Impact of Maternal Body Mass Index (BMI) On Pregnancy Outcome in A Non-Diabetic Mother & Its Effect on Cord Blood Glucose & Insulin

Thesis

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By

Noha Hassan Mohammed Zaki

M.B.,B. CH.,
Faculty of Medicine
Cairo University

Supervised By:

Dr.Abdel-Maguid Ramzy

Professor of Obstetrics & Gynecology
Faculty of Medicine
Cairo University

Dr.Iman Mostafa El-Zahaby

Lecturer of Obstetrics & Gynecology
Faculty of Medicine
Cairo University

Dr. Sherif Mofeed Ekladious

Lecturer of Clinical and Chemical Pathology
Faculty of Medicine
Cairo University

Faculty of Medicine

Cairo University

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Abstract

The amount of weight gained during pregnancy can affect the immediate and future health of a woman and her infant. Maternal obesity and underweight both are on the rise with negative impact on pregnancy and birth outcomes. And since normal pregnancy is characterized by insulin resistance, and BMI had the largest effect correlated with HOMA-IR, this paper aims at studying the impact of maternal BMI on outcome of pregnancy in a non-diabetic mother and its effect on cord blood glucose and insulin.

We concluded that increased maternal BMI is associated with increased incidence of CS delivery, macrosomic babies, fetal hyperinsulinaemia and insulin resistance. While decreased maternal BMI is more likely to be associated with increased incidence of SGA and NICU admission.

Key Words:

Maternal obesity- underweight- BMI- macrosomia- SGA- hyperinsulinaemia- HOMA IR- Apgar score.

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List of Abbreviations:

AOB	All Our Babies Study
aOR	Adjusted Odds Ratio
BMI	Body Mass Index
CI	Confidence Interval
DRD4	Dopamine Receptor D4
FFA	Free Fatty Acids
FGR	Fetal Growth Restriction
FPG	Fasting Plasma Glucose
FPI	Fasting Plasma Insulin
FTO gene	Fat Mass And Obesity Associated Gene
GDM	Gestational Diabetes Mellitus
GLUT	Glucose Transporter
GWG	Gestational Weight Gain
HAPO	The International Multicenter Hyperglycemia And Adverse Pregnancy Outcomes
HCPs	Health Care Providers
HDL	High-Density Lipoprotein
HOMA-IR	Homeostasis Model Assessment-Estimated Insulin Resistance
IDA	Iron Deficiency Anemia
IGFBPs	IGF-Binding Proteins
IGFs	Insulin-Like Growth Factors
IOM	*Institute Of Medicine*
Kg	Kilogram
KT	Knowledge Translation

LA	Linoleic Acid
lbs	Pounds
LBW	Low Birth Weight
LDL	Low-Density Lipoproteins
LGA	Large-For-Gestational Age
LH	Literacy For Health
m	Meter
MC4R gene	Melano-Cortin-4 Receptor Gene
MOMTech	Maternal Obesity Management Using Mobile Technology
NICU	Neonatal Intensive Care Unit
NO	Endothelium-Derived Nitric Oxide
Nr3c1	Nuclear Receptor Peroxisome Proliferator-Activated Receptor Alpha (Ppara)
NRP	The Neonatal Resuscitation Program
NW	Normal Weight Group
OB	Obese Group
OGTT	Oral Glucose Tolerance Test
OR	Odds Ratio
OW	Overweight Group
PE	Pre-Eclampsia
PIH	Pregnancy-Induced Hypertension
PlGF	Placental Growth Factor
PPARy2	Peroxisome Proliferator-Activated Receptor Y2
PROM	Premature Rupture Of Membranes
RCOG	The Royal College Of Obstetricians And Gynecologists
RDS	Respiratory Distress Syndrome

SEM	Standard Error Of The Mean
sFlt-1	Soluble Fms-Like Tyrosine Kinase-1
SGA	Small-For-Gestational Age
SLC2A3	Solute Carrier Family 2 (Facilitated Glucose Transporter) Member 3
T2DM	Type 2 Diabetes Mellitus
TG	Triglycerides
UK	United Kingdom
VBAC	Vaginal Birth After Caesarean Section
VEGF	Vascular Endothelial Growth Factor
WHO	World Health Organization
WHR	Waist To Hip Ratio

List of Figures:

Weight gain during pregnancy:

Weight gain, one of the hallmarks of pregnancy, relates extensively to the well-being of the fetus and infant. Therefore, Women should set pregnancy weight gain goals based on their pre-pregnancy BMI ***(Cunningham et al., 2001).*** Healthy pregnant women with a good nutritional status certainly improves the outcome of baby ***(Lumbanraja[a] et al., 2013)***.

The amount of weight gained during pregnancy can affect the immediate and future health of a woman and her infant. ***(The American College for Obstetricians and Gynecologists, 2013)***.

Women with normal body mass index before pregnancy promised a better outcome for pregnancy itself, also for the outcome of baby birth. Pregnant women with inadequate maternal weight gain were often result on low baby birth weight and increase perinatal morbidity and mortality. On the other hands, over increase of maternal weight gain also resulted on poor fetal outcome and affect the methods of delivery later ***(Lumbanraja[a] et al., 2013)***.

Primary maternal BMI and her weight gain during pregnancy are of utmost importance, indeed, low BMI is a risk factor for LBW ***(Allen, 1994).*** Prior investigators have shown the association between the ratio of weight to height prior to the pregnancy and weight gain during pregnancy with fetal growth and development ***(Mickey et al., 1997)*** have explained a reverse correlation between BMI and simultaneous preterm delivery among different ethnic groups ***(Copper et al., 1995)*** have reported a lesser tendency among obese females for weight gain during pregnancy ***(Jenabi et al., 2011)***.

Maternal obesity:

Is defined as a body mass index (BMI) > 30 kg/m^2. It affects more that 30% of the antenatal population in the UK and is the most common co-morbidity of pregnancy ***(Denison et al., 2013)***.

Worldwide there has been a dramatic increase in the prevalence of overweight (body mass index [BMI, calculated as weight (kg)/[height (m)]^2] 25 and higher) and obesity (BMI 30 and higher) in women of child-bearing age. ***(Ovesen et al., 2011)***.

Maternal obesity and excessive gestational weight gain (GWG) are on the rise with negative impact on pregnancy and birth outcomes ***(Soltani et al., 2015)***.

Obese women have higher risk of complications during pregnancy and delivery. Furthermore, their obesity may have adversely affected the health of their offspring ***(Ovesen et al., 2011)***.

Insulin resistance:

Normal pregnancy is characterized by insulin resistance which is greatest in the third trimester. Insulin resistance increases with increasing body mass index, waist circumference and in particular waist-hip ratio ***(Aronne et al., 2002)***.

Exaggeration of the insulin resistance normally seen in pregnancy is associated with gestational diabetes mellitus and gestational hypertension ***(Seely et al., 2003)***. The Homeostasis model assessment-estimated insulin resistance (HOMA-IR), developed by ***Matthews et al. in 1985*** has been widely used for the estimation of insulin resistance in research**.**

Maternal underweight:

After the global alert for overweight and obesity, an opposite extreme on the same spectrum of malnutrition status has drawn attention in both developing and developed countries due to different reasons ***(Triunfo et al., 2015)***.

Malnutrition in the mother has direct effects on the body size of the offspring, and may contribute to the health risks in childhood, persisting throughout life ***(Triunfo et al., 2015)***.

In these pregnancies, an increased risk of fetal loss, preterm birth, anemia, infections, fetal growth restriction (FGR), birth defects, low BW, brain damage, admission to neonatal intensive care unit, and a longer duration of hospital stay, signs of the metabolic syndrome accompanied the catch-up in body weight and central adiposity have been recognized ***(John et al., 2012)***.

Aim Of Work :

Studying the Impact of maternal body mass index (BMI) on pregnancy outcome in a non-diabetic mother & its effect on cord blood glucose & insulin.

Chapter I

Physiology Of Weight Gain During Pregnancy

Physiology of pregnancy:

Pregnancy in the human female is an unusual state in which virtually all maternal systems are dramatically altered to permit the sustenance and growth of the intrauterine conceptus. In very real ways, the maternal organism is life-adapted ***(Barclay, 2009)***.

Many system-specific changes occur in the course of pregnancy. A number of well-described adaptive physiologic states that produce changes in human systems similar to those seen in pregnancy ***(Andersen et al., 1981)***.

Among the physiologic states that produce adaptive changes similar to those seen in pregnancy are metabolic changes and weight gain.

Metabolic Changes:

Pregnancy is characterized by increased metabolic activity as measured by the basal metabolic rate. The researchers hypothesized that this increase in metabolic activity primarily represented increased fetal and placental metabolic work, with only a small fraction being attributable to increased maternal metabolic activity ***(Heini et al., 1992)***. At term, the products of gestation were estimated to be responsible for approximately 13% of the 20% increase in total metabolic activity. More modern studies using oxygen consumption measures and indirect calorimetry estimate the energy output of an average-sized pregnant woman at 36 weeks' gestation to be approximately 98 W (8443 ± 243 kJ/day). This compares with an energy output of approximately 81 W (6971 ± 172 kJ/day) for a similar-sized, non-pregnant, non-lactating woman. Although the more recent studies used different methodologies, they all support the results of the earlier work ***(Barclay, 2009)***.