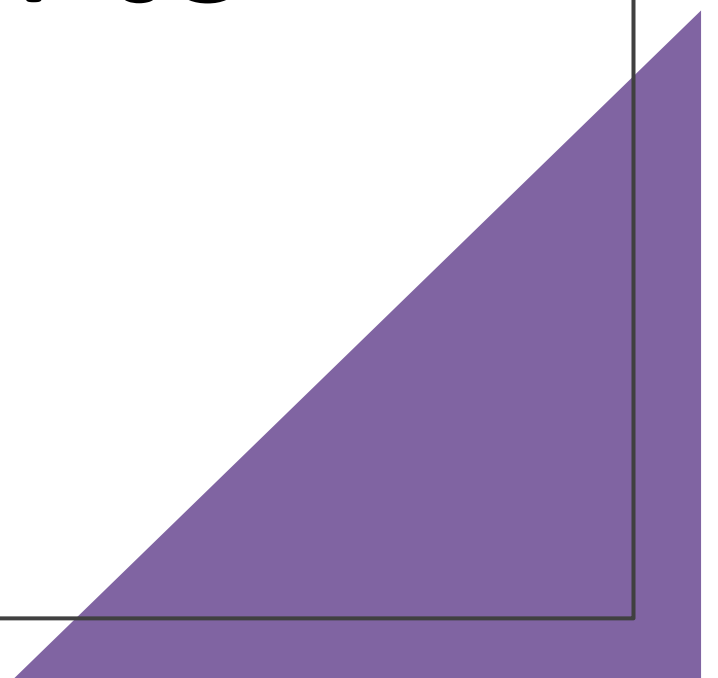


Nutrition in Pregnancy From Preconception to Postpartum Care

Dr. Kadingi Arnauld Kabulu



Why Nutrition Matters in Pregnancy

- Placental development

- Fetal growth

- Brain development

- Maternal health

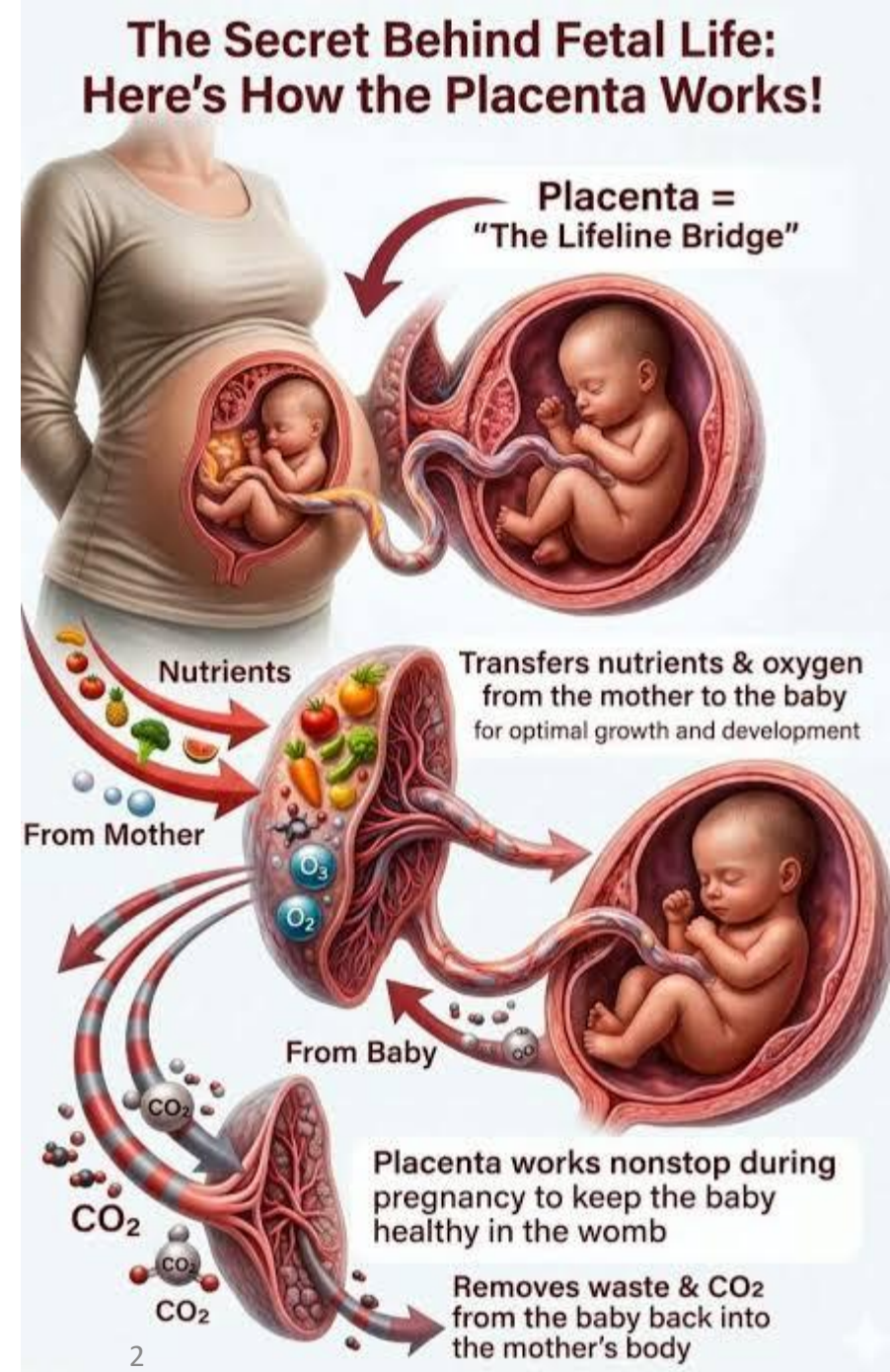
- Pregnancy outcomes

- Lifelong health of offspring

Maternal nutrition is among the most modifiable determinants of pregnancy outcome.

Barker DJP. J Am Coll Nutr. 2004.
WHO Antenatal Care Recommendations.
2020

Information for Healthcare Professionals Only



A top-down view of a white bowl filled with a variety of healthy snacks. The bowl contains a mix of golden-brown granola clusters, fresh raspberries, sliced almonds, green grapes, and dark red grapes. The background is slightly blurred, focusing attention on the food.

Foundations of Maternal Nutrition

Global Burden of Maternal Malnutrition

The Double Burden of Malnutrition

Undernutrition:

- Wasting
- Micronutrient deficiencies
- Food insecurity

Overnutrition:

- Overweight
- Obesity
- Metabolic disease

Current Reality: Many countries now face both simultaneously



UNICEF Maternal Nutrition Report. 2023.
WHO Global Nutrition Report.

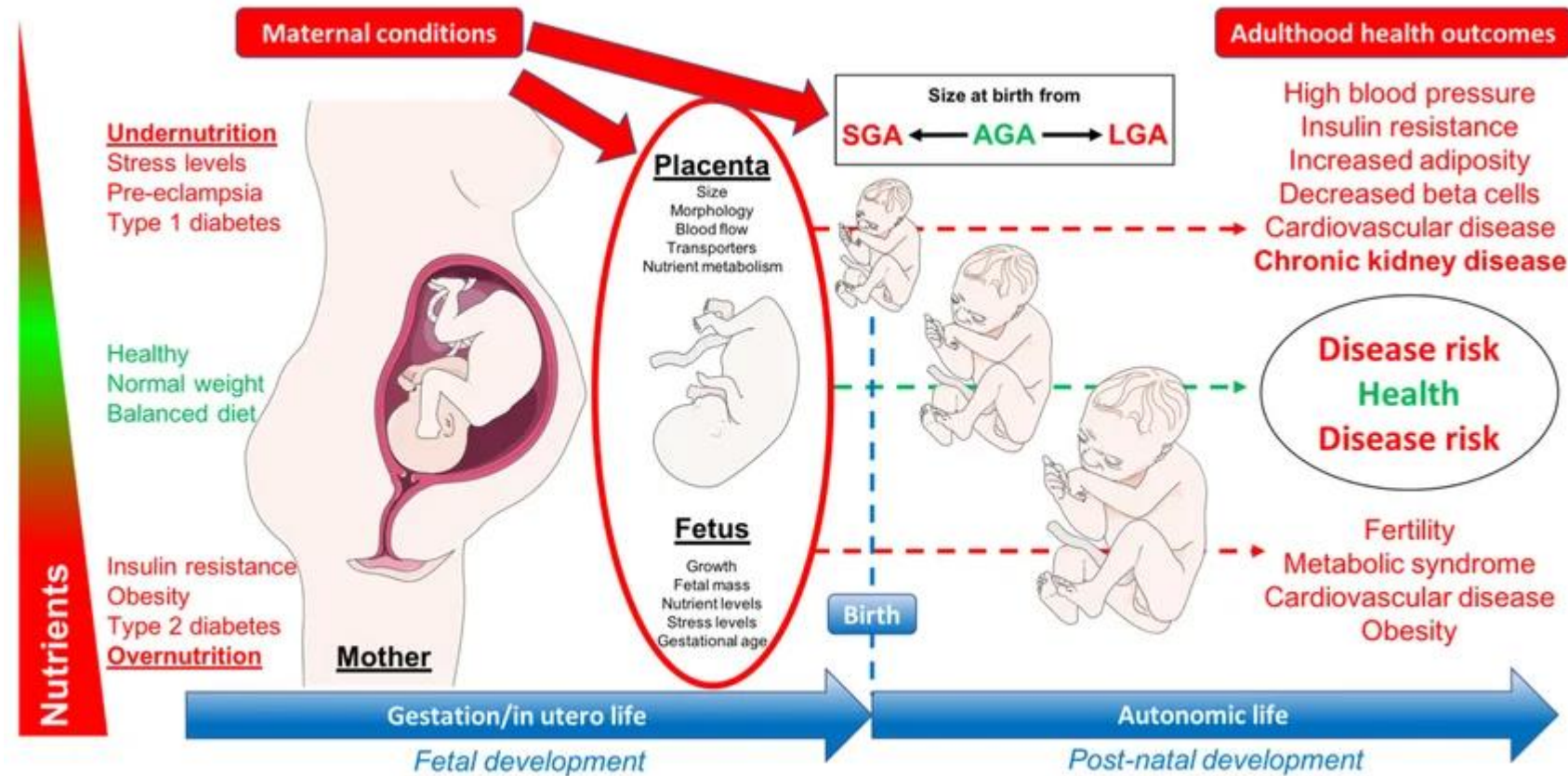
Maternal Nutrition and Fetal Programming

➤ Maternal nutrition influences:

- Gene expression
- Organ development
- Endocrine pathways
- Metabolic regulation
- Disease susceptibility

➤ Clinical Pearl

The fetus is not simply growing—it is being biologically programmed.



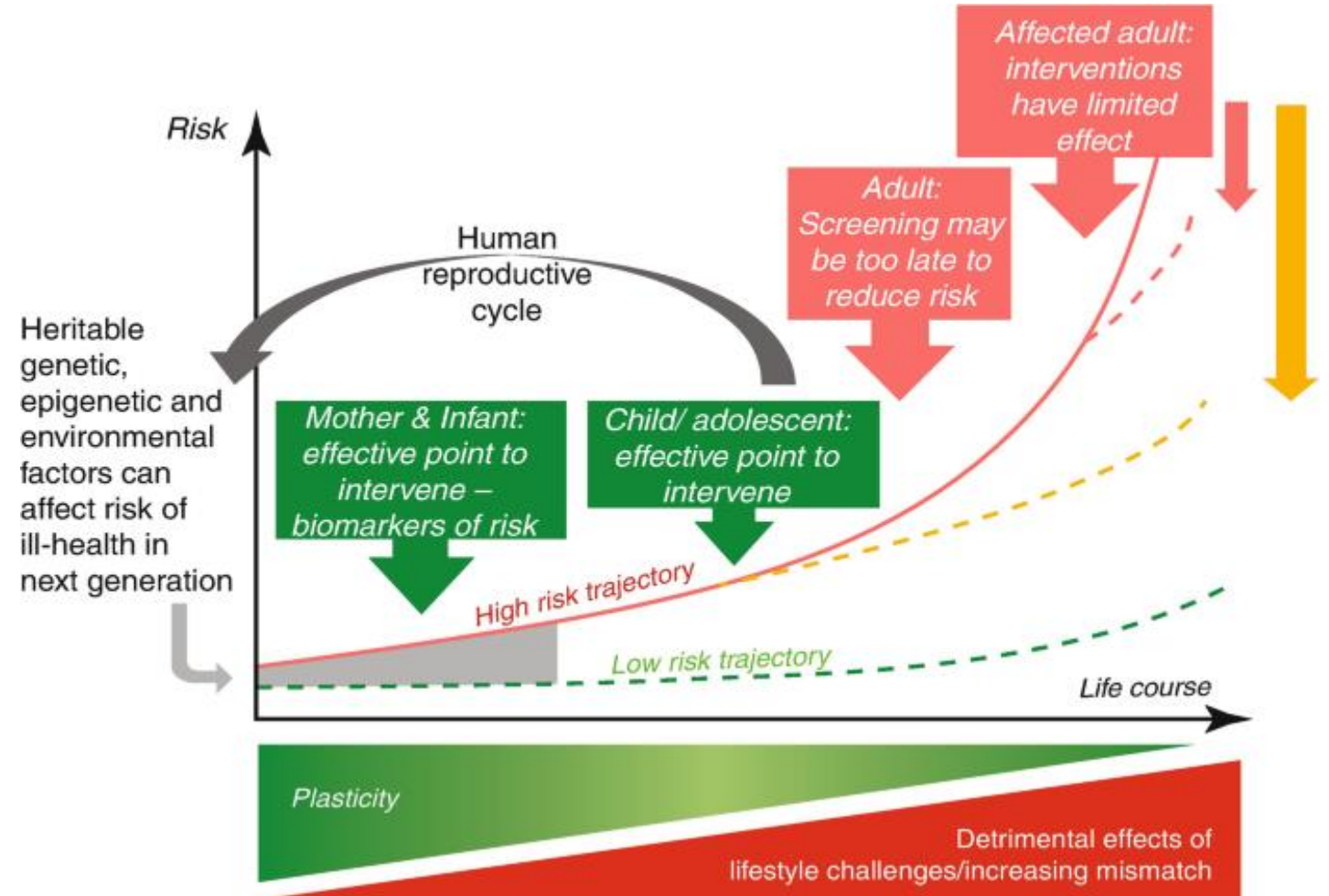
Gluckman PD. Lancet. 2008.

Barker DJP. 2004

Developmental Origins of Health and Disease (DOHaD)

➤ Early-life exposures influence:

- Obesity
- Type 2 diabetes
- Hypertension
- Cardiovascular disease
- Neurodevelopmental disorders



Barker DJP. 2004.

Gluckman PD, Hanson MA. 2008

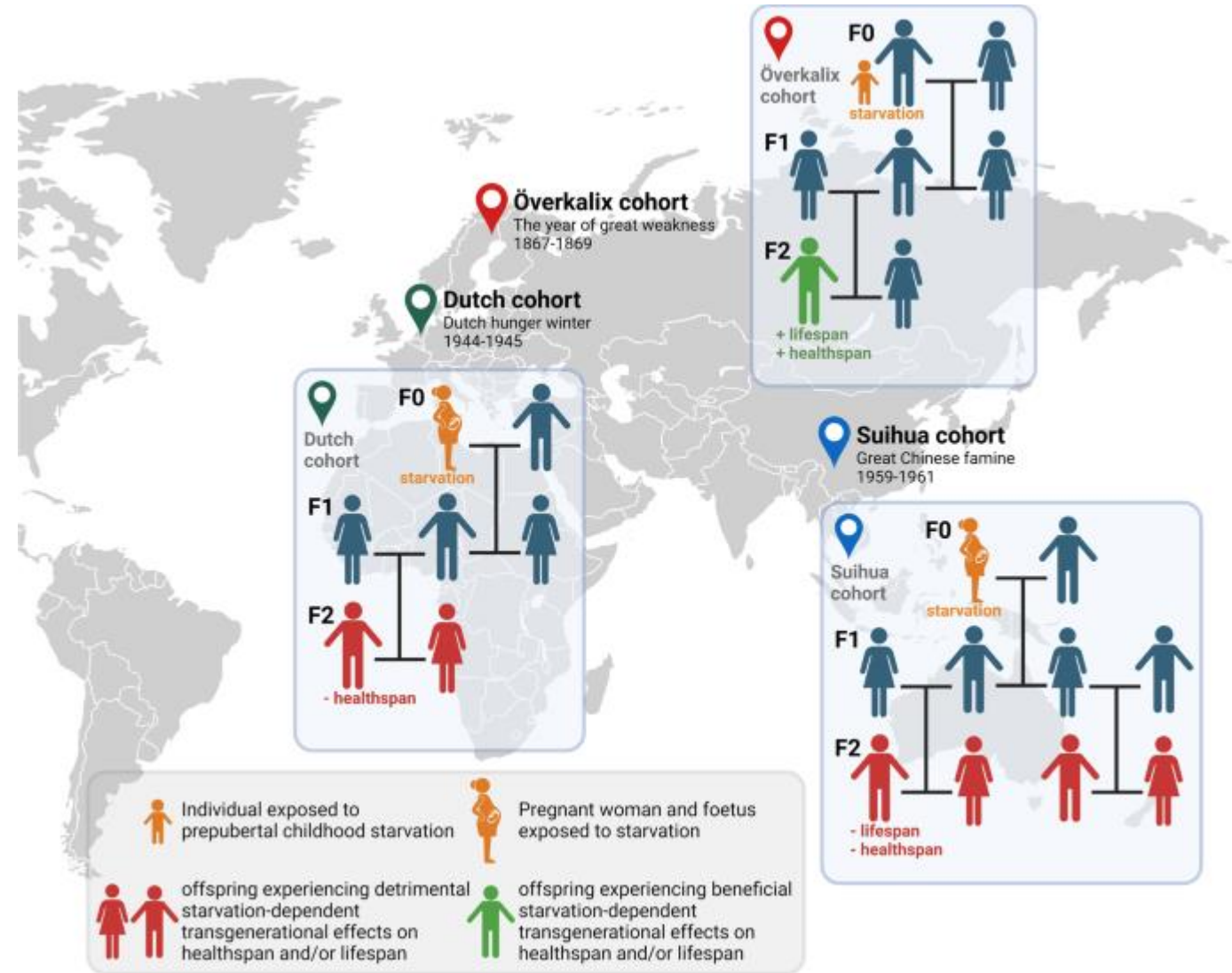
Information for Healthcare Professionals Only

Sata, F. 2019

Dutch Hunger Winter: Evidence for Fetal Programming

- Dutch Famine (1944–1945)
- Prenatal exposure associated with:
 - Obesity
 - Type 2 diabetes
 - Cardiovascular disease
 - Schizophrenia

Roseboom TJ et al. Mol Cell Endocrinol. 2006.
Lumey LH et al. Annu Rev Public Health. 2011.



Learning Objectives

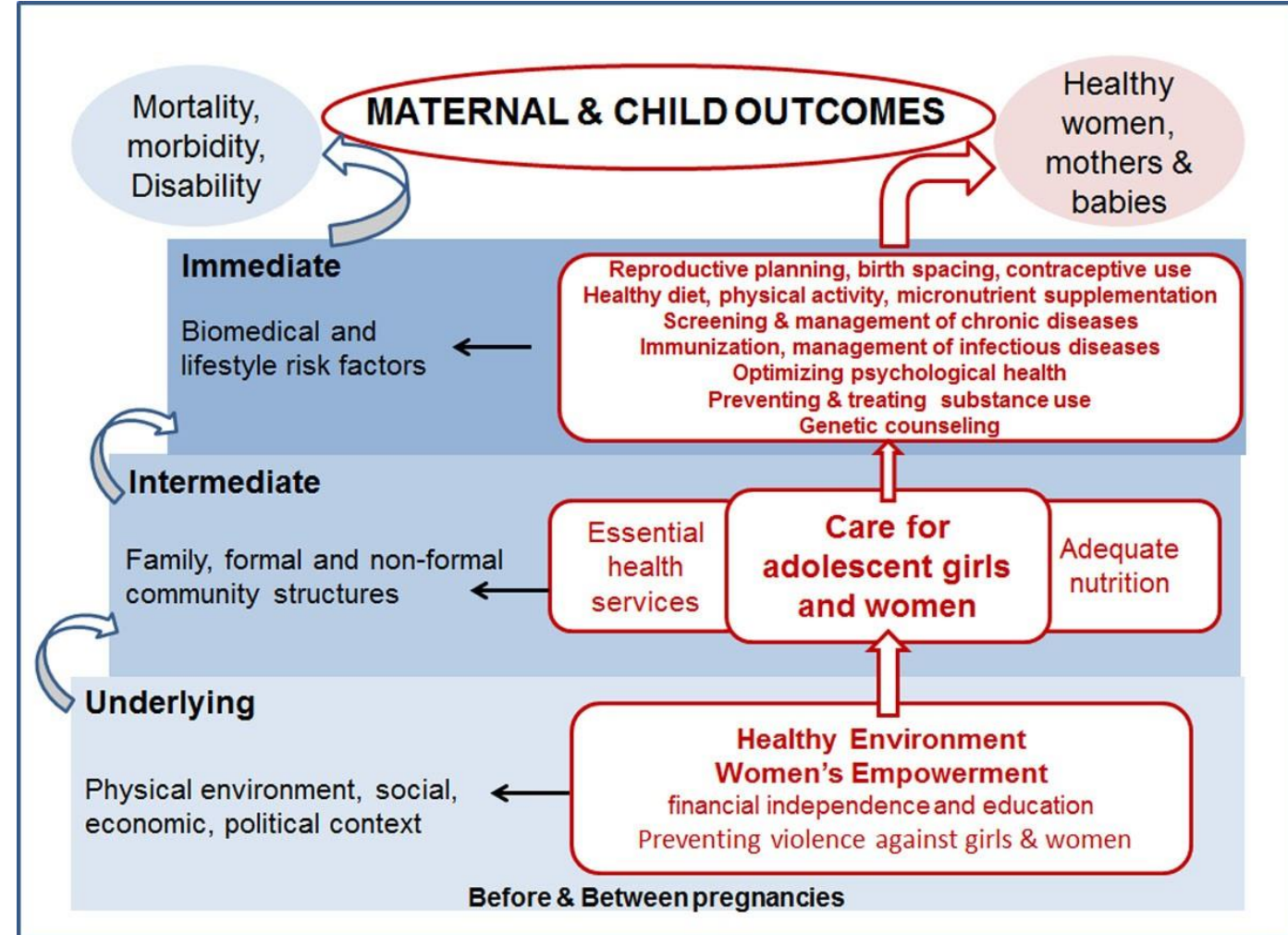
1. Describe nutritional requirements during pregnancy
2. Explain physiological adaptations
3. Recognize nutritional deficiencies
4. Apply IOM recommendations
5. Discuss HAPO study findings
6. Provide evidence-based counselling

Importance of Preconception Nutrition

➤ Benefits:

- Improved fertility
- Adequate nutrient stores
- Reduced congenital anomalies
- Improved pregnancy outcomes
- Better fetal development

➤ Nutritional care should begin before conception



WHO Preconception Care Guidelines.

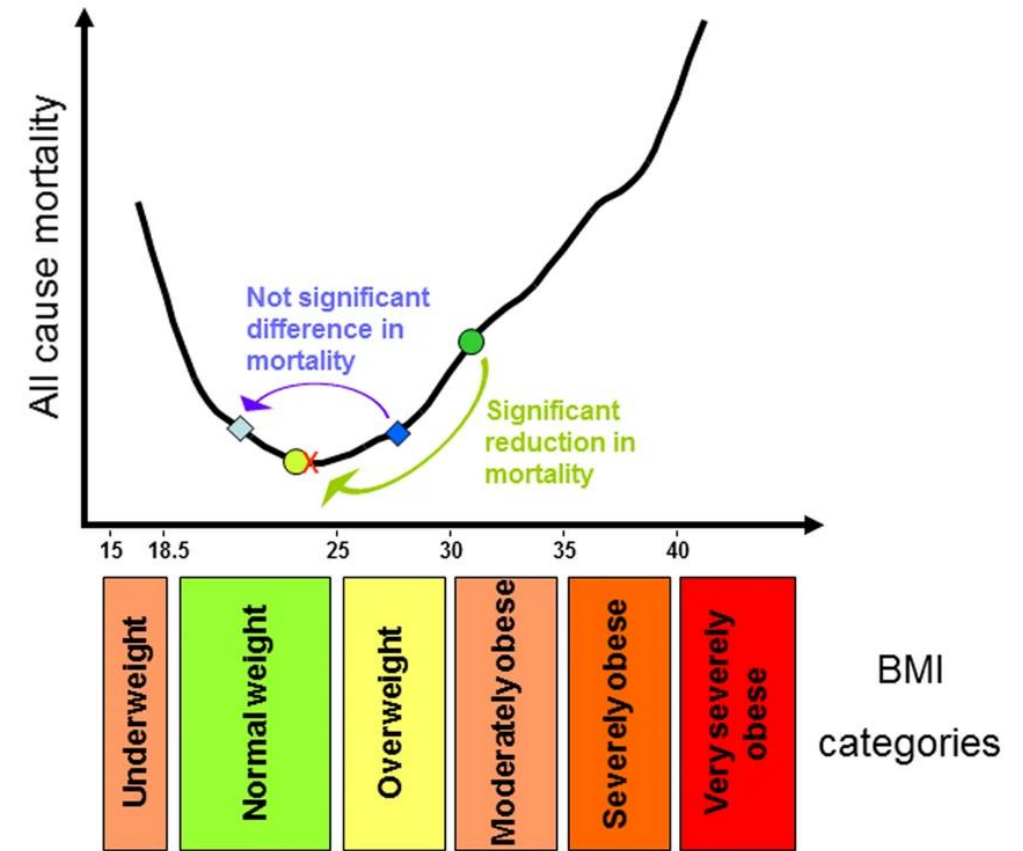
FIGO Nutrition Checklist

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Pre-Pregnancy BMI Optimization

- BMI <18.5: Underweight
 - BMI 18.5–24.9: Normal
 - BMI 25–29.9: Overweight
 - BMI ≥30: Obese
-
- Both extremes increase pregnancy risks.

IOM. Weight Gain During Pregnancy. 2009



Legend

		Weight (Kg)	BMI
X	Reference man	70	24,2
●	WNPRC Control "man equivalent"	90	31,1
●	WNPRC CR "man equivalent"	67,5	23,4
◆	NIA Control "man equivalent"	80,1	27,7
◆	NIA CR "man equivalent"	60,1	20,8

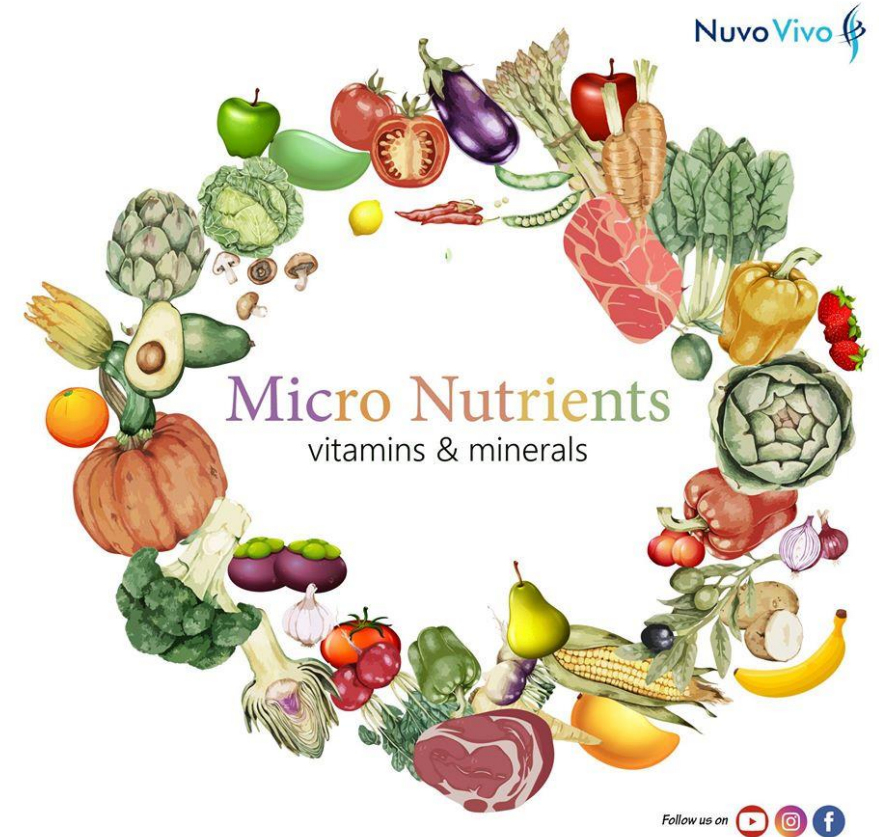
Key Micronutrients Before Conception

- Folate – Neural tube formation
- Iron – Prevention of anemia
- Iodine – Neurodevelopment
- Vitamin D – Bone health
- Vitamin B12 – Neurological development
- Zinc – Cellular growth

Many deficiencies exist before pregnancy begins

WHO Micronutrient Guidelines.
National Academies Dietary Reference Intakes

Information for Healthcare Professionals Only

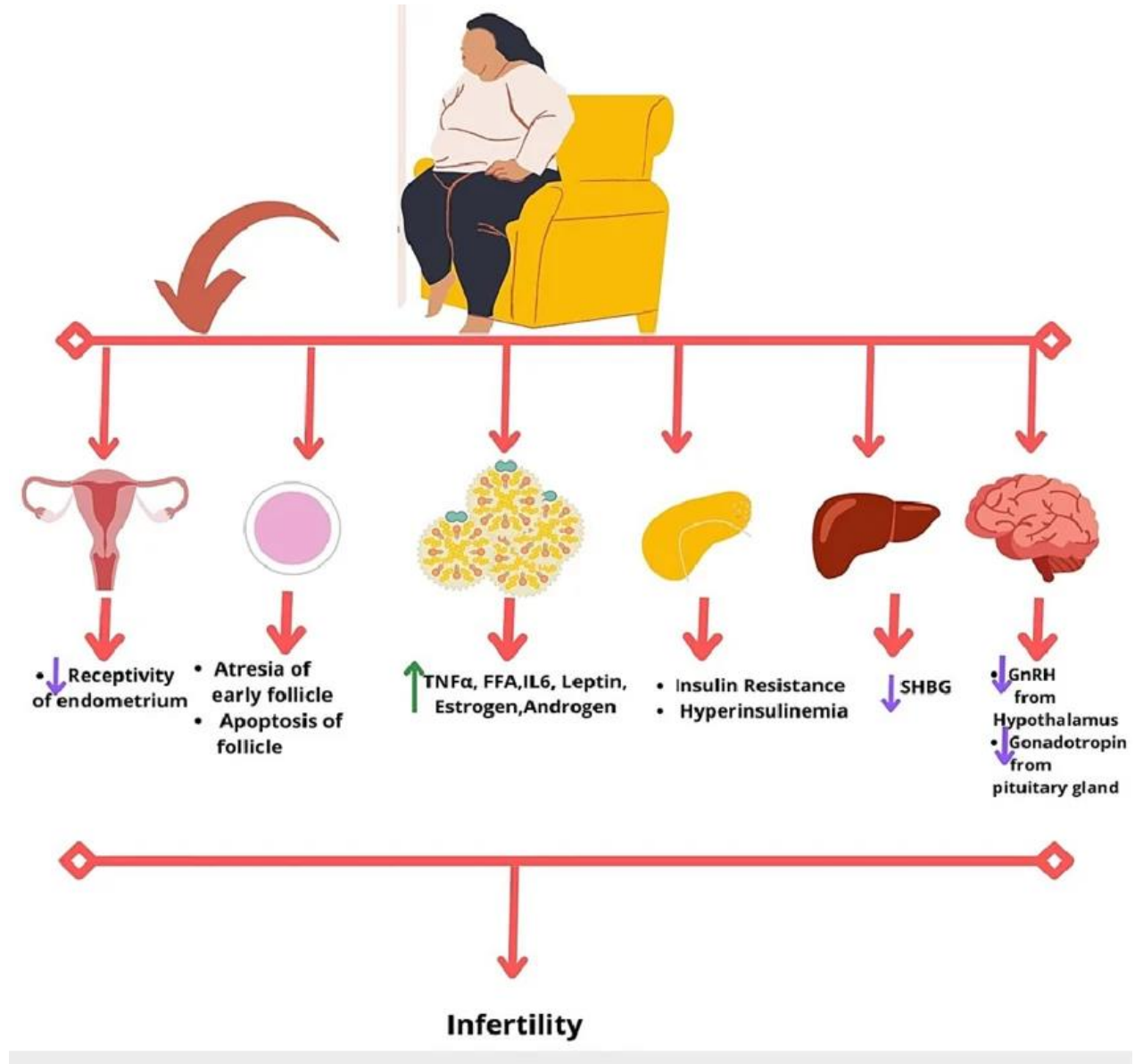


Obesity and Fertility

- Obesity contributes to:
 - Insulin resistance
 - Ovulatory dysfunction
 - PCOS
 - Subfertility
 - Miscarriage
- Pregnancy risks: GDM, preeclampsia, macrosomia, cesarean delivery
- Clinical Pearl: A 5–10% reduction in body weight can improve ovulation and fertility in many women with obesity.

ACOG Practice Bulletin: Obesity in Pregnancy.
FIGO Obesity Guidelines

Information for Healthcare Professionals Only



Ahmad et al 2022

Maternal Physiological Adaptations and Nutritional Requirements

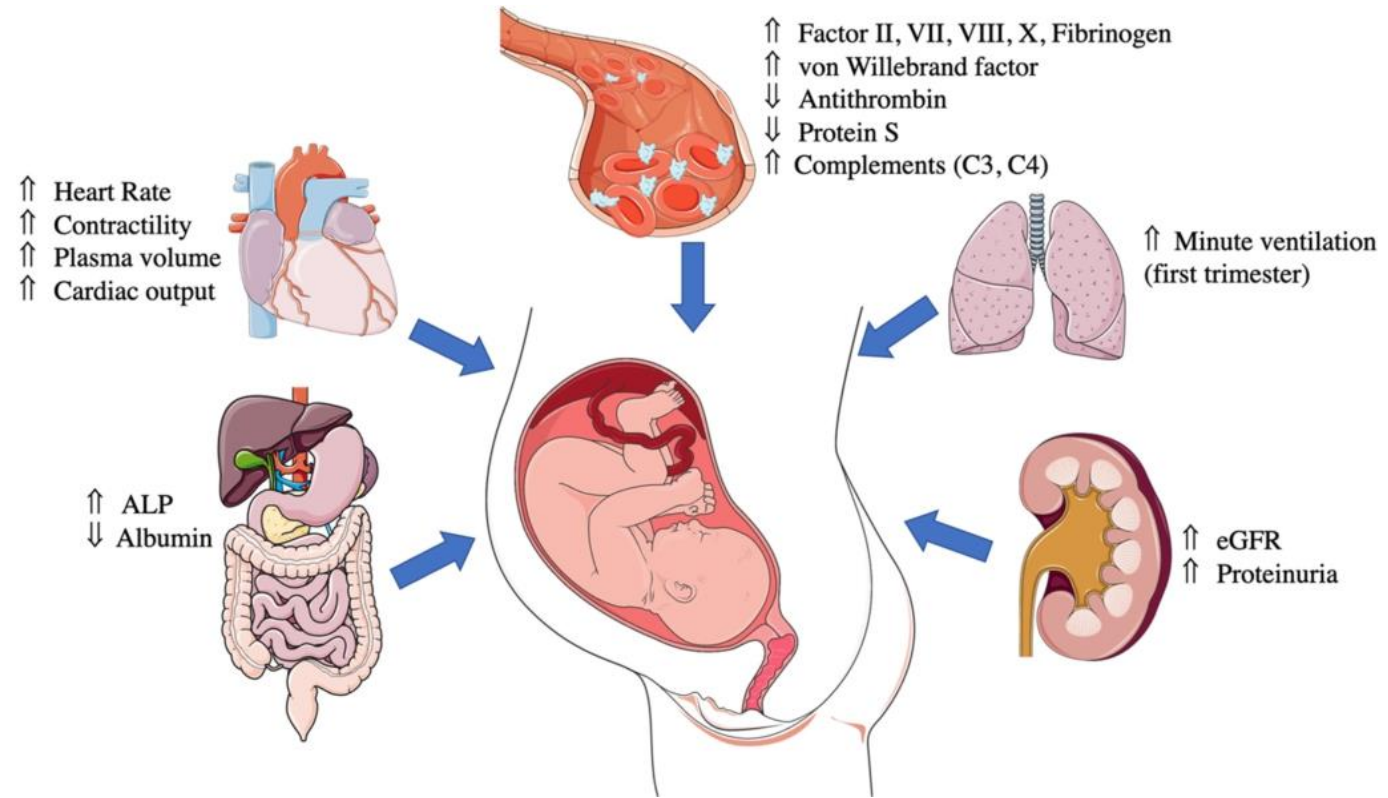
Physiological Adaptations to Pregnancy

➤ Pregnancy is a Dynamic Metabolic State

- Increased basal metabolic rate
- Plasma volume expansion (40–50%)
- Increased cardiac output
- Altered insulin sensitivity
- Enhanced placental nutrient transfer

➤ Maternal physiology adapts to prioritize fetal growth while maintaining maternal homeostasis.

King JC. Am J Clin Nutr. 2000



Fartoon Siad, 2025

Carbohydrate Metabolism and Gestational Diabetes

➤ Early Pregnancy:

- ✓ Increased insulin sensitivity,
- ✓ glycogen storage,
- ✓ fat deposition

➤ Late Pregnancy:

- ✓ Physiological insulin resistance,
- ✓ increased glucose production,
- ✓ enhanced fetal glucose supply

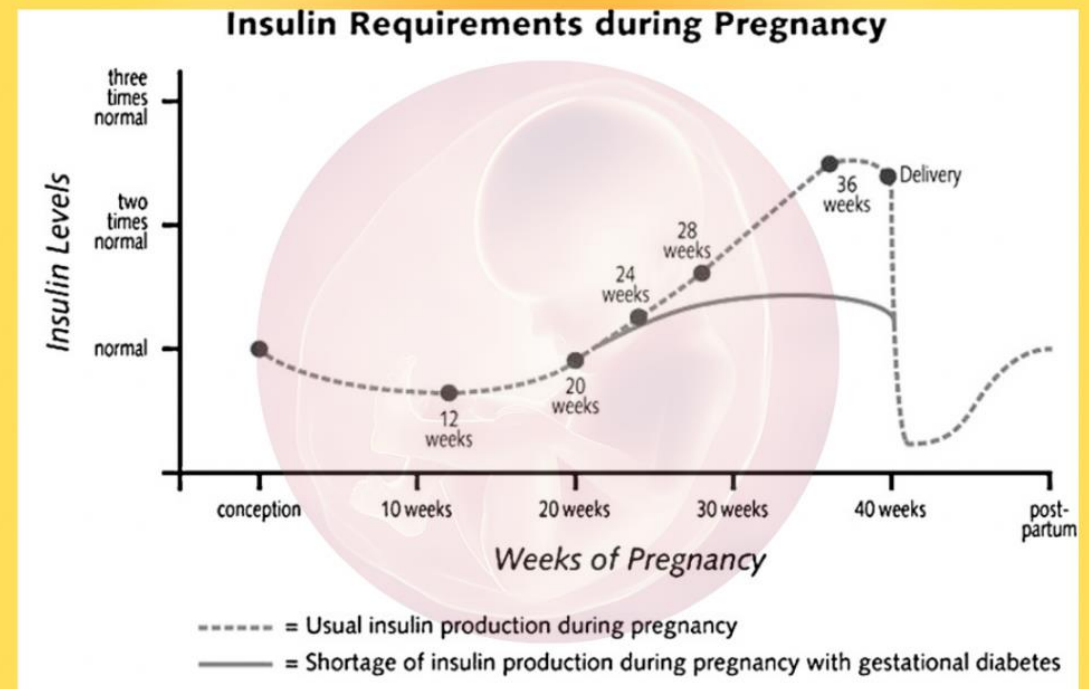
➤ Key Hormones

- ✓ Human placental lactogen
- ✓ Cortisol
- ✓ Progesterone
- ✓ Placental growth hormone

Metzger et al., 2008; Barbour et al., 2007

Information for Healthcare Professionals Only

during pregnancy the body needs much more insulin



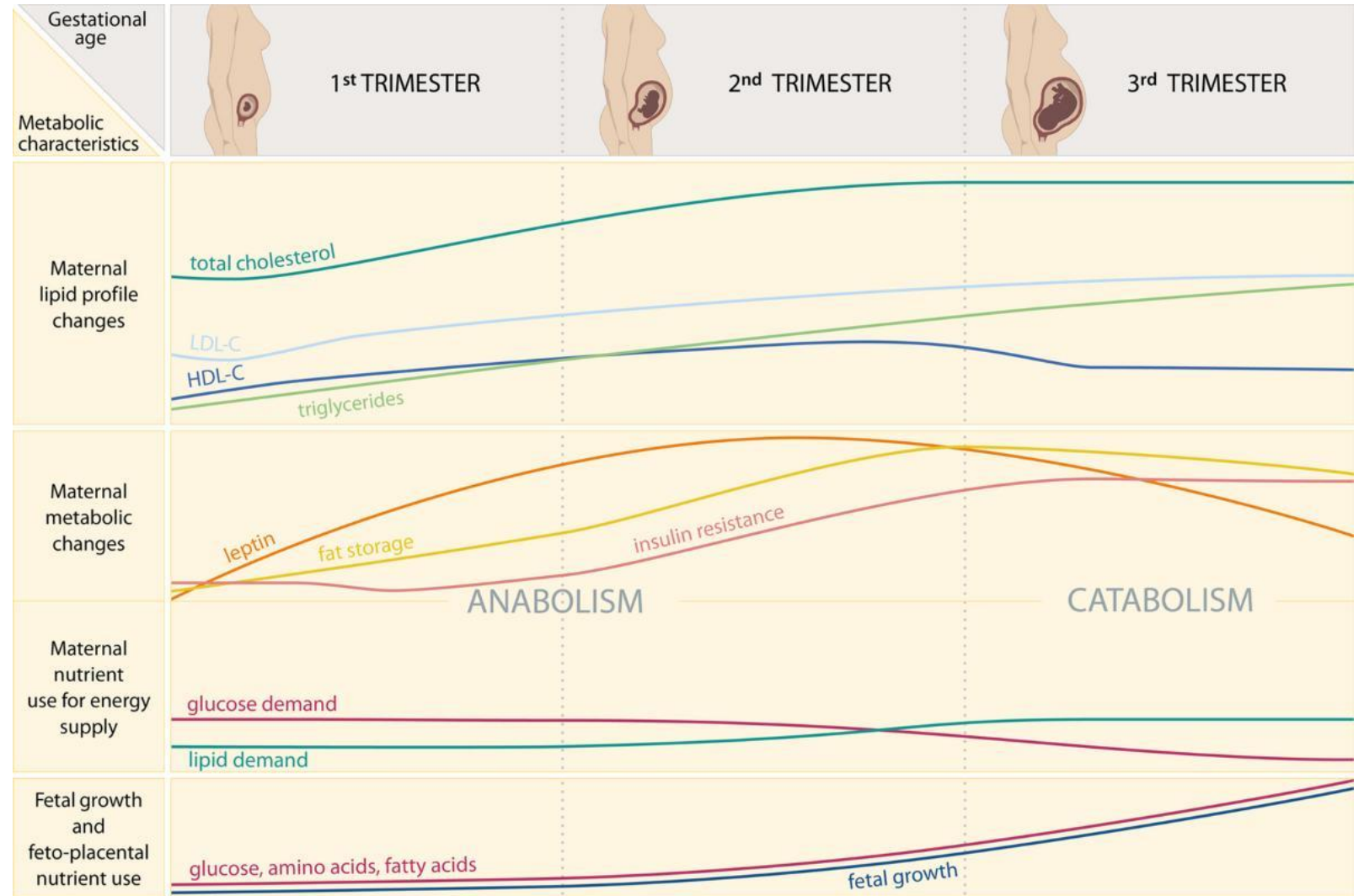
Gestational diabetes mellitus: Taking it to heart, Jessica A. Marcinkevage & K.M. Venkat Narayan (2010)



THOSE WHO CANNOT PRODUCE OR USE
ENOUGH INSULIN ARE DIAGNOSED
WITH GESTATIONAL DIABETES

Protein and Lipid Metabolism

- Protein supports fetal growth, placental development, uterine enlargement and breast development.
- Recommended intake: ~71 g/day.
- Lipids: early fat storage, late fat mobilization.



Herrera & Ortega-Senovilla, 2014

Information for Healthcare Professionals Only

Placental Nutrient Transfer

- Functions: nutrient transport, endocrine regulation, immunological protection, metabolic regulation.

The Placenta: More Than a Filter

- Glucose: facilitated diffusion
- Amino acids: active transport
- Lipids: selective transport
- Key Message:

Healthy fetal growth depends on both maternal nutrition and placental function.

Burton & Fowden, 2015

Energy and Weight Gain Requirements

- Energy:
 - ✓ +340 kcal/day (2nd trimester),
 - ✓ +452 kcal/day (3rd trimester).

➤ IOM Weight Gain:

- ✓ Underweight: 12.5–18 kg
- ✓ Normal : 11.5–16 kg
- ✓ Overweight : 7–11.5 kg
- ✓ Obese: 5–9 kg

Weight category	IOM BMI category criteria	Asian BMI category criteria	IOM-recommended weight gain
Underweight	< 18.5 kg/m ²	< 18.5 kg/m ²	12.5–18 kg
Normal weight	18.5–24.9 kg/m ²	18.5–22.9 kg/m ²	11.5–16 kg
Overweight	25.0–29.9 kg/m ²	23–24.9 kg/m ²	7–11.5 kg
Obese	≥30 kg/m ²	≥25 kg/m ²	5–9 kg

➤ Key Message:

Appropriate gestational weight gain improves maternal and neonatal outcomes

IOM, 2009; WHO, 2020

Macronutrients and Micronutrients for Optimal Pregnancy Outcomes

Carbohydrates and Glycaemic Quality in Pregnancy

➤ Recommended intake: ≥ 175 g/day

Why Carbohydrates Matter?

- ✓ Primary fetal energy source
- ✓ Brain development
- ✓ Prevention of maternal ketosis
- ✓ Support of placental metabolism

IOM Dietary Reference Intakes (2005);
FIGO Nutrition Checklist (2021)

Prefer

- Wholegrains
- LegumesFruits
- Vegetables

Limit

- Refined sugars
- Sugar-sweetened beverages
- Ultra-processed foods



Information for Healthcare Professionals Only

Dietary Fat and Fetal Neurodevelopment

- Functions: energy storage, hormone synthesis, cell membrane formation, placental development
- DHA: 200–300 mg/day
- DHA: A Critical Nutrient
 - ↳ Supports, Brain development,
Retinal development
Cognitive function



Koletzko et al.;
FAO/WHO Expert Consultation

Information for Healthcare Professionals Only

Critical Micronutrients in Pregnancy

- Folate, Iron, Calcium, Vitamin D, Iodine, Choline, Vitamin B12

- **Key Message**

Micronutrient deficiencies may occur despite adequate caloric intake.

WHO Antenatal Nutrition Guidelines;
FIGO Recommendations

Folate, Vitamin B12 and Choline

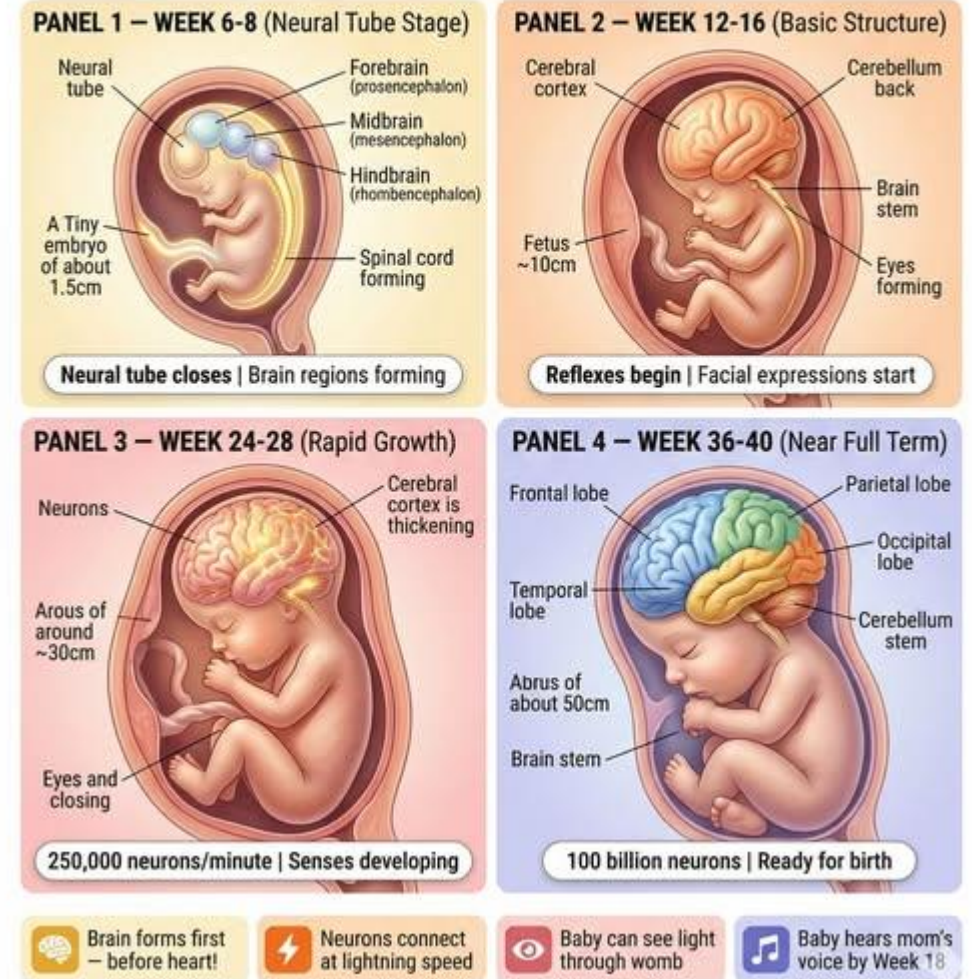
- **Folate 600 µg/day**
 - Neural tube closure and DNA synthesis
- **Vitamin B12 2.6 µg/day**
 - Neurological development
 - Red blood cell production
- **Choline 450 mg/day**
 - Brain development
 - Memory pathways
 - Neural tube development

WHO Folic Acid Recommendations;
National Academy of Medicine

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HOW BABY'S BRAIN GROWS

Your baby's brain develops at an incredible speed during pregnancy — from just a few cells to 100 billion neurons by birth! Every week counts.



Healing Blueprint

Iron and Anemia in Pregnancy

- Iron requirement 27 mg/day
- Consequences of deficiency:
 - **Maternal:**
 - Fatigue
 - Anemia
 - Reduced work capacity
 - **Fetal:**
 - Preterm birth
 - Low birth weight
 - Perinatal mortality
- Global Burden
 - ~37% of pregnant women are anemic worldwide.

WHO Global Anemia Report;
FIGO Anemia Recommendations

Calcium, Vitamin D and Iodine

- **Calcium 1000 mg/day**

- ✓ Skeletal development
- ✓ Reduced preeclampsia risk

Suggested Graphic

Bone–thyroid–brain infographic

- **Vitamin D 600 IU/day**

- ✓ Bone health
- ✓ Immune regulation

- **Iodine 220 µg/day**

- ✓ Thyroid function
- ✓ Neurodevelopment

WHO Calcium Guidelines;
WHO Iodine Guidelines

Information for Healthcare Professionals Only

Practical Supplementation Recommendations

- WHO recommends:

- Iron + folic acid,
- calcium where indicated,
- iodized salt,
- balanced energy-protein supplementation

Suggested Antenatal supplementation algorithm.

- Clinical Principle:

Supplements support—but do not replace—a healthy diet

WHO Antenatal Care Recommendations (2020);
FIGO Checklist (2021)

Nutritional Disorders and High-Risk Conditions

Iron Deficiency Anemia in Pregnancy

- WHO Definition: Hb <11 g/dL
- Maternal:
 - Fatigue,
 - reduced physical capacity,
 - postpartum morbidity
- Fetal:
 - Preterm birth,
 - low birth weight,
 - perinatal mortality
- Key Message: Iron deficiency remains one of the leading preventable causes of adverse pregnancy outcomes.

Iron Deficiency



Anemia



Reduced Oxygen Delivery



Maternal & Fetal Complications

WHO Global Anaemia Estimates (2021);
FIGO Advice on Iron Deficiency and Anemia (2023)

Obesity in Pregnancy

- BMI ≥ 30 kg/m²
- Maternal risks:
 - GDM,
 - preeclampsia,
 - cesarean delivery,
 - thromboembolism
- Fetal risks:
 - Macrosomia,
 - congenital anomalies,
 - stillbirth
- Key Message:
Obesity is one of the most important modifiable obstetric risk factors.

Maternal Obesity



Metabolic Dysfunction



Maternal & Fetal Complications

ACOG Obesity in Pregnancy;
FIGO Obesity Guideline (2020)

Gestational Diabetes Mellitus (GDM)

- Pregnancy hormones → Insulin resistance → Hyperglycaemia → GDM
- Major Complications
 - Maternal
 - Preeclampsia
 - Cesarean delivery
 - Fetal
 - Macrosomia
 - Shoulder dystocia
 - Neonatal hypoglycemia
- Management:
 - Medical nutrition therapy
 - Physical activity

Suggested Graphic

Insulin resistance pathway.

The HAPO Study: Why It Changed Obstetrics

- >23,000 women across 9 countries
- Increasing maternal glucose associated with:
 - Macrosomia
 - Cord C-peptide elevation
 - Neonatal adiposity
 - Cesarean delivery
 - Preeclampsia

Metzger BE et al. N Engl J Med. 2008

Hypertensive Disorders and Nutrition

- Risk factors:
 - Low calcium intake
 - Obesity
 - Excessive gestational weight gain
- Prevention(Evidence-Based):
 - Calcium supplementation: **WHO Recommendation 1.5–2 g elemental calcium/day** for populations with low calcium intake
 - Weight optimization
 - Balanced diet

Poor Nutrition



Placental Dysfunction



Preeclampsia

WHO Calcium Guideline;
Hofmeyr et al. Cochrane Review

Nutrition through Labour, Lactation and Postpartum Recovery

Special Nutritional Situations in Pregnancy

- Populations Requiring Enhanced Nutritional Surveillance

- Multiple pregnancy
- Adolescent pregnancy
- Vegetarian and vegan diets
- Pregnancy after bariatric surgery

Special Pregnancy



Higher Nutritional Demand



Enhanced Monitoring

- Common Challenges

- Increased nutritional requirements
- Micronutrient deficiencies
- Fetal growth concerns

ACOG Multifetal Gestation Bulletin

Academy of Nutrition and Dietetics Position Statement

ACOG Pregnancy After Bariatric Surgery

Nutrition During Labour

- Modern Approach
- For low-risk women:
 - Clear fluids generally allowed
 - Individualized oral intake
- Benefits(water, Clear juice, tea without milk)
 - Improved hydration
 - Improved maternal comfort
 - Energy support during labour
- **Labour is a physiologically demanding process that requires adequate hydration.**

Hydration



Maternal Energy



Labour Performance

ACOG Committee Opinion on Oral Intake During Labour
ERAS Society Recommendations

Postpartum Nutrition and Recovery

- Goals of Postpartum Nutrition

- Tissue healing
- Replenishment of nutrient stores
- Recovery from blood loss
- Prevention of nutritional depletion

- Priority Nutrients

- Iron
- Protein
- Folate
- Calcium
- Vitamin D

- **Nutritional care should continue beyond delivery.**

Delivery



Recovery



Nutritional Replenishment

WHO Postnatal Care Guidelines

ACOG Optimizing Postpartum Care

Breastfeeding and Maternal Nutrition

- Additional Requirements During Lactation
 - ✓ Energy: +330–400 kcal/day
 - ✓ Protein: ~1.3 g/kg/day
- Important Nutrients
 - Protein
 - Calcium
 - Iodine
 - Vitamin D
 - Omega-3 fatty acids
- **Breastfeeding increases nutritional demands but provides substantial benefits for both mother and infant.**

Maternal Nutrition



Breast Milk



Infant Growth

Victora CG et al. Lancet. 2016
WHO Breastfeeding Recommendations

Long-Term Maternal Health: Postpartum Weight Retention

- Consequences
 - Obesity
 - Type 2 diabetes
 - Hypertension
 - Cardiovascular disease
 - Future pregnancy complications
- Prevention
 - Healthy diet
 - Physical activity
 - Breastfeeding support
 - Interpregnancy weight optimization

Excess Pregnancy Weight Gain



Weight Retention



Future Chronic Disease

The postpartum period is a critical opportunity for chronic disease prevention.

WHO Maternal Health Reports
ACOG Postpartum Care Recommendations
IOM Weight Gain During Pregnancy

Maternal Nutrition, Lifelong Health and Future Directions

Maternal Nutrition and Lifelong Health

- Developmental Origins of Health and Disease (DOHaD)
- Maternal nutrition influences future risks of:
 - Obesity
 - Type 2 diabetes
 - Hypertension
 - Cardiovascular disease
 - Neurodevelopmental disorders

Maternal Nutrition



Fetal Programming



Child Health



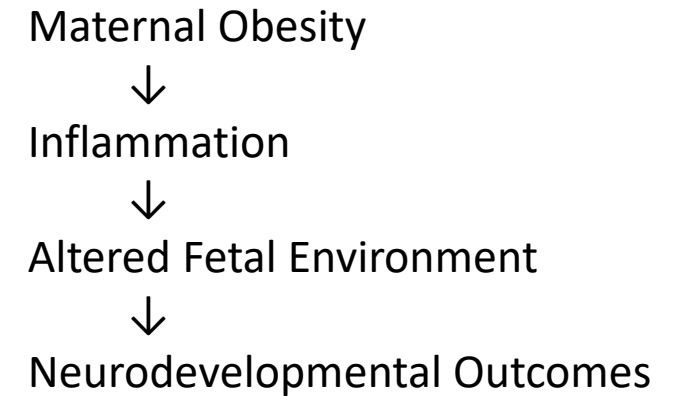
Adult Health

Barker DJP. J Am Coll Nutr. 2004.

Gluckman PD, Hanson MA. 2008.

Maternal Obesity, Neurodevelopment and Emerging Evidence

- Current evidence suggests associations between maternal obesity and:
 - Childhood obesity
 - Insulin resistance
 - Neurodevelopmental disorders
 - Autism spectrum disorder (ASD)
- **Important note: Association does not prove causation.**



Li M et al. Pediatrics. 2016.
Reynolds LC, Inder TE.

Key Take-Home Messages and Conclusions

- Remember:
 - ✓ Nutrition begins before conception
 - ✓ Undernutrition and overnutrition increase risks
 - ✓ Folate, iron, calcium, iodine, vitamin D and choline are critical
 - ✓ Appropriate gestational weight gain improves outcomes
 - ✓ Maternal nutrition influences future generations

**"Healthy mothers create
healthier pregnancies,
healthier children, and
healthier societies."**