دراسة حول العلاقه بين نسبة بعض المعادن في دم الام ووزن الطفل عند الولادة
باستخدام استطياف الانهيار المستحث بالليزر

رسالة مقدمة من:الطالبة

چيهان محمد عبد الرحمن الشرنوبى
مدرس مساعد طب الاطفال
المعهد القومي لعلوم الليزر
جامعة القاهرة

للحصول على درجة الدكتوراة فى طب الأطفال

قسم تطبيقات الليزر الطبية بالمعهد القومي لعلوم الليزر
جامعة القاهرة
٢٠٠٨

لجنة الإشراف

العنوان:
دراسة حول العلاقه بين نسبة بعض المعادن في دم الام ووزن الطفل عند الولادة باستخدام استطياف الانـهيار المستحث بالليزر

الأستاذة الدكتورة / إكرام عبد السلام
أستاذ طب الأطفال والوراثة
بكلية الطب
جامعة القاهرة

الأستاذ الدكتور / محمد عبد الحارث
أستاذ فيزياء الليزر
المعهد القومي لعلوم الليزر
جامعة القاهرة

الاستاذ الدكتور / محمد عمرو النوري
أستاذ طب النساء و التوليد
المعهد القومي لعلوم الليزر
جامعة القاهرة

جامعة القاهرة
٢٠٠٨

A study on the relation between maternal blood level of some metals and birth weight using LIBS technique

By

Jehan Mohamed Abdel Rahman Al Sharnoubi

Thesis Submitted in partial fulfillment of the requirements of PhD degree in medical laser applications in Pediatrics

Department of Medical Applications of Lasers (MAL)
National Institute of laser Enhanced Science (NILES)
Cairo University
2008

Supervisors

Title: A study on the relation between maternal blood level of some metals and birth weight using LIBS

Name: Jehan M.A. Alsharnoubi

This thesis for the degree of PhD had been approved by:

Professor Dr. Ekram Abdel Salam Ahmed
Professor of pediatrics & Genetics
Faculty of Medicine
Cairo University

Professor Mohamed Abdel Harith Mohamed
Professor of laser physics
National Institute of Enhanced Laser Science
Cairo University

Dr. Mohamed Amr Elnoury
Professor of Gynecology & Obstetrics
National Institute of Enhanced Laser Science
Cairo University

Cairo University
2008

List of Tables

List of Figures

Abbreviations

AAS atomic absorption spectrophotometer

AL Aluminum

AML Admissible maximum level

AF Attribution factor

BLL Blood lead level

BMI Body mass index

BW birth weight

CCD Charge coupled device

Cd Cadmium

CHL Crown-heel length

CO Carbone monoxide

Cr Crome

CRH Corticotrophin releasing hormone

Cu Copper

CYP2E1 Cytochrome P-450 2E1

DNA Deoxyribose nucleic acid

EPHX1 Epoxide hydrolase 1

ETS Environmental tobacco smoke

Fe Iron

GW Giga watt

H Hydrogen

H.C Head circumference

Hb Hemoglobin

ICP Inductively Coupled Plasma

ICP-AES Inductively coupled plasma atomic emission spectrometry

ICP-MS Inductively coupled plasmas mass spectroscopy

IQR Inter-quartile range

IUGR Intra uterine growth retardation

K Potassium

L Length

LASS Laser Spark Spectroscopy

LBW Low birth weight

Li Lithium

LIBS Laser induced Breakdown Spectroscopy

LIPS Laser Induced Plasma Spectroscopy

LOD limits of detection

Md Median value

Mg Magnesium

Mn Manganese

MUAC Mid upper arm circumference

Na Sodium

NAD (P) H N-nitrosamine-metabolizing enzymes

NBW Normal birth weight

Nd:YAG Neodymium yttrium Aluminium Garnet

NO(2) Nitrogen dioxide

NQO1 Nitrosamine quinone oxidoreductase 1

NTDs Neural tube defects

O(3) Ozone

PAR Population attributable risk

Pb Lead

PbB Blood lead

PM(10) Particulate Matter of 10 Microns in diameter

PM(2.5) Particulate Matter of 2.5 Microns in diameter

PPM part per million

RDA Recommendation daily amounts

Re Rare earth elements

SES Socio-economic-state

SGA Small for gestational age

SO Sulpher oxide

SUA Single umbilical artry

USRDA United States Recommended dietary allowance

WHO world health organization

Zn Zinc

ACKNOWLEDGMENT

First and foremost thanks to God, whose kindness and mercy helped me throughout this work.

I would like to express my profound appreciation and gratitude to the guidance, follow up, fruitful remarks, patience and encouragement of Professor Dr. ***Ekram Abdel-Salam***, Professor of Pediatrics and Genetics, Faculty of Medicine, Cairo University, who without her I would have never accomplished this work. This thesis was exalted by being under her supervision.

My deepest appreciation and gratitude to Professor Dr. ***Mohamed Abdel Harith***, Professor of Laser Physics, National Institute of Laser Enhanced Science, Cairo University, for his help, supervision, guidance, follow up and fruitful advice.

I am grateful to Professor Dr. ***Mohamed Amr Hussein Elnoury***, Professor of Gynecology & Obstetrics, National Institute of Laser Enhanced Science, Cairo University, for his effort, support and much assistance during preparation of this thesis and collecting data for the study.

My thanks are extended to the staff members and colleagues working and responsible of the LIBS laboratory of the National Institute of Laser Enhanced Science, Cairo University under supervision of Professor Dr. M. Abdel Harith.

Last but not least I am indebted to those patients who participated in this work, by donating their blood and I pray God to give them an everlasting cure.

1. Introduction

1.1-Introduction and Aim of Work

The placenta serves as the point of contact between maternal and fetal circulation. It functions as the means by which all necessary nutrients are delivered to the fetus, as well as a barrier to prevent passage of toxic substances, including metals. If the latter is accomplished by binding of the metals to the placenta, it may interfere with placental function, in particular the transport of essential trace elements required for fetal growth and development. The exposure of pregnant women to toxic metals and transfer from the mother's blood to the developing fetus has mostly been studied in heavily exposed individuals. There are few studies on placental concentrations of toxic metals in women living in less polluted areas, and for some metals the reported data are conflicting ***(WHO 1996***).

The fetus is totally dependent upon the mother for his supply of minerals essential for growth and development. The placental transport of minerals is highly complex and is determined by maternal, fetal, and

placental factors that is specific for each element ***(Lall and Wapnir, 2005).***

Maternal nutrition before and during pregnancy may influence the course of the pregnancy, fetal development and the child's health in its early and also adult life. Maternal underweight before pregnancy (BMI<19.8

kg/m2) and low pregnancy weight gain may increase the risk of low infant birth weight ***(Szostak-Wegierek, 2000)***.

Fetal under nutrition represents a large numbers of newborns in developing countries, with adverse consequences for their immediate survival and lifelong health. It manifests as intrauterine growth retardation (IUGR), defined as birth weight <10th percentile, which probably underestimates the number failing to achieve full growth potential. Birth weight is a crude measure of the dynamic process of fetal growth and does not capture effects of fetal under nutrition on body composition and the development of specific tissues. The link between maternal nutrition and fetal nutrition is indirect. The fetus is nourished by a complex supply line that includes the mother's diet and absorption, endocrine status and metabolism, cardiovascular adaptations to pregnancy and placental function ***(Fall, et.al, 2003***).

Low birth weight newborns (LBW) are weighing 2500 g or less at birth. LBW are associated with increased neonatal morbidity and mortality. Neonates weighing less than 1500 g are termed as very low birth weight newborns (VLBW) and they are associated with neonatal deaths and handicapped newborns. Newborns of extremely low birth weight (ELBW) are less than 1000 g and mostly die ***(Sommerfelt, 1998).***

Small for gestational age (SGA) babies are those whose birth weight lies below the 10th percentile for that gestational age. They have usually been the subject of intrauterine growth restriction (IUGR), formerly known as intrauterine growth retardation. Low birth weight (LBW), is sometimes used synonymously with SGA, or is otherwise defined as a fetus that weighs