because once absorbed it readily crosses the placenta, putting the developing foetus at risk by affecting each and every organ of the body. It is well known that foetus is extremely sensitive to its surrounding. During embryonic development and in growing mammals calcium is required for formation and growth of bone. The amount of calcium is passing through umbilical cord from maternal blood circulation enters to the foetal area will decide the framework of foetal skeleton. The lead intoxication produced considerable fall in the total serum ionised calcium during the last several days of pregnancy in the rat[2,3,4,5] . The lead intoxication interrupts the ossification resulted in low birth weight and correlated with decreased preadolescent growth rates and reduced stature[5]. The effects of lead on fetal growth, intrauterine development and postnatal status have long been of concern in occupational and environmental medicine[6] but evidences are fairly lacking to prove correlation between morphology and ossification process during embryonic life . Therefore present study was extensively designed to assess the effect of lead acetate on morphological indices such as weight and length in developing swiss albino mice .

Material and methods

Animals

Female and male Swiss albino mice (Musculus albinus) were procured from veterinary college Mhow (M.P.). Young, healthy, sexually, mature Swiss albino female and male mice (weighing 24 ± 2 gm) were used for present study. The experimental animals were housed in polypropylene cages and were given free access to clean drinking water and standard animal pallet diet throughout the experiment. The animals were acclimatized for a time period of one week to laboratory conditions before the initiation of experiment. Healthy sexually mature female and male mice were selected and grouped together in the ratio of 2:1 in each cage. After copulation the

vaginal plug was observed (considered zero day of pregnancy) and then male mice were separated from pregnant female mice.

Treatments

Lead was used for present study in the form of lead acetate [Pb $(CH_3COO)_2$]. The dose of lead acetate was selected after calculating the LC_{50} value. LC_{50} was found to be 0.5 ppm/l. The 0.5 ppm of lead acetate was given to pregnant mice orally till the last day of experiment.

Experimental design

28 pregnant mice were divided into 4 groups for 14 and 21 days of treatments. The control group consisting of 14 mice were fed on standard food and plain tap water (without administration of lead acetate) for the same period, At the end of the 14 and 21 days of the treatment the pregnant mice of control and treated groups were anaesthetized and dissected out. Embryo/foetus were separated and immediately fixed into 4% paraformaldehyde. Length of embryo/fetuses were recorded by geometric measurement scale[7] (Rough, 1964). Weight of embryo/fetuses were recorded by standard electronic balance.

Results

In mammals, the meeting of oocyte and sperm and subsequent fertilization , take place in the ampulla of oviduct . The preimplanted embryo passes through distinct metabolic phases, undergoing changes in protein synthesis ,energy requirement and amino acid uptake as it develops from fertilized zygote to the bastocyst stage. In general two types of bones are found in the skeleton ; flat bones (Skull bones ,scapula , mandible and ileum) and long bones (Tibia , femur ,humerus etc) . For the study of skeletal structures in embryonic condition, the whole part were devided into morphological study, histological study (spine and femur) and whole skeleton of embryo.

The 7 days embryo was 0.9 to 1.9 mm in average size. In 7 days duration of experimental period average weight of embryo revealed fluctuations in treated group (Table-1). The average length of the various beaded structure were reduced i.e. 1.9 mm to 0.9 mm in average litter (Table-2). In 14 days duration of experimental period average weight of embryos revealed reduction in treated group (Table-1) similarly the average length of the various embryos were decreased i.e. 14.6 mm to 11.7 mm (Table-2). In 21 days duration of experimental period the average weight of fetuses revealed fluctuations and were decreased in treated group (Table-1). The average lengths of the various fetuses were also decreased i.e. 24.5mm to 22.1 mm average (Table-2).

Table 1 : Average weight (mg)of embryo/fetus in control, treated groups .

S.No.	Days	Control group	Lead acetate treated group
1.	7	0.11 ± 0.01	0.06 ± 0.01
2.	14	0.42 ± 0.02	0.16 ± 0.01
3.	21	0.88 ± 0.02	0.45 ± 0.01

Number of embryos = 7 (In each group).

All values are expressed in Mean ± SEM.

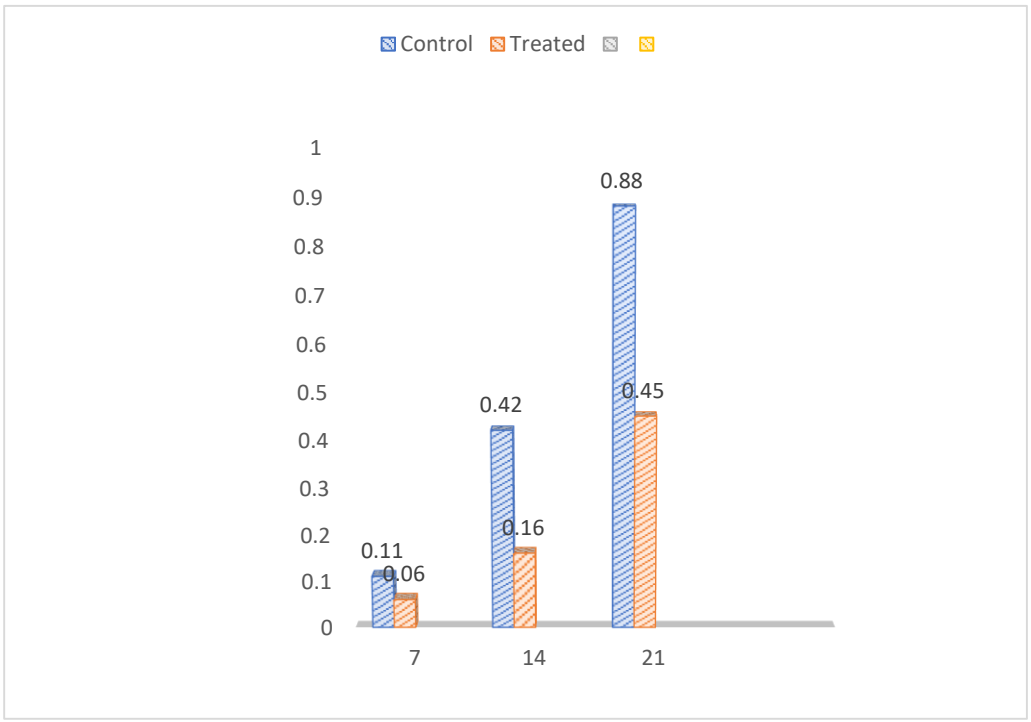
Table 2 : Average length (mm)of embryo/fetus in control, treated groups .

S.No.	Days	Control group	Lead acetate treated group
1.	7	1.9 ± 0.1	0.9 ± 0.1
2.	14	14.6 ± 0.1	11.7 ± 0.1
3.	21	24.5 ± 0.1	22.1 ± 0.7

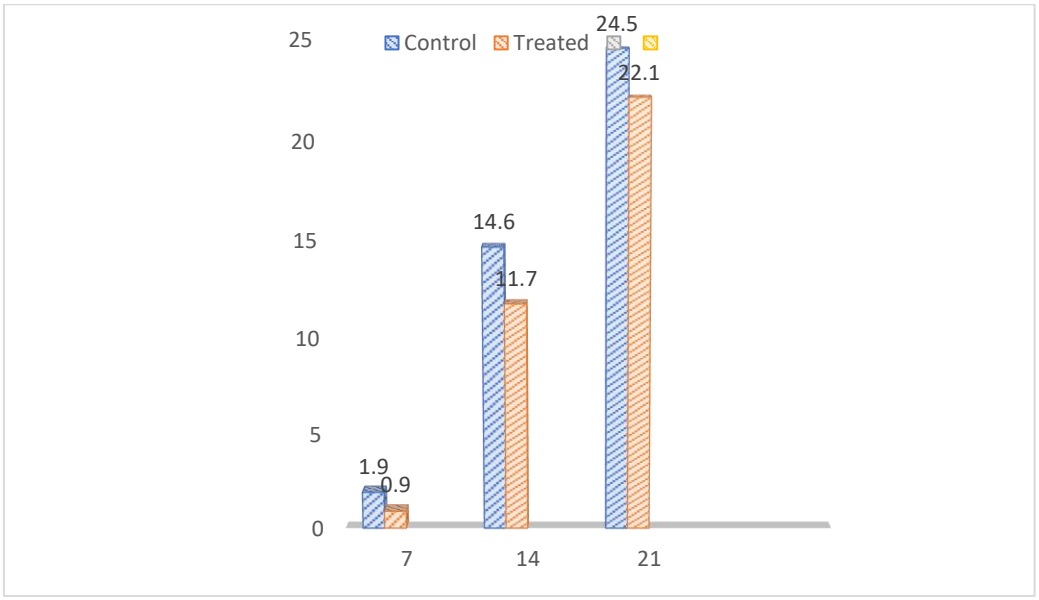
Number of embryos = 7 (In each group) .

All values are expressed in Mean ± SEM .

GRAPH – 1 Average weight (mg)of embryo/fetus in control, treated groups .



GARPH – 2 Average length (mm)of embryo/fetus in control, treated groups .



Discussion & conclusion

In the present experiment the assessment of embryonic development, morphological changes, viability of early organogenesis and other abnormalities has been taken into consideration. These result were similar to Zhu *et al.*, (2010) [8] they observed that low-level of lead exposure were associated with a small risk of decreased weight[8] . Further lead level during early pregnancy contributed to the risk for retarded fetal growth and reduced birth weight (Ha *et al.,* 2008) [9] . Similarly, the weights of fetuses were reduced due to lead acetate at the dose of 15 mg / kg (Jacquet *et al*., 1979) [10]. Further the lead showed a significant decreased foetal weight (Dilts and Ahoka, 1970) [11]. In addition ,Heavy metal toxicants caused remarkable damage to the reproductive tissue and also reported as embryofetotoxic and teratogenic in rats and mice Fuyuta *et.al*., (1979) [12] . Lead impedes collagen synthesis in mouse, which have deleterious effects on chorioamniotic membrane structure and induces its premature rupture [13] while low level lead exposure were associated with low fetal growth [14,15].The reports regarding transport of metal across the placenta and metabolism of metals by placenta were review by Roger(1996) [16]. In general, placenta and its associated extraembryogenic membrane had been considerd the conduct for the transport of molecule from mother to foetus and *vice versa*.The Transport activity of the placenta were an important process because it transfer the toxicants which had action upon the embryo/foetus [17]. Lead during pregnancy resulted in low birth weight and correlated with decreased preadolescent growth rates and reduced stature[18] . Lead induced low birth weight, preterm births and small for gestational age. Lead impairs normal foetal bone growth[19]. Lead stored in bones has a long half life (20-30) years, and mobilized into blood and soft tissues during times of physiologic stress including pregnancy and lactation.

This study has some limitations due to small sample size although every mouse underwent the entire protocol , some data were omitted during analysis due to technical artifacts .Thus it is concluded from present study that lead acetate at the dose of 0.5 ppm is responsible for damage of fetal tissue , produced deleterious impact on the morphological parameters , confirms that lead disturbs pro and anti oxidative balance causing oxidative stress produces malfunction of a number of system like reduced weight and length of fetus in experimental animal .

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