Παχυσαρκία στην εγκυμοσύνη

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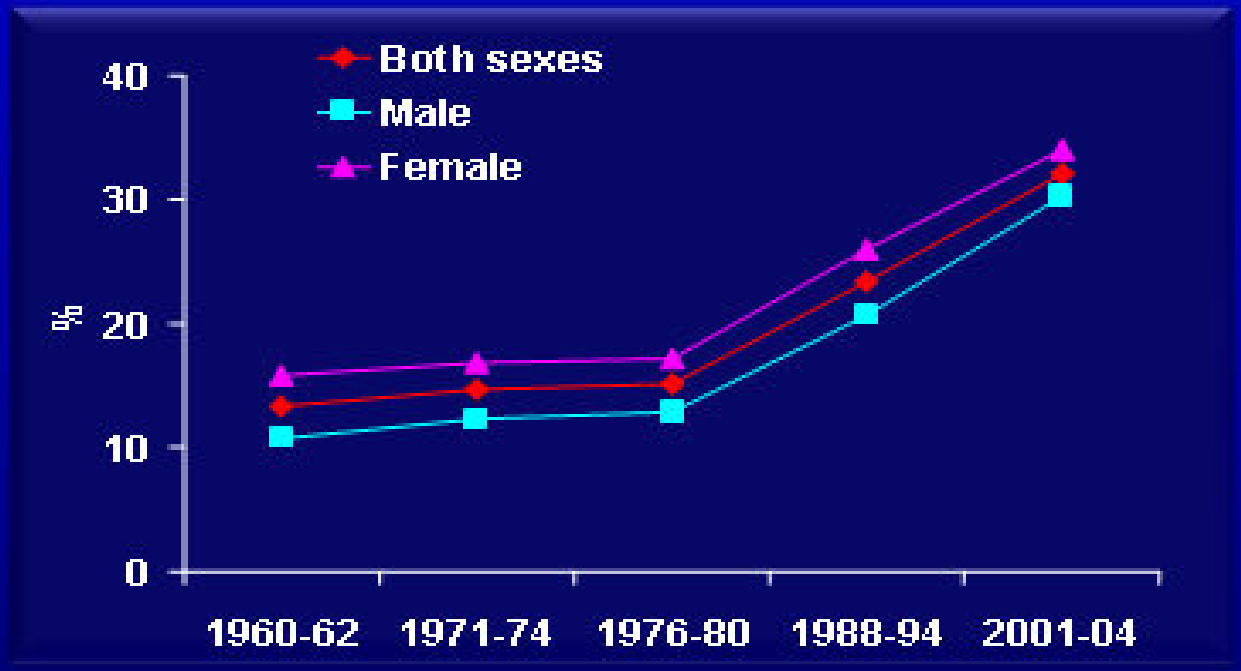
Θέματα

- Παχυσαρκία γενικά
- Λιποκύτταρο
- Λιπώδης ιστός στην εγκυμοσύνη

1. Φυσιολογικές μεταβολές στην εγκυμοσύνη
2. Εναπόθεση και τρόποι μελέτης
3. Παχυσαρκία και μεταβολικοί κίνδυνοι για τη μητέρα και το έμβρυο
4. Κλινικά κριτήρια αντιμετώπισης
5. Θεραπευτικοί στόχοι-μέσα

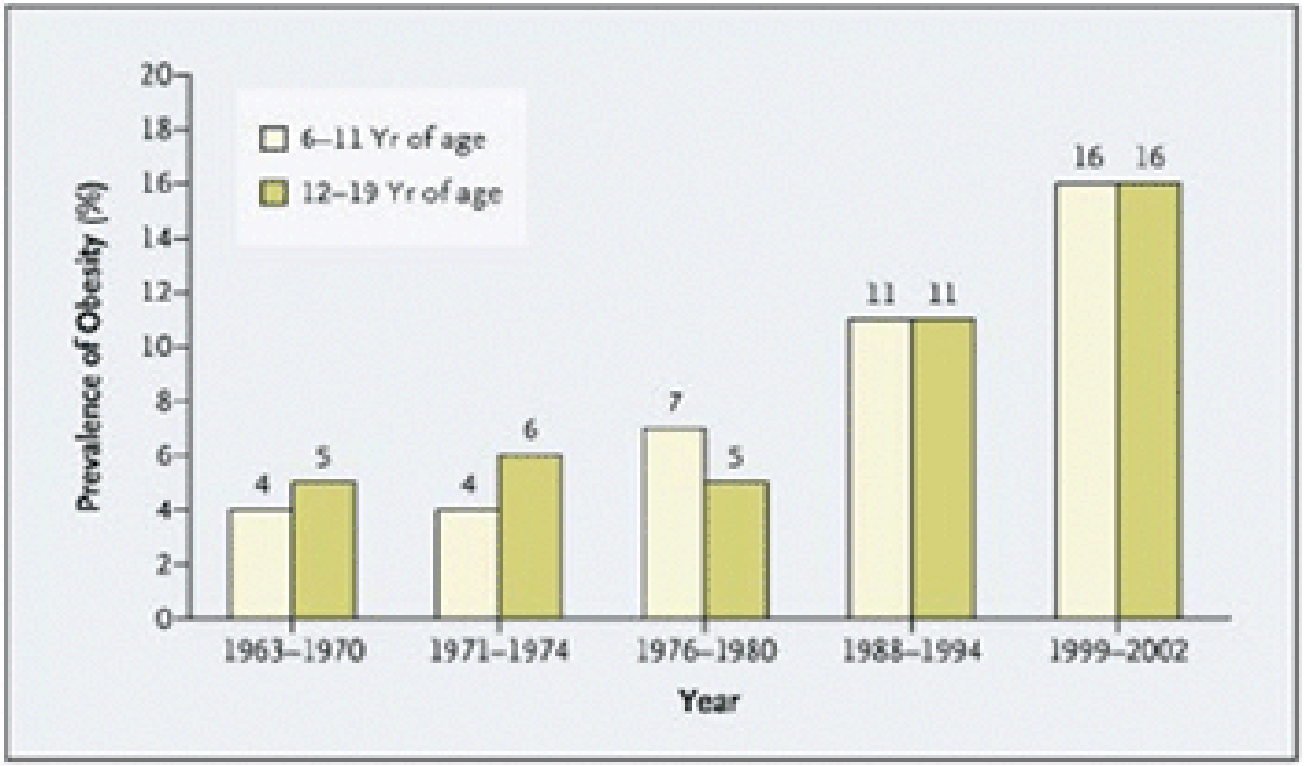
Το φαινόμενο-παρατήρηση

Trends in Obesity in the United States



Health United States, 2006. Available at: www.cdc.gov/nchs/data/hus/hus06.pdf. Accessed June 6, 2007.

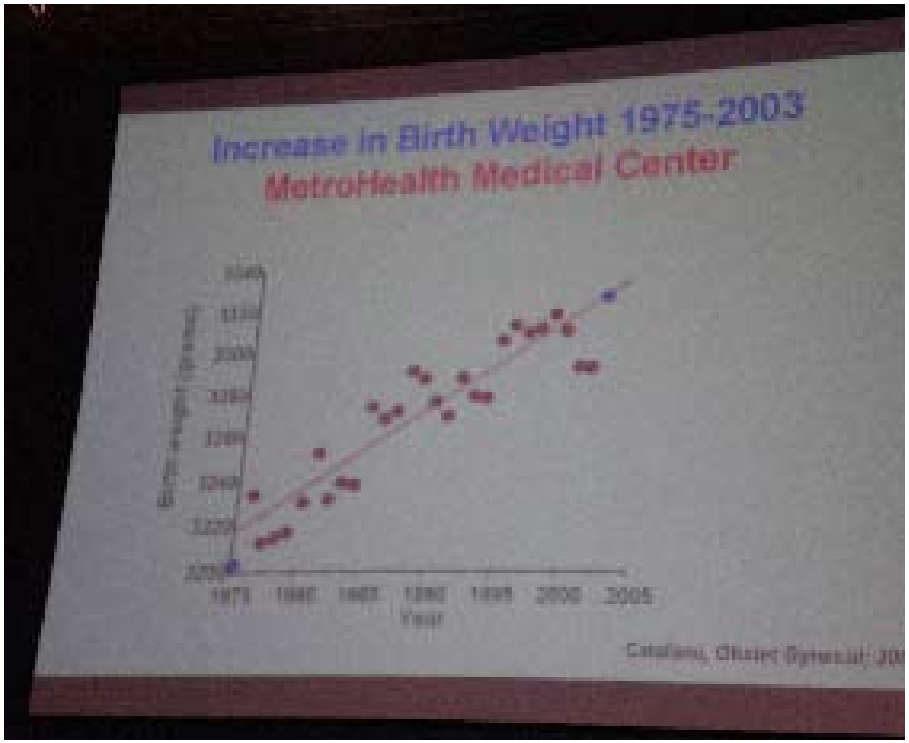
Obesity in U.S. Children and Teenagers



Nestle, M. *N Engl J Med.* 2006;354:2527-9.

Increasing trend of birth weight between 1975-2003

Catalano Obst & Gynae 2004



Increasing trends in birth weight Europe (ACOG 2001, Obst&Gynae 2001)

- Denmark 1990-1999

1. Mean birth weight increased from 3474gr to 3619 gr
2. >4000gr increased from 6.7% to 20%

- Sweden 1992-2001

1. 23% increase of LGA newborns
2. >2 SD mean birth weight for gestational age

Increasing trends in birth weight USA/Canada 1985-1998

(Ann Seminars Perinat 2004)

- Term SGA

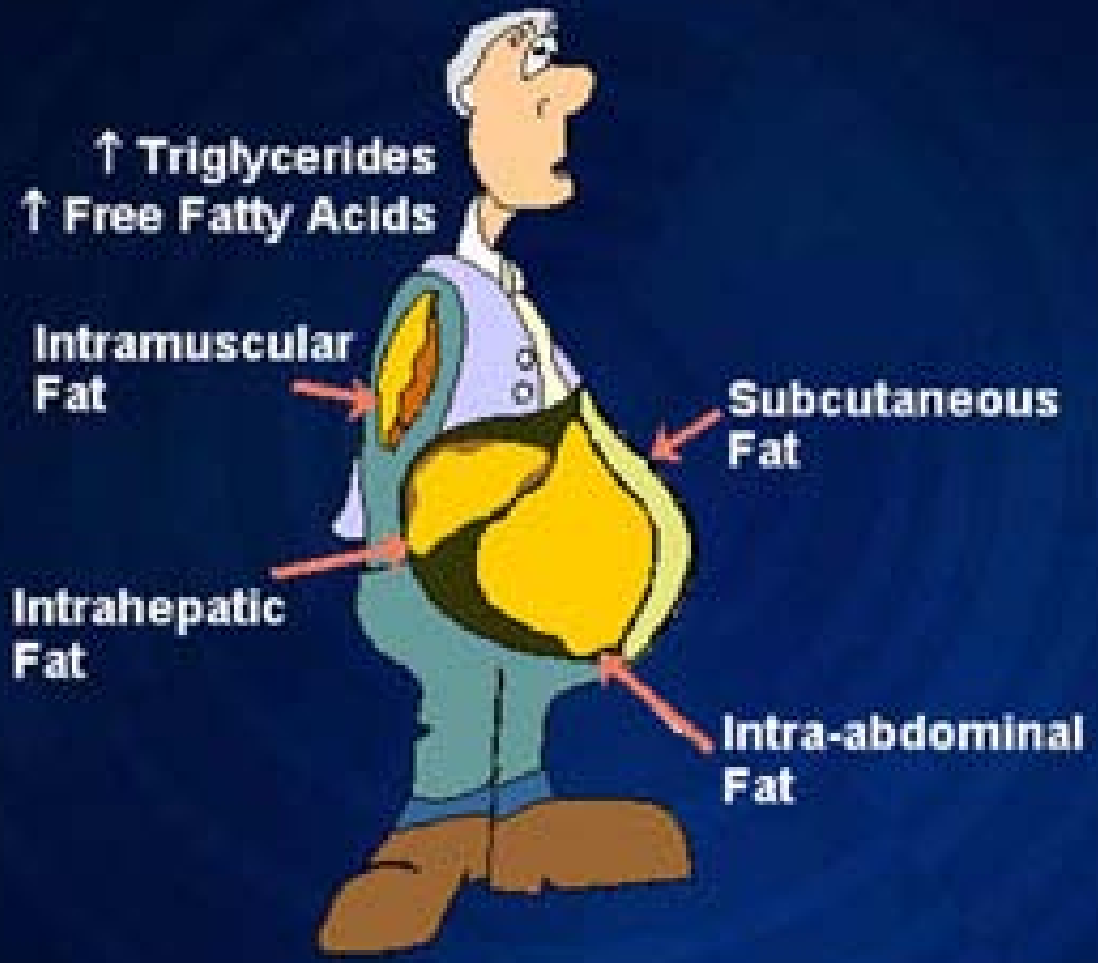
1. USA white 11%
2. USA black 12%
3. Canada 27%

- Term LGA

1. USA white 6%
2. USA black 9%
3. Canada 24%

Η Παχυσαρκία γενικά

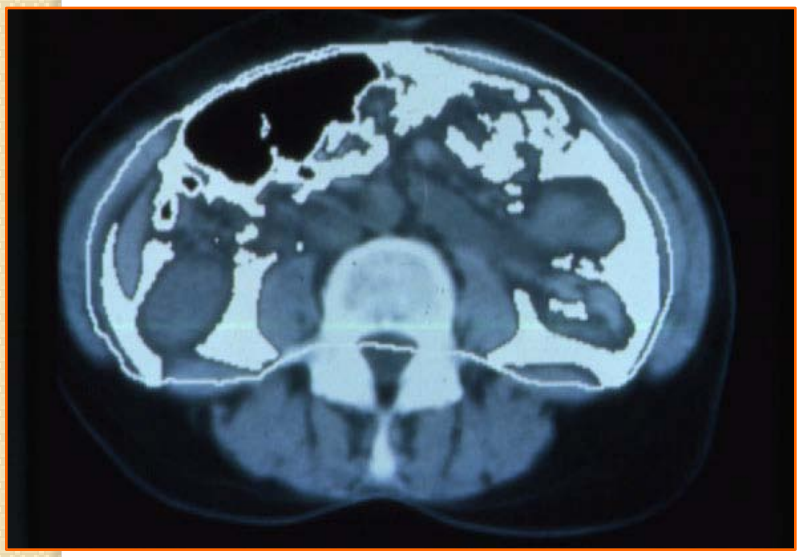
Central Adiposity

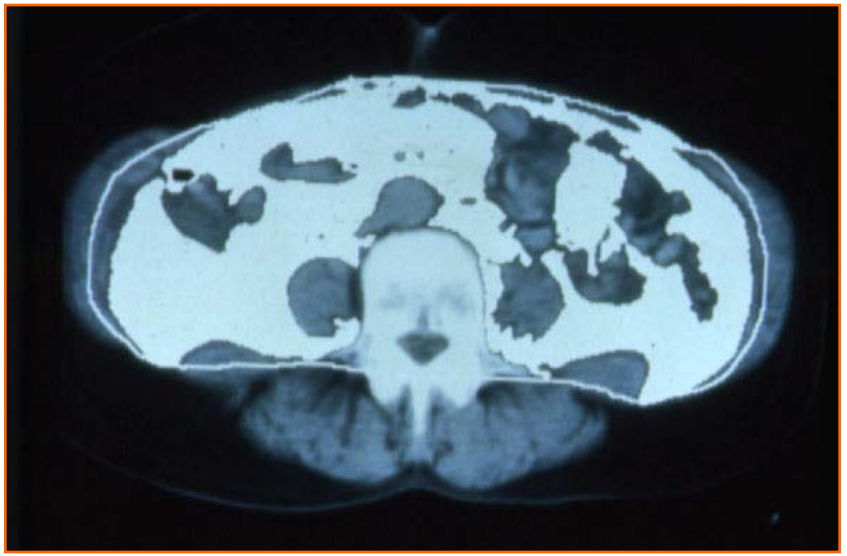


Adapted from DeFronzo RA. *Br J Diabetes Vasc Dis*. 2003;3(suppl 1):S24-S40.

Joslin Diabetes Center

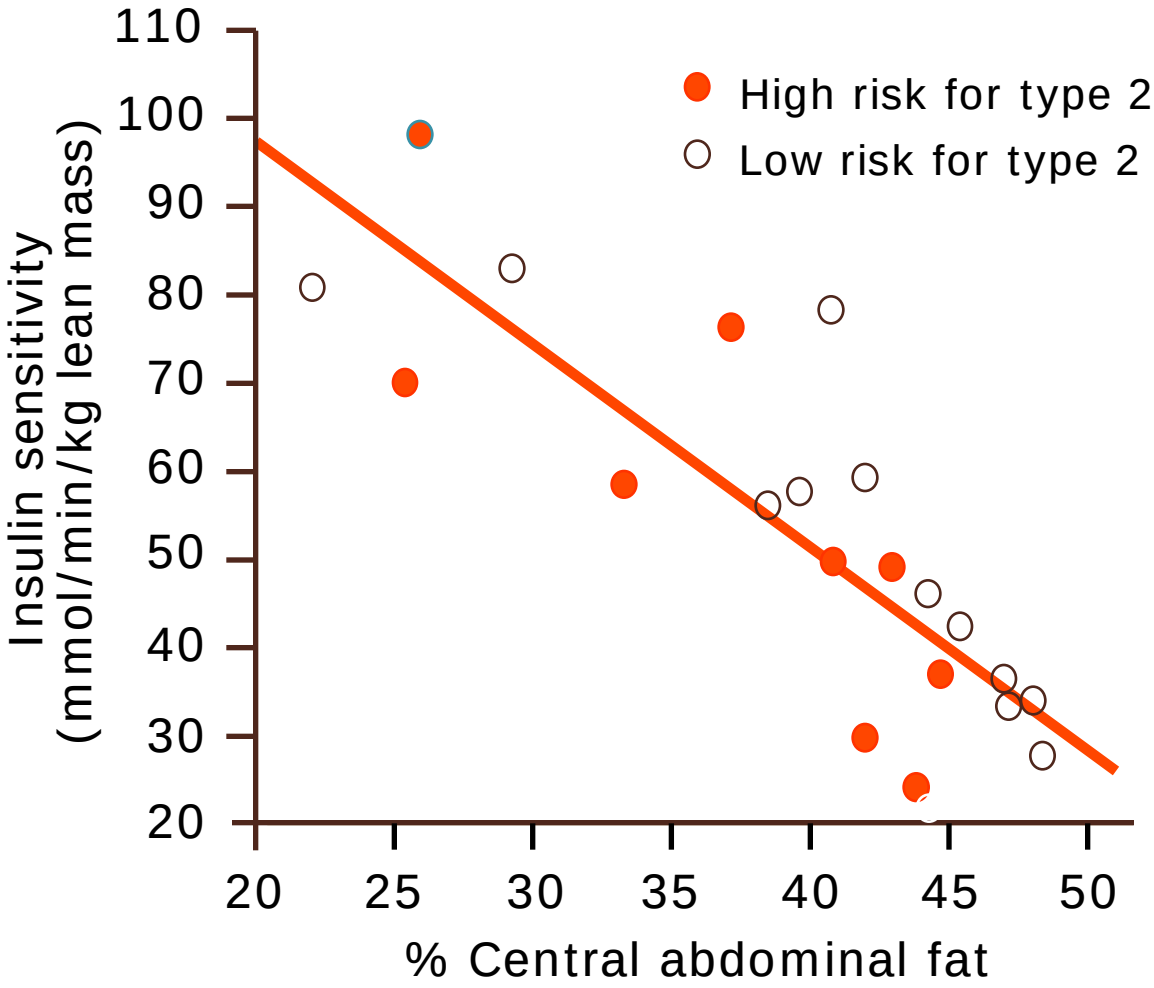
Φυσιολογική και παθολογική εναπόθεση του λίπους ενδοκοιλιακά





Κεντρική παχυσαρκία και ευαισθησία στην ινσουλίνη

Variance in S_i Accounted for by Regional Fat Mass	
Region	**R^2 Value**
Central abdomen	**0.80**
Trunk	**0.60**
All nonabdominal	**0.44**
Arms	**0.30**
Legs	**0.10**



Adapted from Carey DG et al. *Diabetes*. 1996;45:633-638.

IDF Criteria of the Metabolic Syndrome

Similar to the AHA/NHLBI except required waist circumference and lower thresholds for abdominal obesity

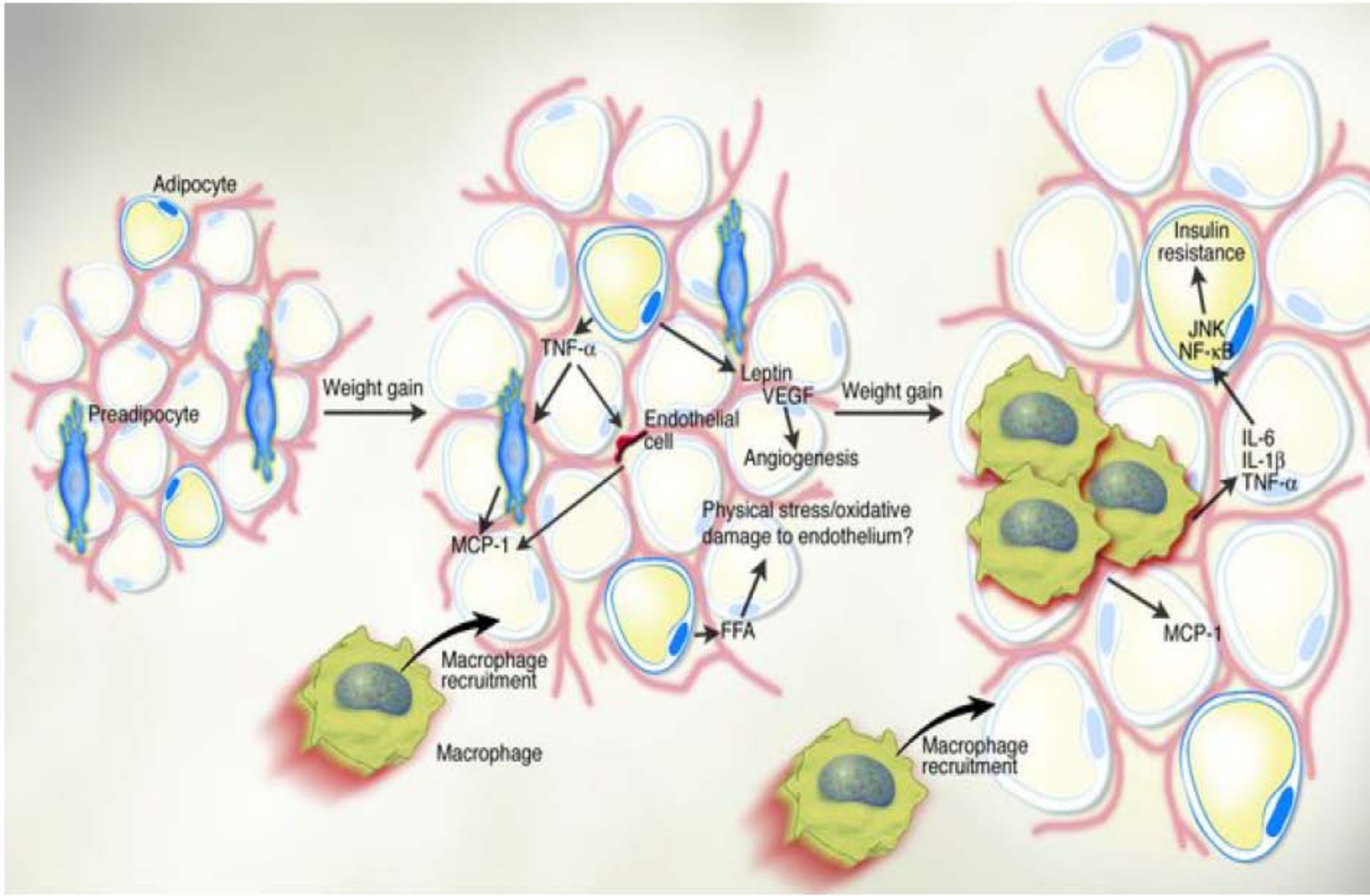
- High waist circumference

  Plus any two of

- ↑ Triglycerides (≥ 1.7 mmol/L [150 mg/dL])
- ↓ HDL cholesterol
  - Men < 1.0 mmol/L (40 mg/dL)
  - Women < 1.3 mmol/L (50 mg/dL)
- ↑ Blood pressure ≥ 130 / ≥85 mm Hg
- ↑ FPG (≥ 5.6 mmol/L [100 mg/dL]), or diabetes

Alberti KGMM, et al. International Diabetes Federation. *Lancet* 2005; 366:1059-1062

- Το λιποκύτταρο εκκρίνει τις λιποκυττοκίνες που εκκρίνονται αποκλειστικά ή κατά κυρίαρχο τρόπο από το λιπώδη ιστό, αλλά που κάποιες από αυτές έχει βρεθεί ότι εκφράζονται και εκκρίνονται και από άλλους ιστούς



J. Clin. Invest. 112:1785–1788 (2003)

Η Δράση των λιποκυττοκινών

Medscape® www.medscape.com

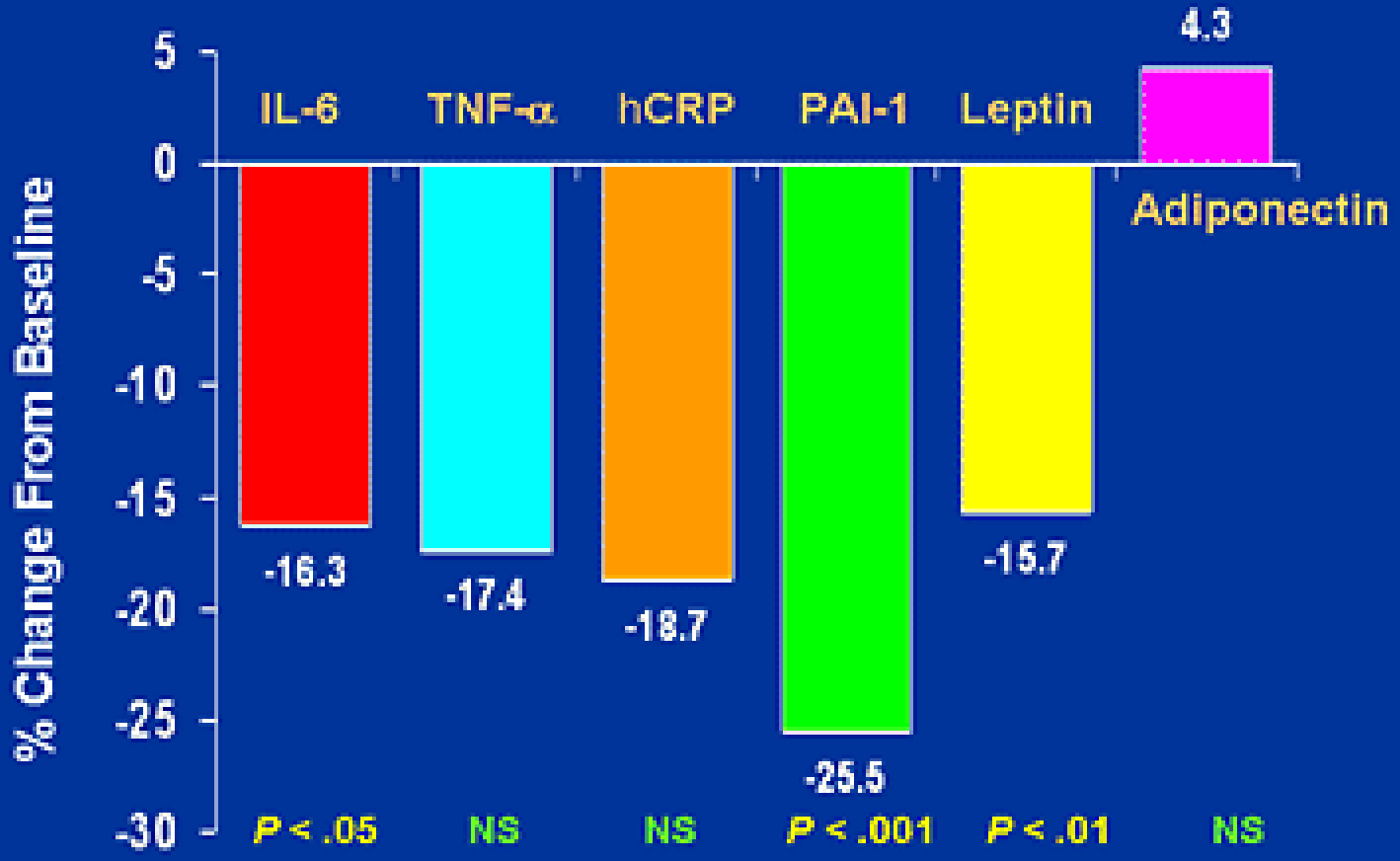
Adipocytokines	Effects on
LPL	Lipid metabolism
HSL	Lipid metabolism
Perilipin	Lipid metabolism
aP2	Lipid metabolism
CETP	Lipid metabolism
RBP	Lipid metabolism
IL-6	Inflammation, atherosclerosis, insulin resistance
TNF-α	Inflammation, atherosclerosis, insulin resistance
Adipsin/ASP	Immune–stress response
Metallothionein	Immune–stress response
Angiotensinogen	Vascular homeostasis
PAI-1	Vascular homeostasis
Adiponectin	Inflammation, atherosclerosis, insulin resistance
PPAR-γ	Lipid metabolism, inflammation, vascular homeostasis
CRP	Inflammation, atherosclerosis, insulin resistance
IGF-1	Lipid metabolism, insulin resistance
TGF-b	Cell adhesion and migration, growth and differentiation
Monobutyrin	Vasodilation of the microvessel
Uncoupling proteins	Energy balance and theromoregulation
Steroid hormones	Lipid metabolism, insulin resistance
Leptin	Food intake, reproduction, angiogenesis, immunity
Resistin	Inflammation, insulin resistance
P450 arom	Lipid metabolism
Apelin	Insulin resistance
Visfatin	Insulin resistance
ZAG	Lipid metabolism, cancer cachexia

Abbreviations: LPL, lipoprotein lipase; HSL, hormone-sensitive lipase; aP2, adipocyte lipid-binding protein; RBP, retinol-binding protein; IGF-1, insulin-like growth factor-1; TGF-b, transforming growth factor-b; PPAR-g, peroxisome proliferator-activated receptor g; ZAG, zinc-a2-glycoprotein.

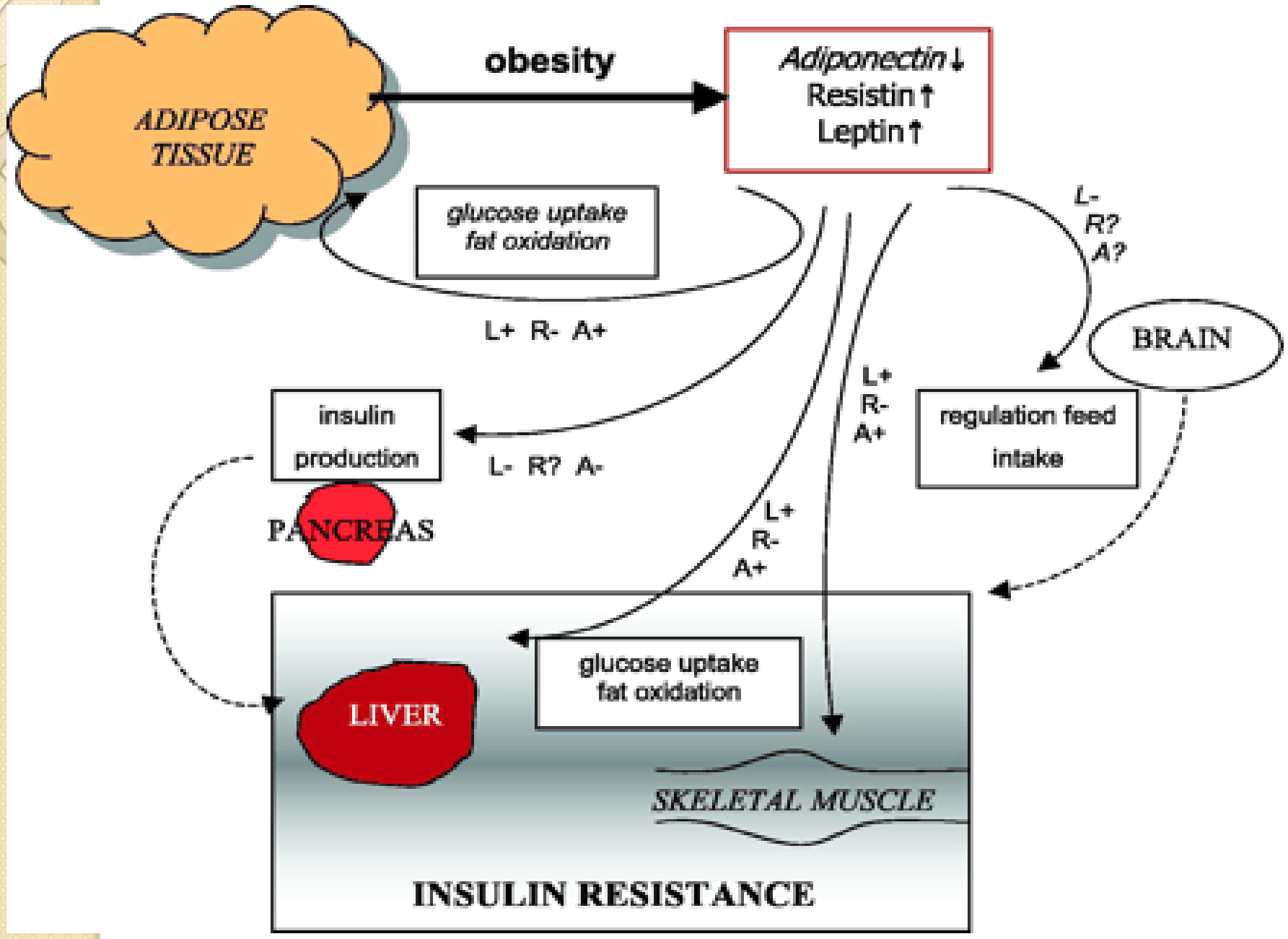
Source: Clin Endocrinol © 2006 Blackwell Publishing

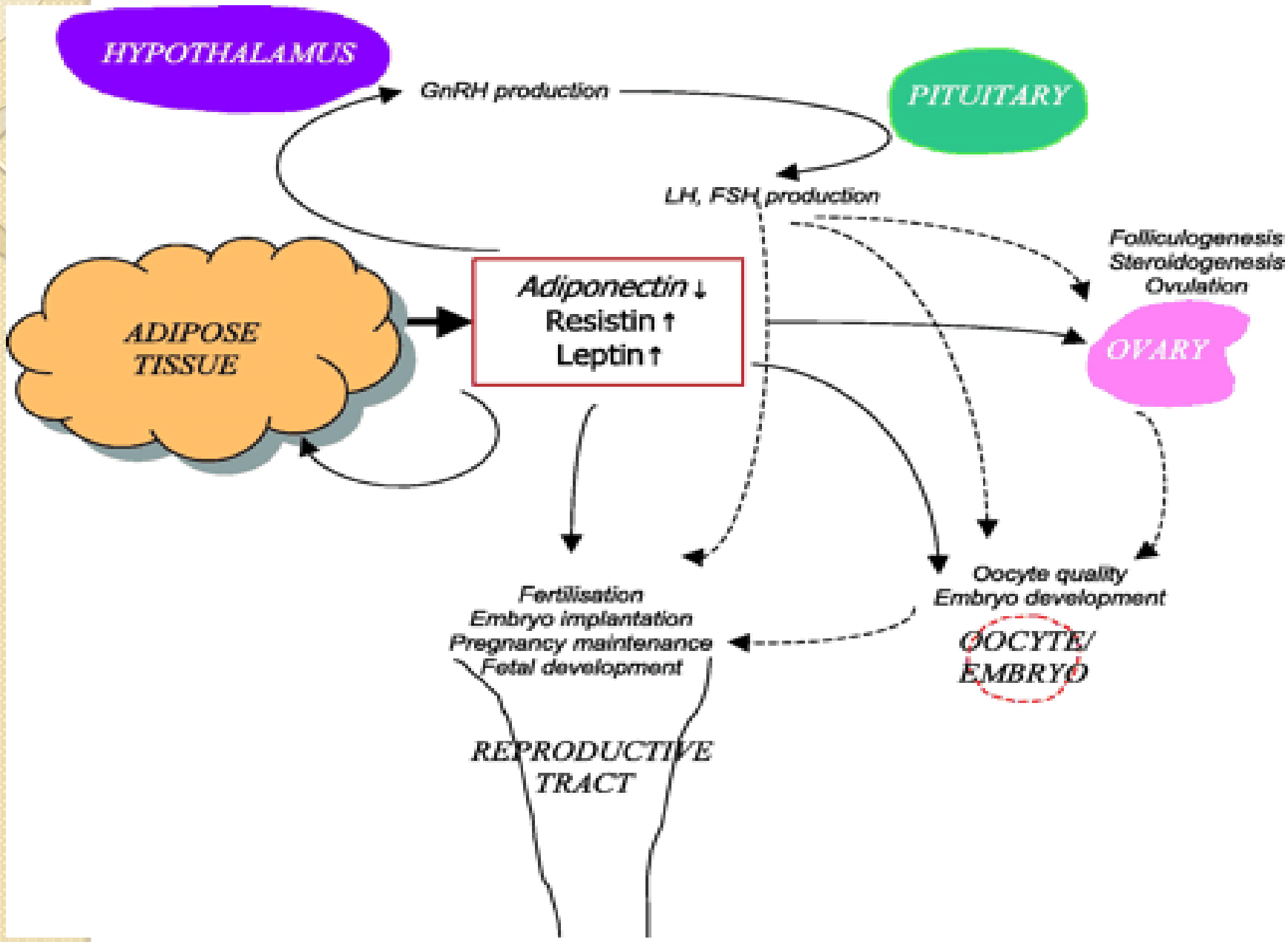
Effects of 6 Months of Weight Reduction

through diet and exercise on plasma cytokines and key markers of inflammation in obese subjects with insulin resistance



Monzillo LU *Obes Res.* 2003;11(9):1048-54.
Hamdy O et al. *Diabetes Care.* 2003;26:2119-2125.


ADIPOSE TISSUE
obesity
Adiponectin↓
Resistin↑
Leptin↑
glucose uptake
fat oxidation
L+ R- A+
L-
R?
A?
BRAIN
insulin
production
L- R? A-
PANCREAS
L+
R-
A+
regulation feed
intake
L+
R-
A+
glucose uptake
fat oxidation
LIVER
SKELETAL MUSCLE
INSULIN RESISTANCE


HYPOTHALAMUS
GnRH production
PITUITARY
LH, FSH production
Folliculogenesis
Steroidogenesis
Ovulation
ADIPOSE TISSUE
Adiponectin ↓
Resistin ↑
Leptin ↑
OVARY
Oocyte quality
Embryo development
Fertilisation
Embryo implantation
Pregnancy maintenance
Fetal development
OOCYTE/ EMBRYO
REPRODUCTIVE TRACT

Ο λιπώδης ιστός στην εγκυμοσύνη

Maternal adaptations in pregnancy and lactation (ENDO 2008)

- A) Alterations in hormonal secretory mechanisms

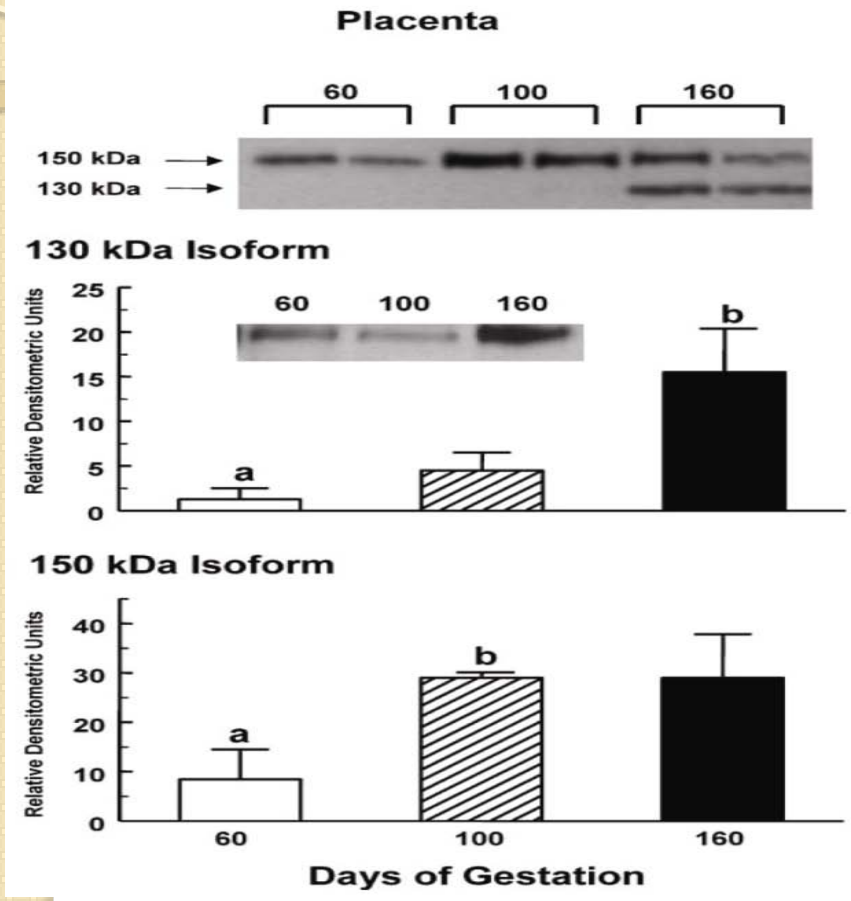
1. Placental hormones
2. Prolactin, ocytocin
3. Reduced stress response

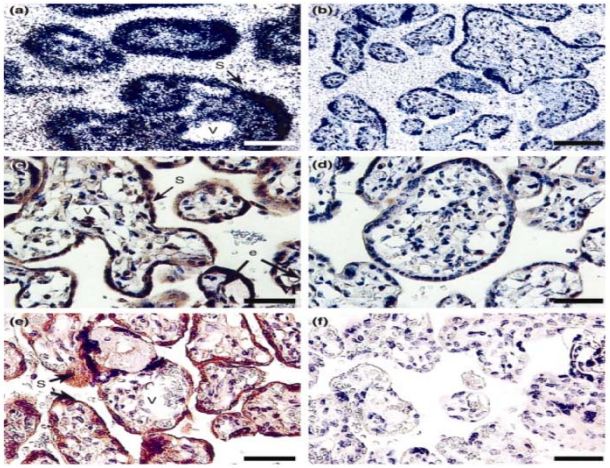
B) Reset of maternal homeostatic regulations

1. Metabolic adaptations-προσαρμογες
2. Temperature, cardiovascular, respiratory, immune
3. Suppression of fertility

Hauguel-de Mouzon et al. Placenta 2005

	Adipocyte	SVF	Placenta
TNF-α	+	+ + +	+
IL-6	+	+	+
IL-1b		+ +	
IL-8	+	+ +	+
IL-1Ra	+	+ +	+
IL-10	+	+ +	+
Leptin	+ +	0	+
Adiponectin	+ +	0	–
Resistin	0	+ +	+
MCP-1	+	+ +	+
MIF	+ +	+	+
VEGF	+	+ +	+
PAI-1	+	+ +	+
Cathepsin S	+	+ +	+



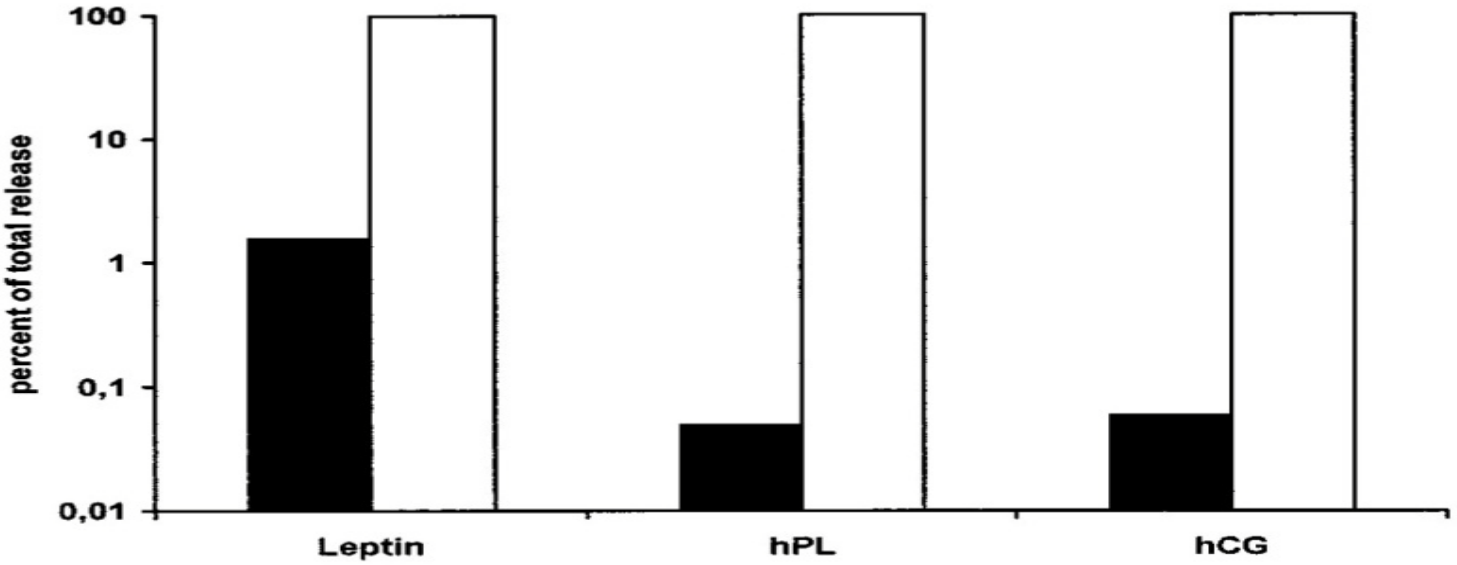


Receptor of Placental Leptin

Henson et al. Biol. Of Reprod. 2005
Ashworth Reviews of Reproduction 2000

Placental release of leptin to embryo and mother (Linnemann K et al., Diabetes 2000)

[a] Percent of total release.



Energy requirements during pregnancy (WHO)

- The ideal situation is for a woman to enter pregnancy at a normal weight and with good nutritional status.
- Aim for adequate maternal gain to ensure

1. the growth of the foetus,
2. placenta and
3. associated maternal tissues

Components of weight gain during pregnancy

- Weight gain during pregnancy comprises

1. the products of conception (foetus, placenta, amniotic fluid),
2. the growth of various maternal tissues (uterus, breasts)
3. the increase in blood, extracellular fluid and maternal fat stores

Extra energy expenditure and fat deposition during pregnancy

(Institute of Medicine/Food and Nutrition Board, 1990, WHO)

- the extra energy cost of pregnancy is
- 77 000 kcal divided into

1. Extra 85 kcal/day, with 11% of the total fat deposition during the first trimester
2. Extra 285 kcal/day, with 47% of the total fat deposition during the second trimester
3. 475 kcal/day, with 42% of the total fat deposition during the third trimester

- The deposition of protein occurs primarily in the second (20 %) and third trimesters (80 %).

Pregnancy-related changes in activity energy expenditure and resting metabolic rate vs body weight changes

Melzer K, et al. Eur J Clin Nutr 2009

- The RMR during late pregnancy was 21.4% higher than the postpartum RMR
- Absolute changes in RMR were positively correlated with the corresponding changes in body weight
- Additional energy expenditure is primarily attributed to an increase in RMR, which is partly compensated by a decrease in Activity EE.

Fat weight vs maternal weight deposition in pregnancy

WHO collaborative study 2002

- 11 longitudinal studies, in 273 well-nourished pregnant women
- at 36 weeks of gestation:

1. 3.7 kg (range 3.1-4.4) fat gain
2. with a mean of 11.9 kg (range 10-14) weight gain

- Extrapolating the calculations to 40 weeks of gestation:

1. fat accretion to 4.3 kg, associated
2. with a mean weight gain of 13.8 kg .

- Daily fat gain:

1. of 8 g/day in the first trimester,
2. 26 g/day in the second trimester
3. and 18 g fat/day in the third trimester.

Body composition at birth in humans

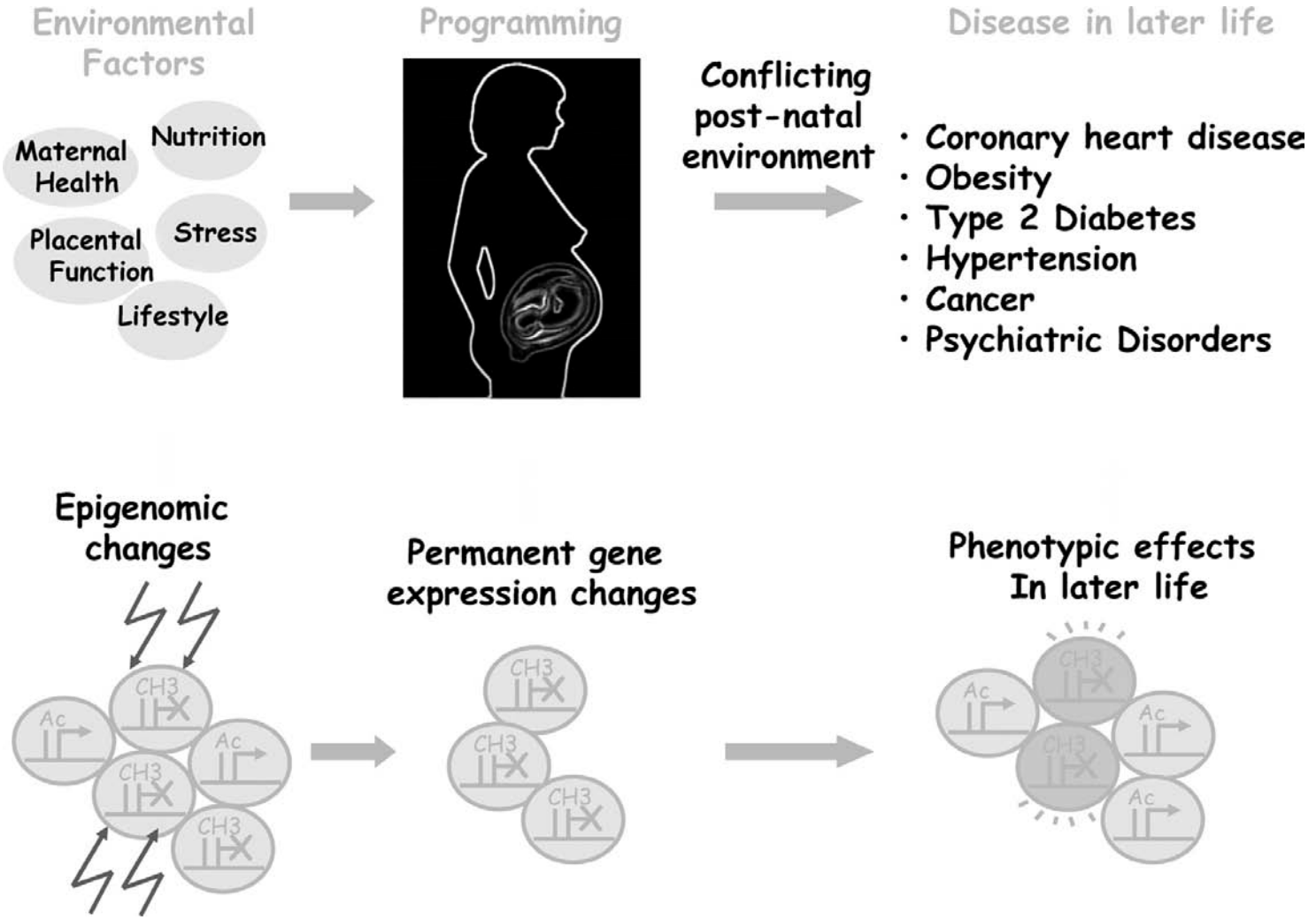
- Fat mass 12-15%
- Fat free mass 85-88%

Endometrial programming

Lucas Arch Dis Childhood 1999

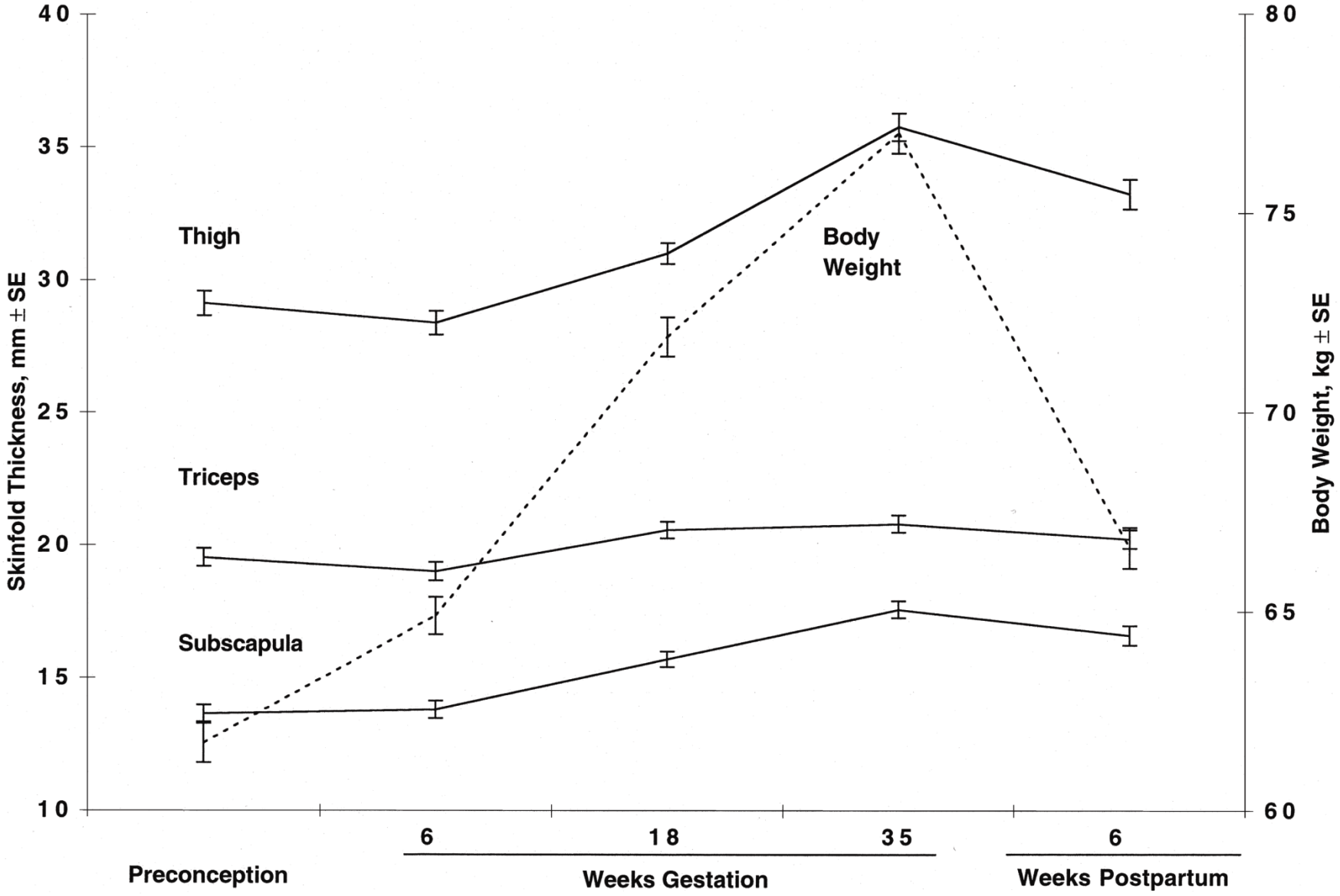
- A process whereby a stimulus applied in utero establishes a permanent response in the fetus leading to enhanced susceptibility later in life

The epigenotype model of developmental origins of disease.



Hochberg Z et al. Endocrine Reviews 2011;32:159-224

ENDOCRINE REVIEWS



Sidebottom et al. Eur. J. Obs. Gyn 2001

Εναπόθεση του λιπώδους ιστού στην κύηση (Mastorakos et al Clin Chem 2007)

N=80	1st trimester	2nd trimester	3rd trimester
weight (kg)	67.6 ± 13.42	76 ± 12.5*	84.4 ±15.6 * #
%fat	30.4 ± 5.2	32.2 ± 4.9*	34.4 ± 6.9* #
Hip circumference (cm)	103.9 ±12.1	107.5 ± 10.2*	116 ±11.8* #
Skinfold (mm)			
biceps	16.5 (11.7-24.2)	20 (14.5-29) *	25.6 (16-29) * #
triceps	16.2 (14-22.7)	21.5 (17-25) *	23 (16-29) *
suprailiac	12.2 (8.5-13)	13.5 (11-15.5) *	16 (12.5-21) * #
subscapular	16.7 (14-26.2)	18 (16-27)	22.2 (14-31) *

Central or peripheral fat is more associated with perinatal outcomes in pregnancy? (1)

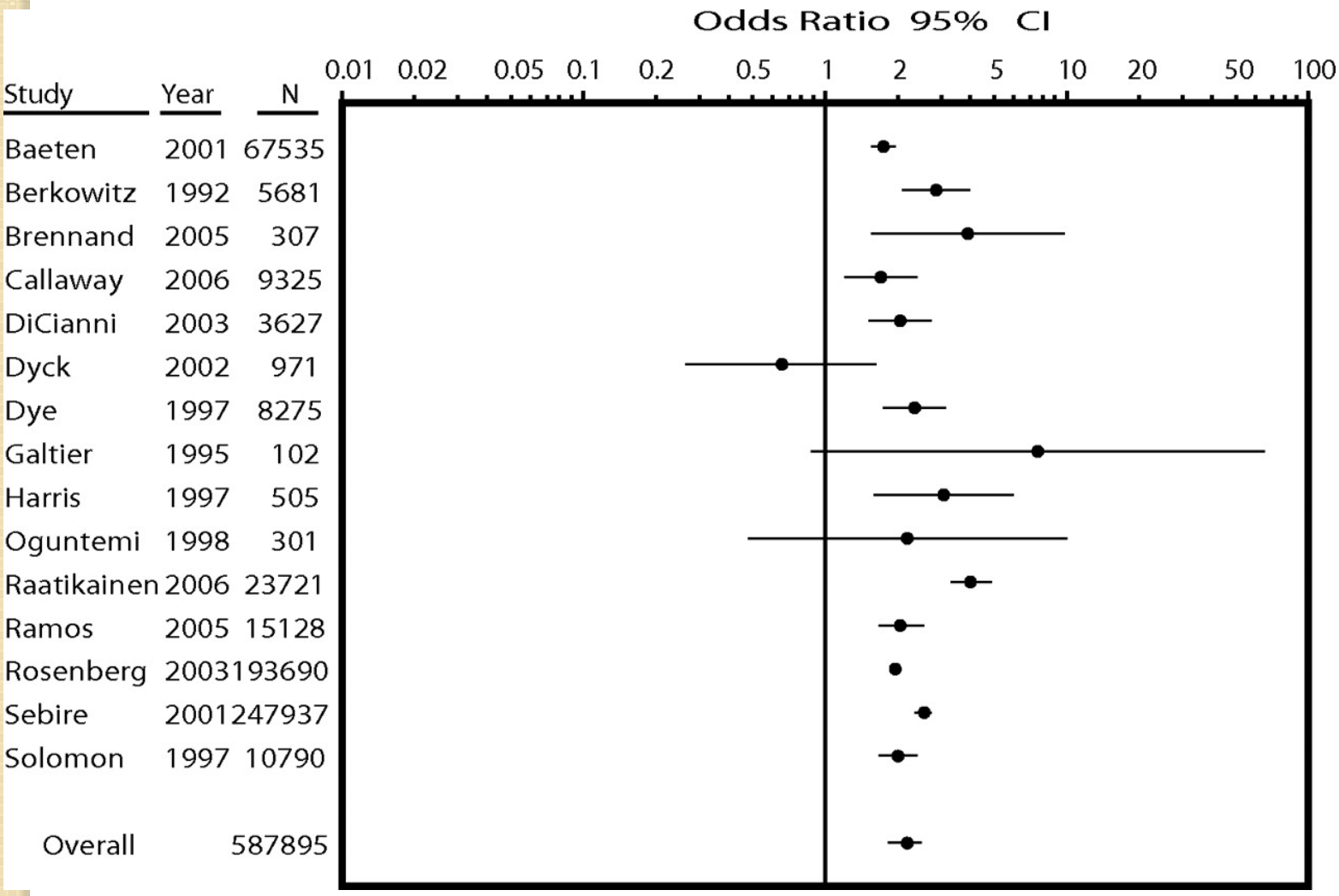
McCarthy EA et al Obstet Gynecol Surv 2004

- skinfold caliper thickness and ultrasound assessment remains impractical during pregnancy and cannot distinguish subcutaneous from visceral fat.

- A few studies suggest that central compared with peripheral fat correlates better with birth weight, gestational carbohydrate intolerance, and hypertension

Παχυσαρκία στην εγκυμοσύνη και μεταβολικοί κίνδυνοι

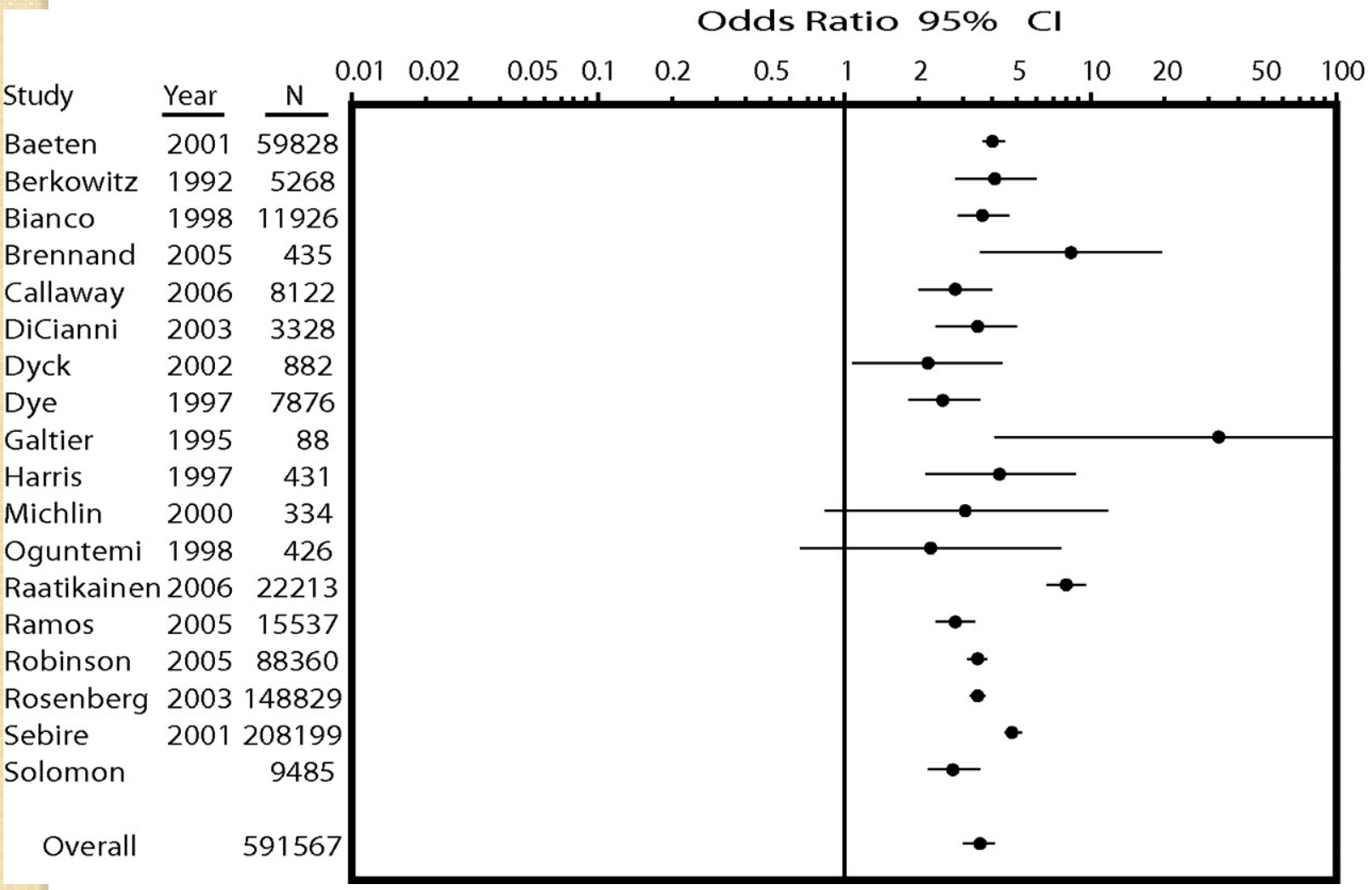
Association of GDM with overweight versus normal maternal BMI.



Chu S Y et al. Dia Care 2007;30:2070-2076

American Diabetes Association.

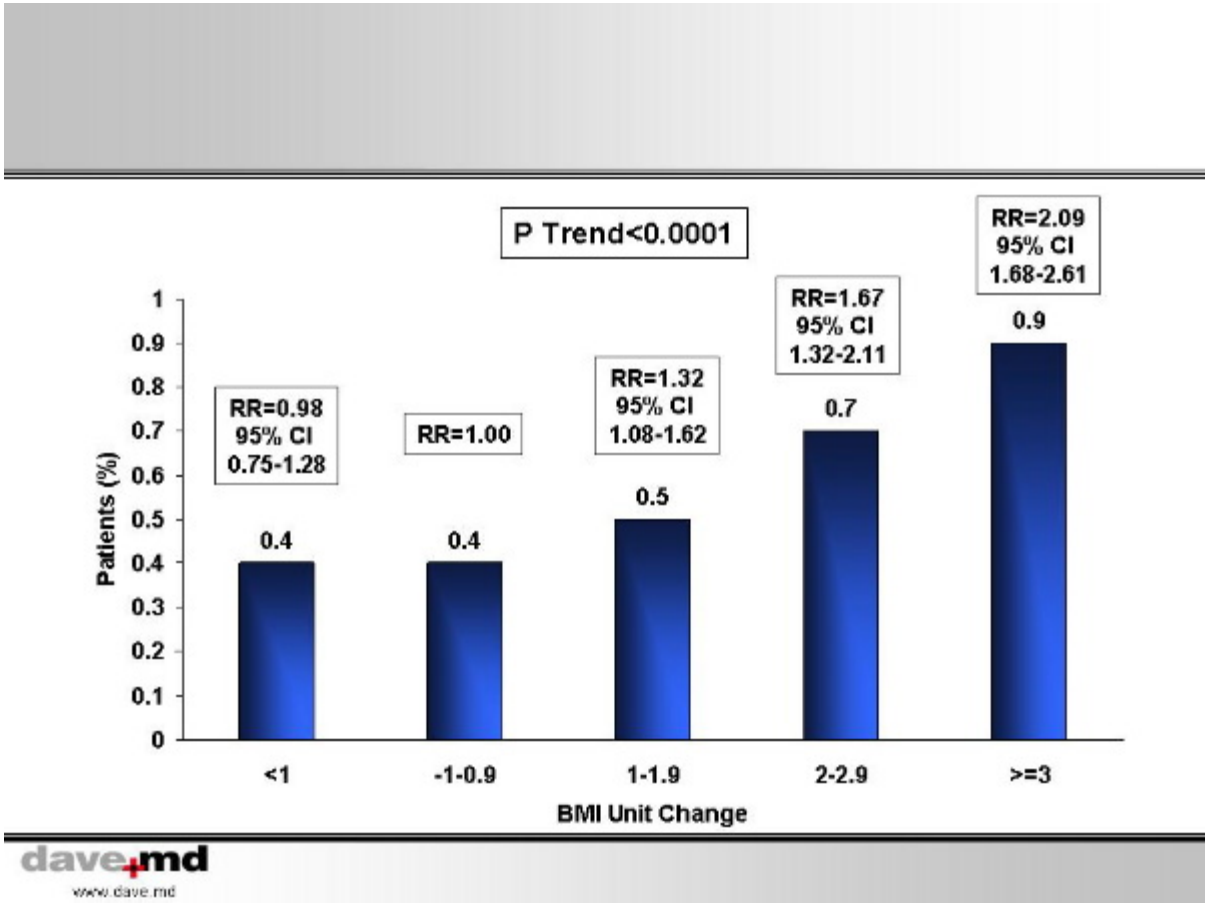
Association of GDM with obese versus normal maternal BMI.



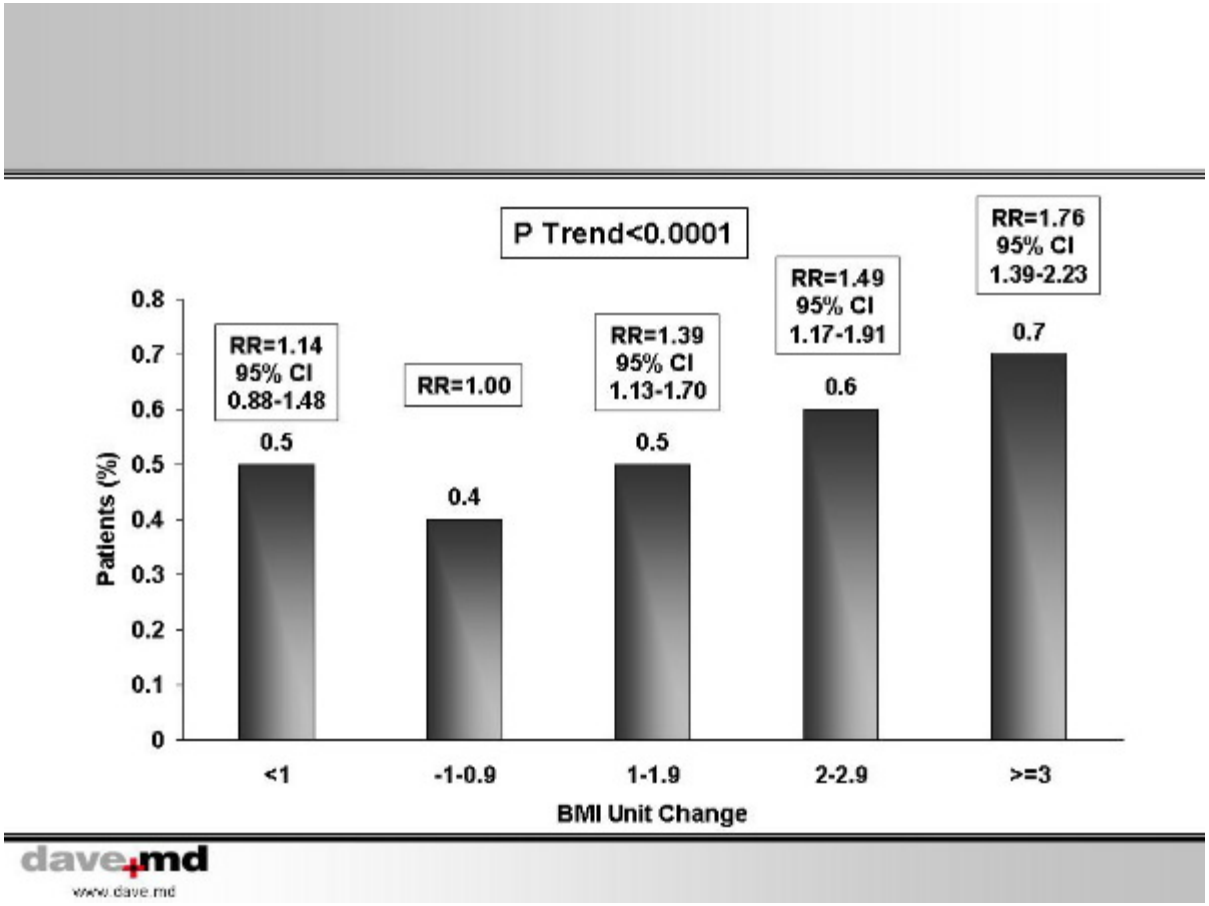
Chu S Y et al. Dia Care 2007;30:2070-2076

American Diabetes Association.

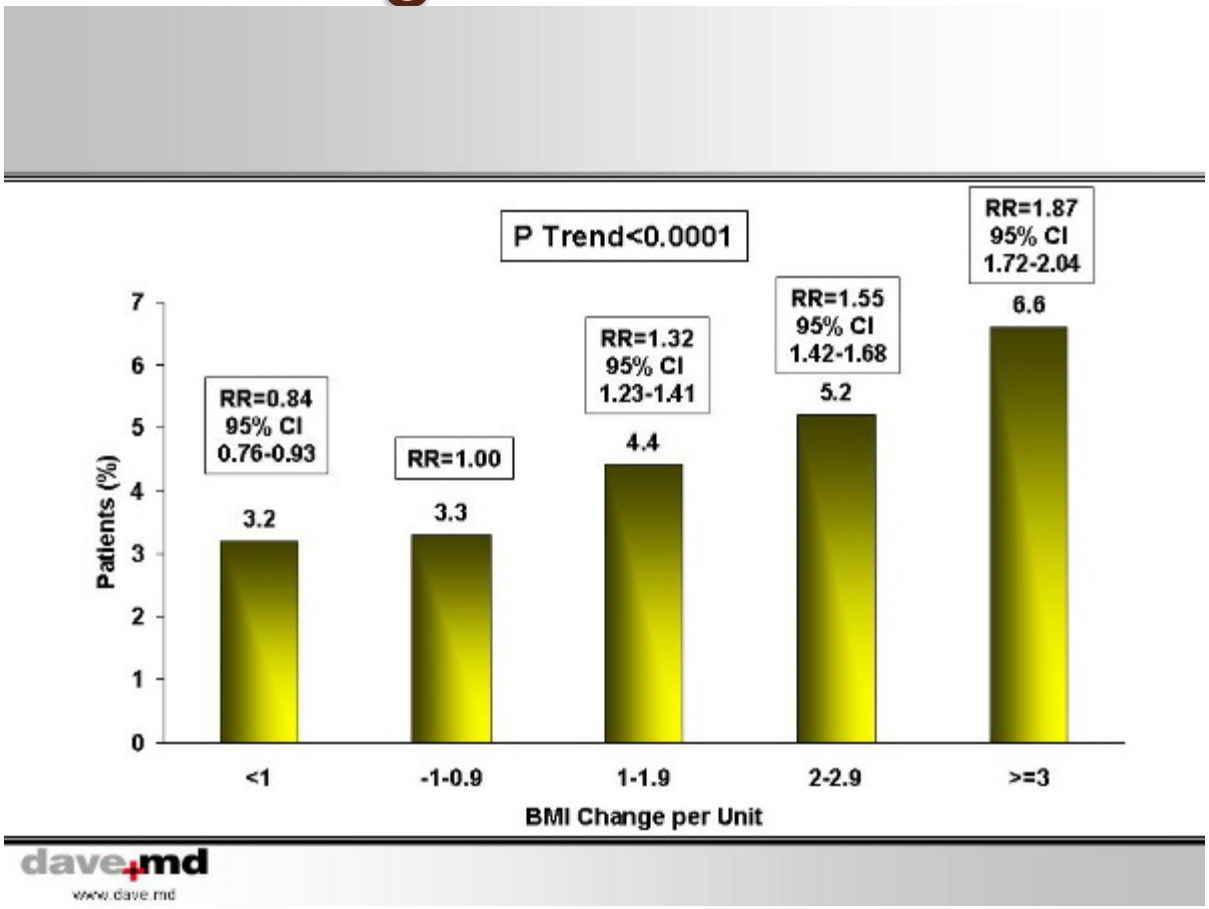
Risk of GDM according to BMI change in pregnancy



Risk of hypertension according to BMI change in GDM



Risk of large fetal gestational weight according to maternal BMI change



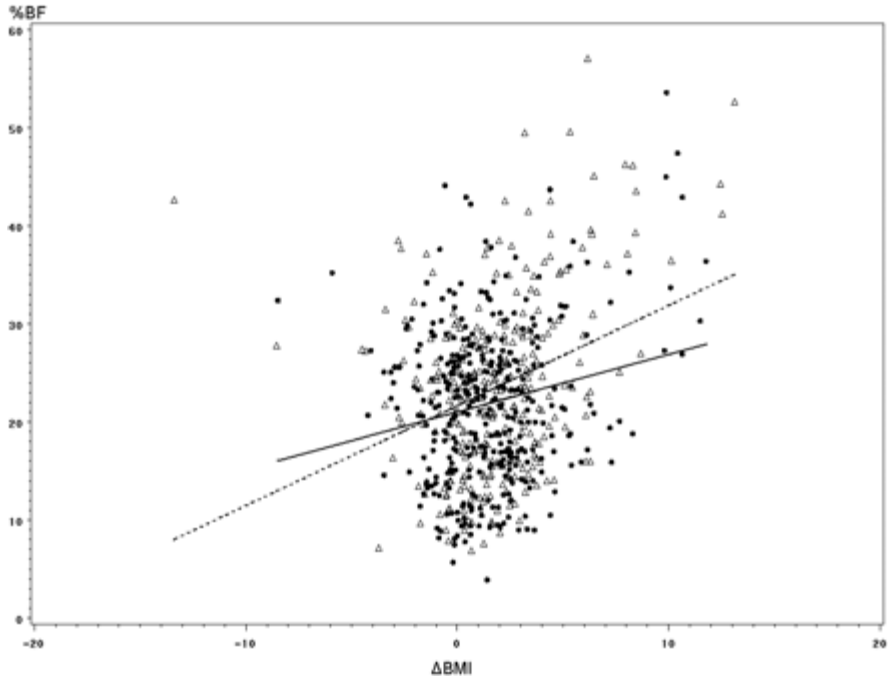
Pregnancy outcome

Outcome (%)	< 5.0 kg (n=93)	5.0-9.9 kg (n=134)	10.0-14.9 kg (n=134)	>=15 kg (n=122)	P value*
Hypertension (Preecl. + PIH)	9.7	11.4	16.7	20.5	0.014
C-section	15.1	24.6	27.3	27.9	0.030
Induction	20.4	32.9	28.0	36.1	0.039
Birth weight >= 4000 g	19.4	29.1	32.6	35.3	0.011
LGA infant	12.8	25.4	22.7	32.8	0.003
SGA infant	4.3	2.2	0.8	3.3	0.63

logistic regression. Weight gain groups scored 1-4

Embryo Body Fat deposition vs maternal BMI change in pregnancy

(Taly Meas JCEM 2008)



Neonatal Body Composition in Obes

Pregravid	BMI < 25	BMI > 25	p-value
Birth weight (g)	3284 ± 534	3436 ± 567	0.051
LBM (g)	2951 ± 406	3023 ± 410	0.22
Fat Mass (g)	334 ± 179	416 ± 221	0.008
Body Fat (%)	9.7 ± 4.3	11.6 ± 4.7	0.006
Weight gain (kg)	6.9 ± 2.4	6.3 ± 3.4	0.001

Sewell, AJ

Factors Relating to Body Composition at Birth (2)

220 Normal Glucose Tolerance, 195 Gestational Diabetes

	r^2	$\Delta r2$	
Fat Mass		-	
Pregravid BMI	0.066	0.070	
EGA	0.136	0.035	
Wt. Gain	0.171	0.016	p=0.0001
Group (GDM)	0.187		
% neonatal Body Fat			
Pregravid BMI	0.072	-	
EGA	0.116	0.044	
Wt. Gain	0.147	0.031	
Group (GDM)	0.166	0.019	p=0.0001

Catalano,

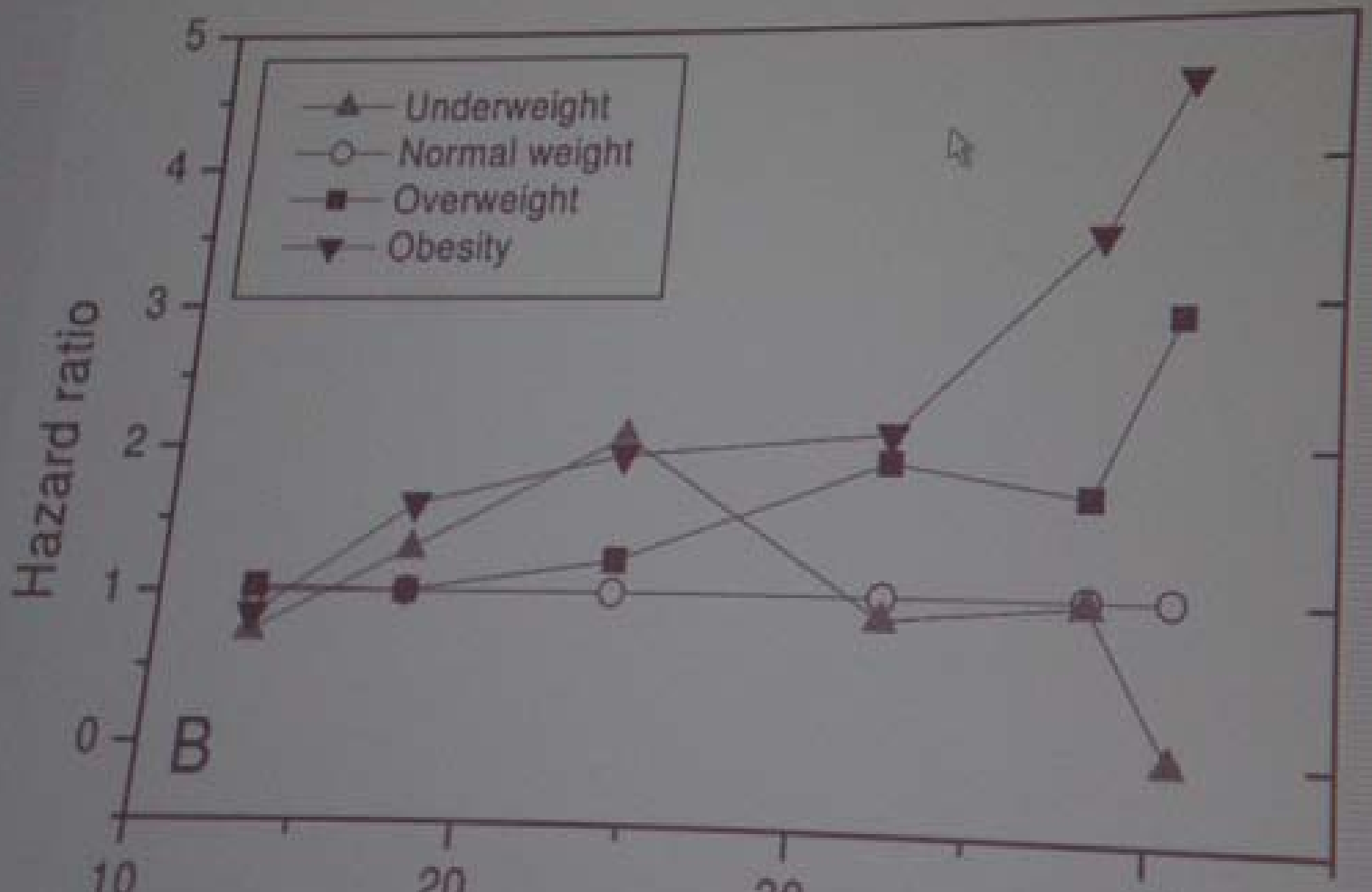
Factors Relating to Body Composition at Birth (1)

220 Normal Glucose Tolerance, 195 Gestational Diabetes

	r^2	Δr^2	
Birthweight			
EGA	0.114	-	
Pregravid Wt	0.162	0.048	
Wt. Gain	0.210	0.048	
Smoking (-)	0.227	0.017	
Parity	0.239	0.012	p=0.0001
Lean Body Mass			
EGA	0.122	-	
Smoking (-)	0.153	0.031	
Pregravid Wt	0.179	0.026	
Wt. Gain	0.212	0.033	
Parity	0.225	0.013	
Maternal Ht.	0.241	0.01	
Paternal Wt.	0.250	0.009	p = 0.0001

Catalano, BJOG;

Fetal death rate per 1,000 weeks by body mass index (BMI) category (N= 54,133; 674 fetal deaths)



Double Trouble

Frequency of Macrosomia

Maternal BMI	Non obese		Obese	
Glucose tolerance (IADPSG) (n = 23,197)	Non GDM	GDM	Non GDM	GDM
	17,224	2791	2247	935
Macrosomia n (%)	1147 (6.7)	286 (10.2)	305 (13.6)	189 (20.2)
Excess macrosomia (Total = 380)	0	100	154	126

The HAPO study: Associations of GDM and obesity with pregnancy outcomes

Catalano PM Diabetes Care Feb 2012

- determine associations of gestational diabetes mellitus (GDM) and obesity with adverse pregnancy outcomes

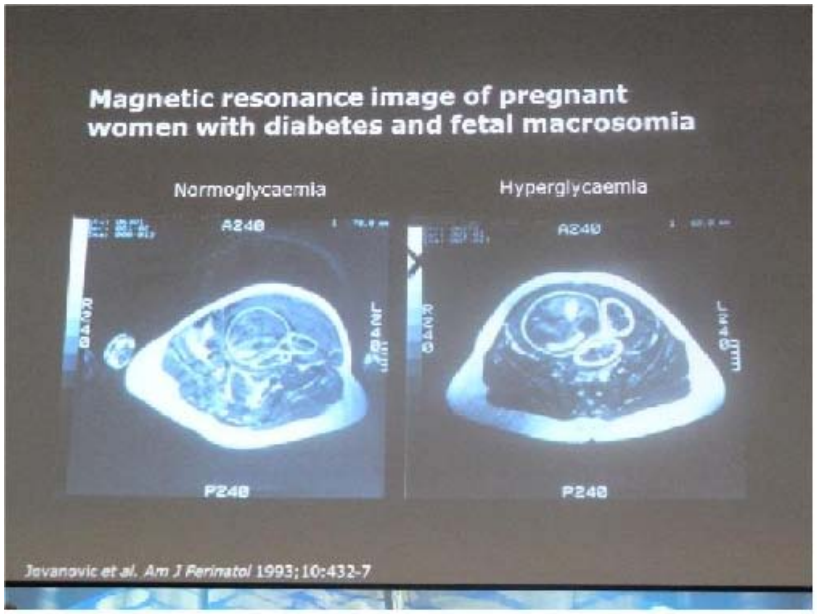
- Mean maternal BMI was 27.7, 13.7% were obese (BMI ≥33.0), and GDM was diagnosed in 16.1%.

1. For non-GDM and nonobese women, odds ratio for birth weight >90th percentile ....
2. for GDM alone was 2.19 (1.93, 2.47),
3. for obesity alone 1.73 (1.50, 2.00),
4. for both GDM and obesity 3.62 (3.04, 4.32).
5. Similar results for primary cesarean delivery and preeclampsia and for cord C-peptide and newborn percent body fat >90th percentiles.

The HAPO study: Associations of GDM and obesity with pregnancy outcomes *Catalano PM Diabetes Care Feb 2012 (2)*

-
- There was a 339-gr difference in birth weight for babies of obese GDM women, compared with babies of normal/underweight women (64.2% of all women) with normal glucose (61.8% of all women)

Fetal macrosomia by MRI during pregnancy



Interpregnancy weight change and risk of adverse pregnancy outcomes

(Eduardo Villamor , Sven Cnattingius Lancet 2006)

- nationwide swedish study of 151025 women: those who gained 3 or more BMI units from the first to the second pregnancy during an average 2 years compared with women whose BMI changed between -1.0 and 0.9 units
- the adjusted odds ratio

1. for pre-eclampsia was 1.78 (95% CI 1.52-2.08)
2. gestational hypertension 1.76 (1.39-2.23)
3. gestational diabetes 2.09 (1.68-2.61)
4. caesarean delivery 1.32 (1.22-1.44)
5. stillbirth 1.63 (1.2-2.21)
6. large for gestational age birth 1.87 (1.72-2.04)

Increased maternal pre-pregnancy weight and fetal outcomes

- Large for gestational age
- Birth weight >4000gr
- Neonatal hypoglycemia
- Respiratory distress syndrome
- Jaundice-ικτερος
- Perinatal mortality
- Congenital malformations-συγγενεις δυσμορφιές

Maternal pre- BMI and risk of Apgar score<7 at 5 min

Malformation incidence according to maternal BMI

(Rasmussen Am J Obstet Gynecol 2008)

- NTD and other CVS effects

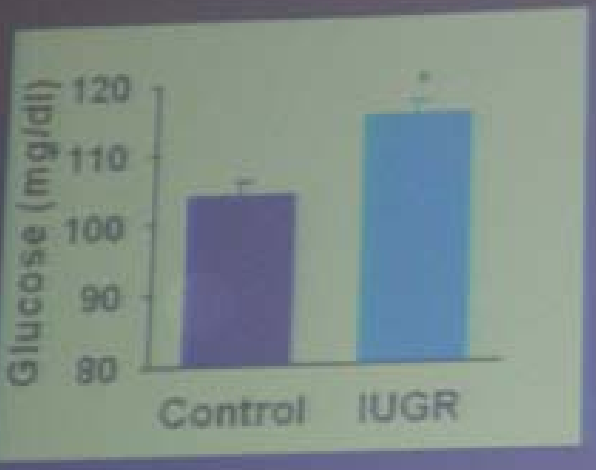
1. BMI 25-29.9 1.22
2. BMI 30-35 1.7
3. BMI >36 3.11

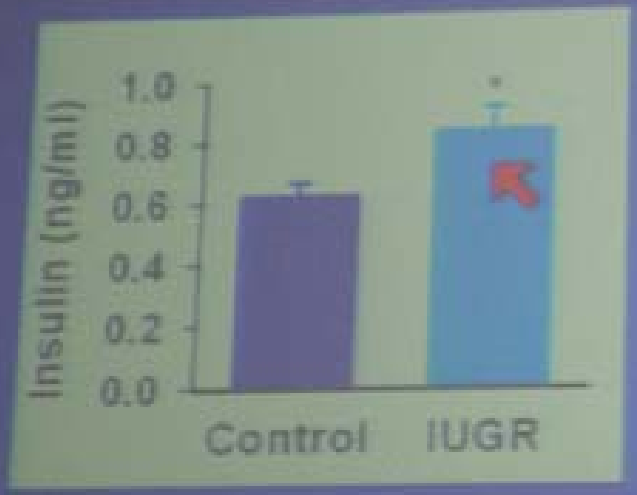
Maternal obesity and congenital anomalies (JAMA 2009)

- Meta-analysis
- Mothers with obesity vs recommended BMI were at increased odds for

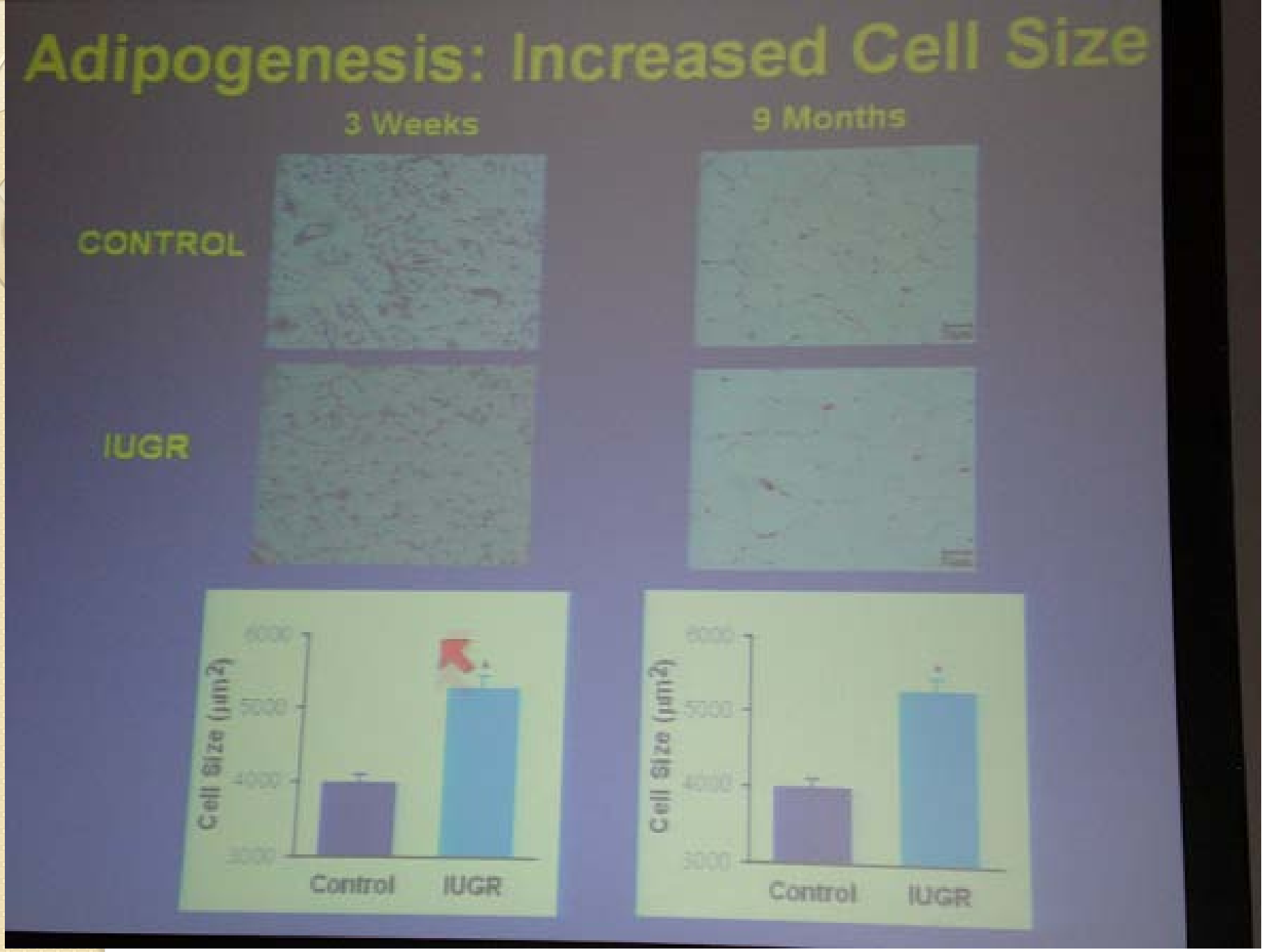
1. NTD 1.87 (1.62-2.15)
2. Spina bifida 2.24 (1.86-2.89)
3. Cardiovascular anomalies 1.30 (1.15-1.50)
4. Septal-διαφραγμα anomalies 1.20 (1.10-1.30)
5. Clift palate-υπερωιοσχιστια 1.23 (1.03-1.47)
6. Anorectal atresia 1.48 (1.12-1.87)
7. Hydrocephaly 1.68 (1.19-2.36)
8. Limb reduction anomalies 1.34 (1.03-1.73)

Glucose and Insulin
9 Month Male Offspring

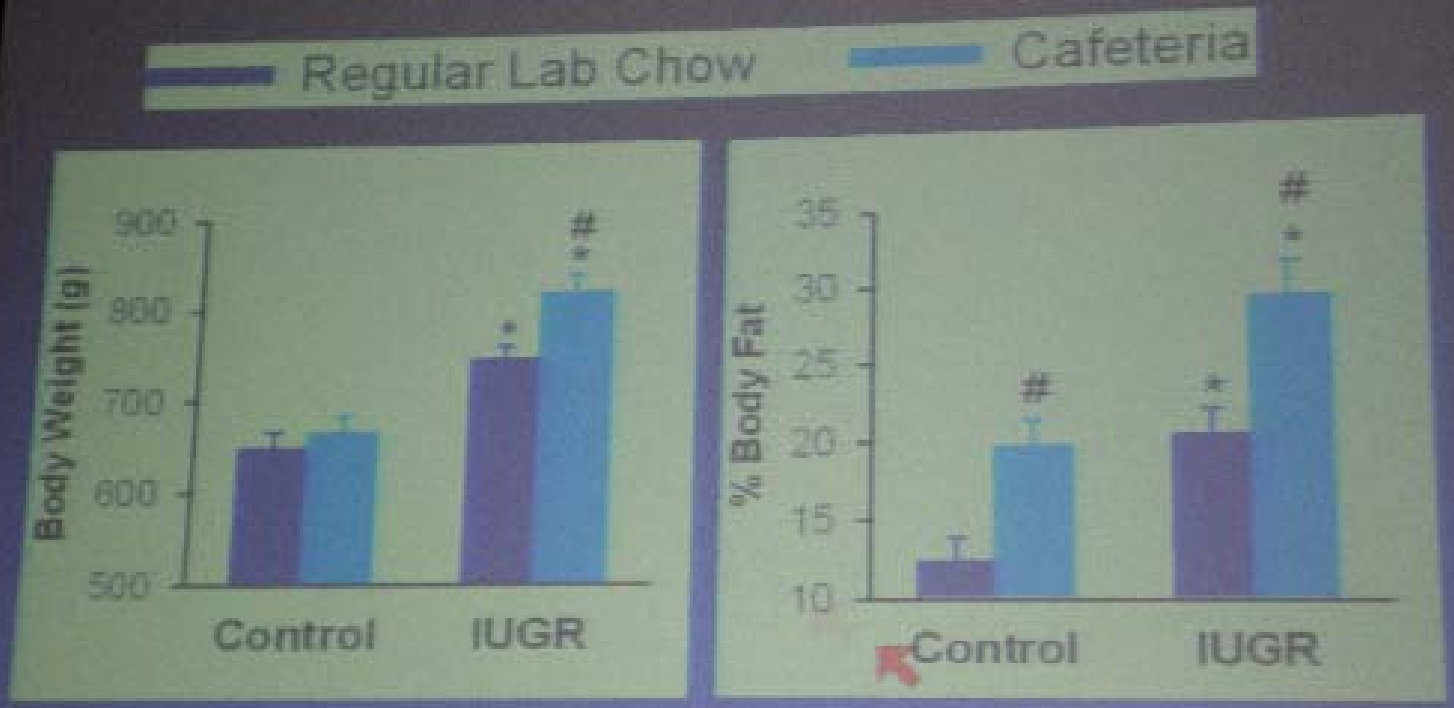




Adipogenesis: Increased Cell Size



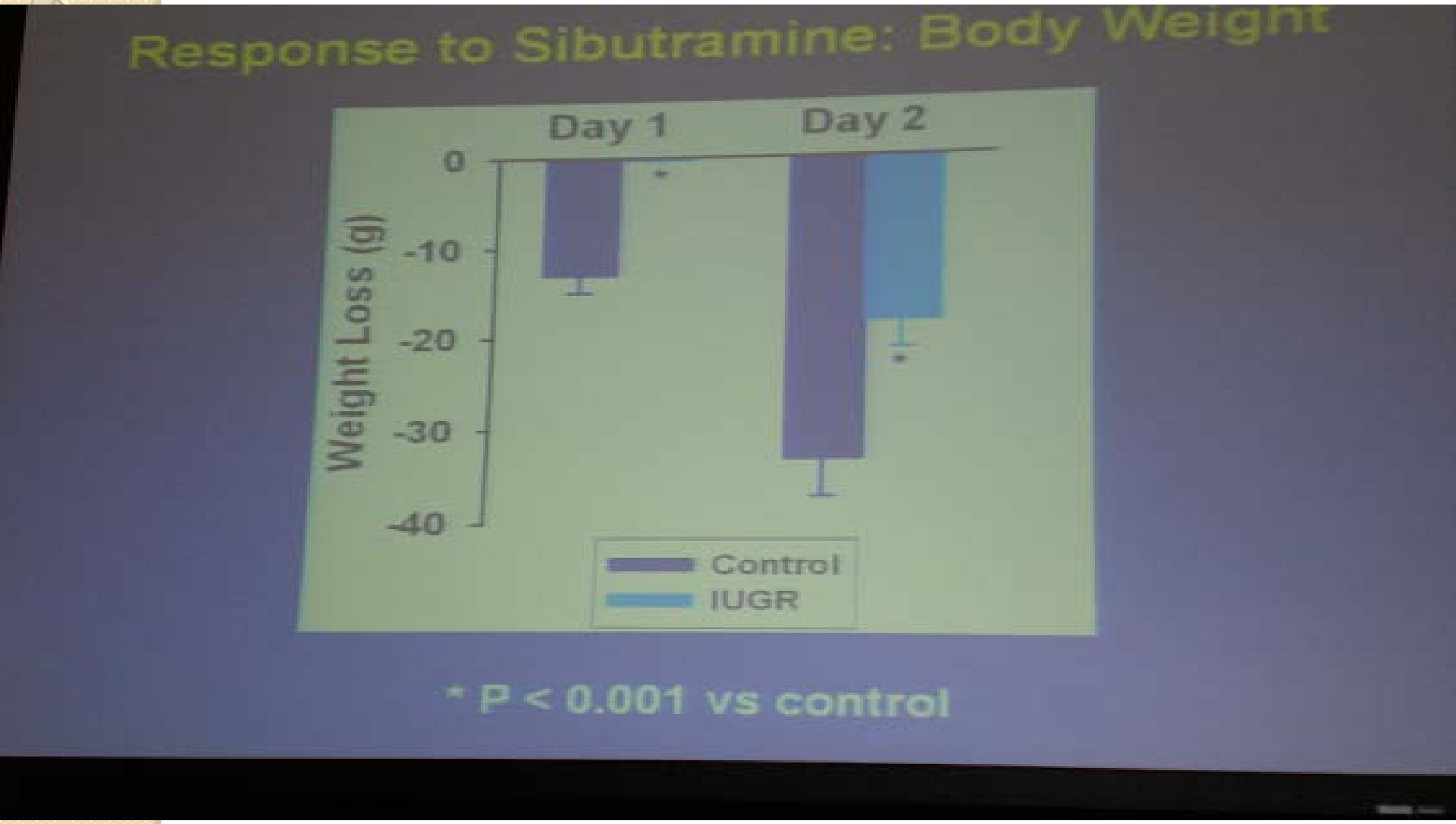
Effects of Cafeteria Diet



IUGR: FR/AdLib

* vs Control; # vs cafeteria diet

IUGR and decreased weight loss response to sibutramine

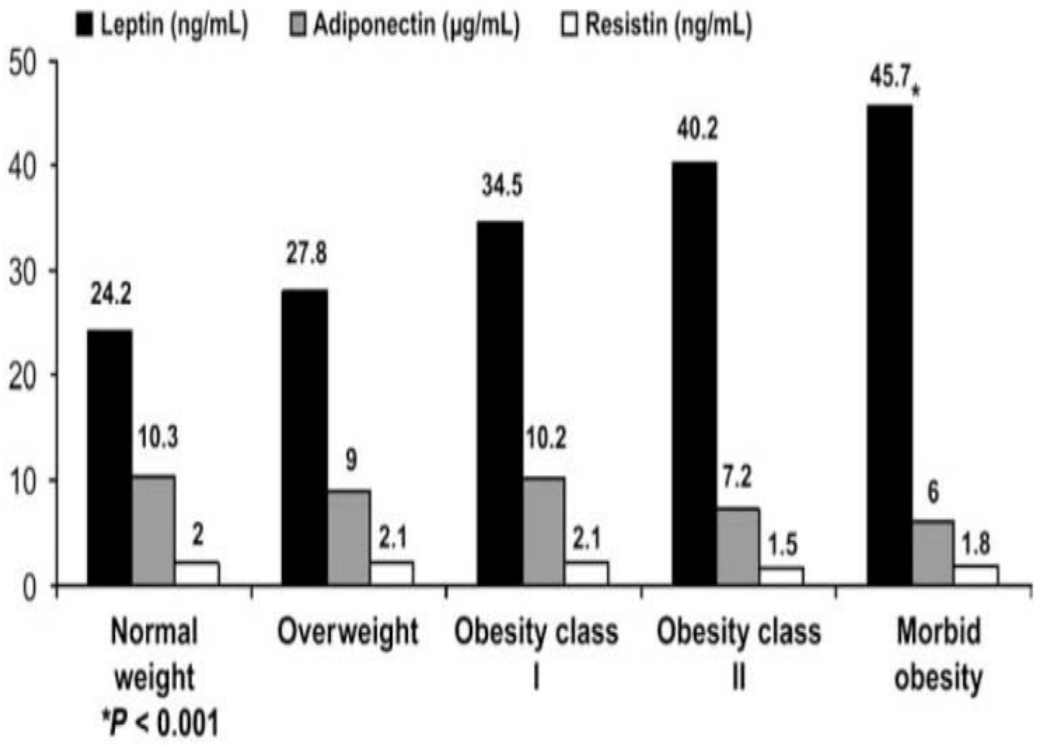


Prevalence of obesity (BMI>95% age and gender) in offspring of obese women

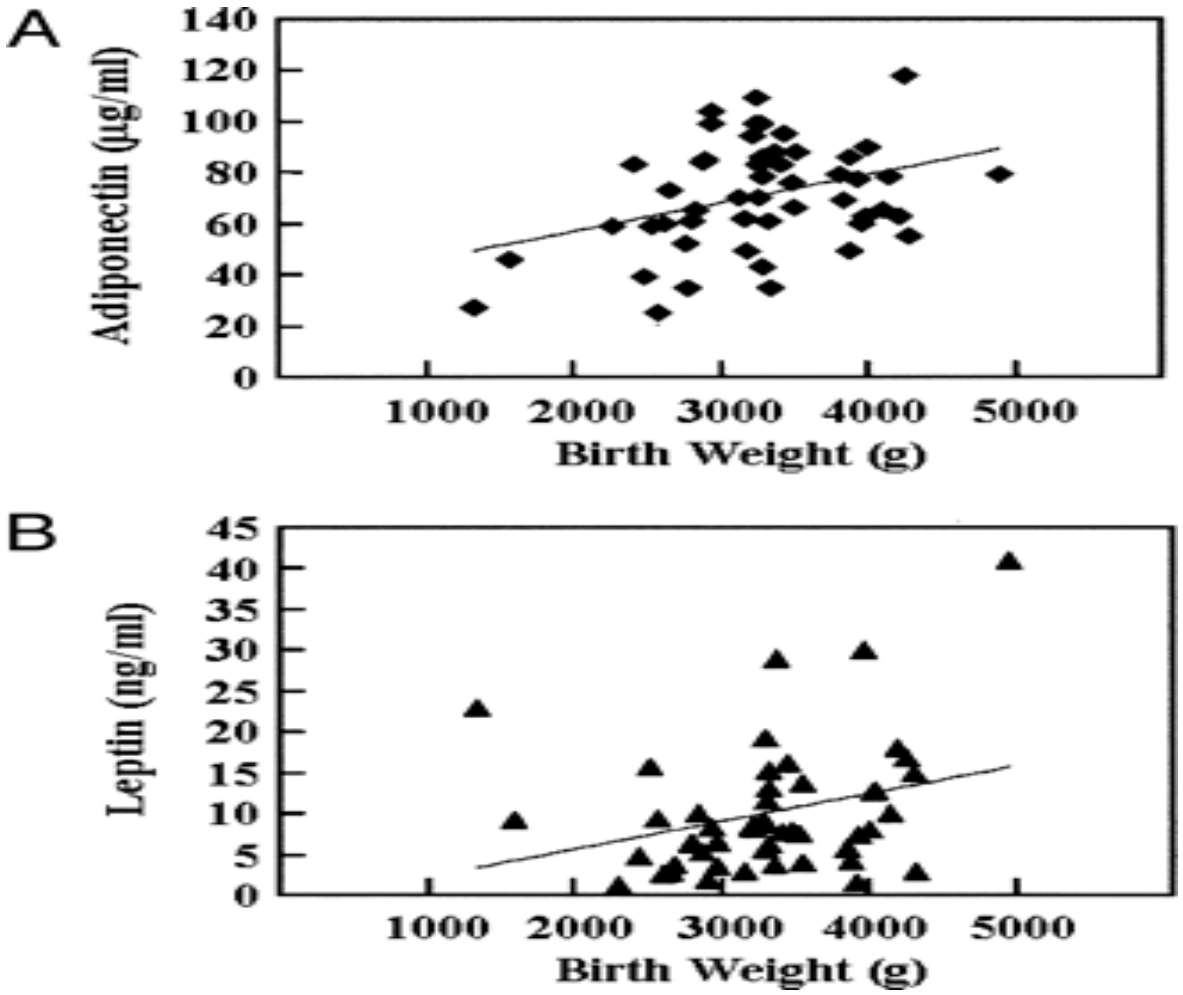
(Whitaker et al. Pediatrics 2004)

Prevalence of obesity	Offspring age
9.5%	2
12.5%	3
14.8%	4

Maternal adipocytokine levels in pregnancy according to pre-pregnancy maternal weight (Hendler I et al. Am. J. Obs. Gyn 2005)

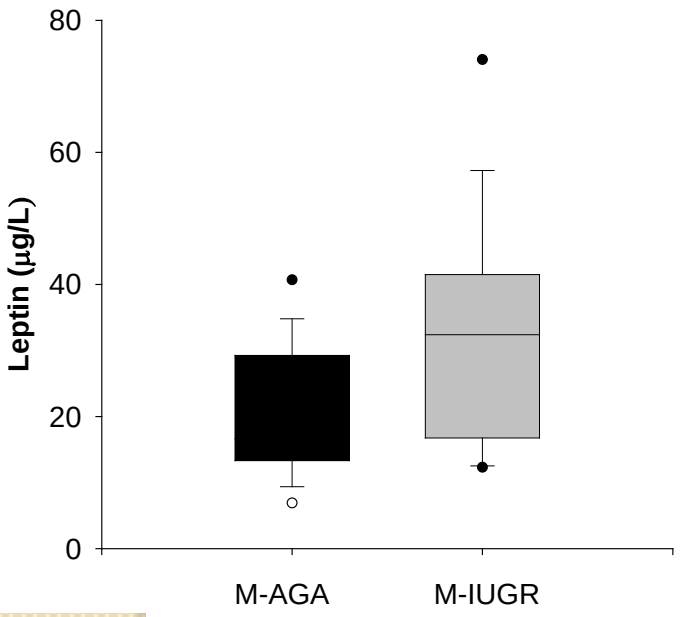


Maternal adipocytokine levels and birth weight (Sivan JCEM 2005)



LEPTINEMIA in IUGR and their MOTHERS

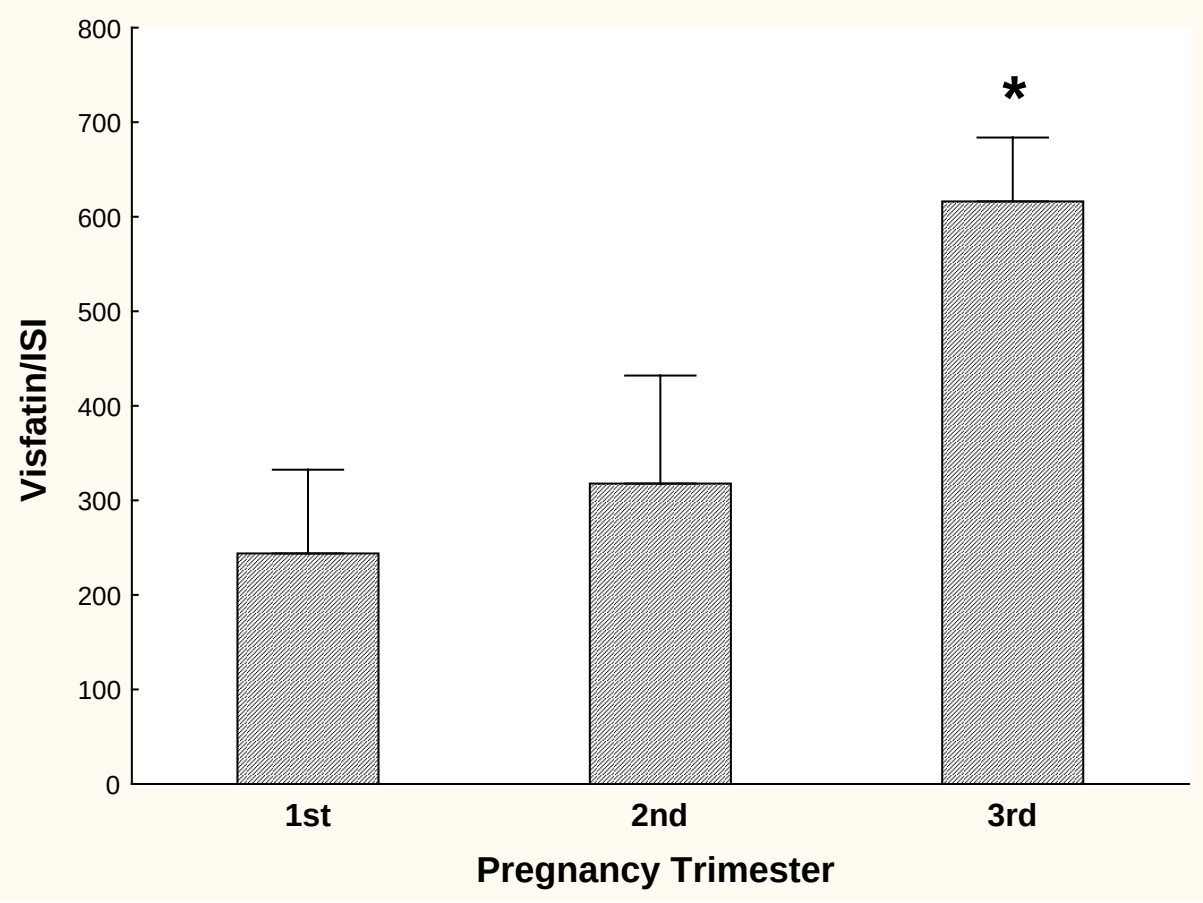
	Leptin (μg/L)	Adiponectin (mg/L)	Cortisol (μg/dL)
IUGR	32.5±3.8	5.4±0.9	33.3±3.8
AGA	20.4±2.1	11.8±1.3	33.8±2.7
P values	<0.05	<0.05	NS



Kyriakakou et al. Eur. J. of Endocrinology 2008

Visfatin secretion during normal pregnancy

(Mastorakos et al Clin Chem 2007)



Visfatin and insulin sensitivity in normal pregnancy

(Mastorakos et al Clin Chem 2007)

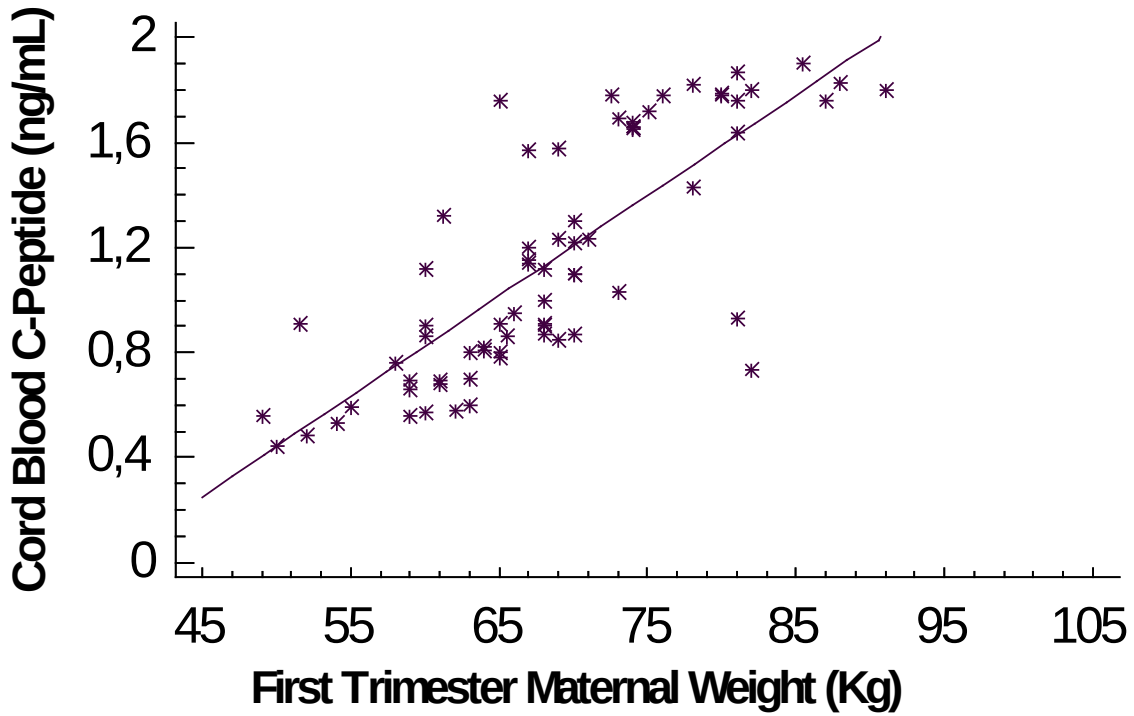
Table 5. Backwards multiple regression analysis for dependent variable ISI 2nd trimester.[a]

	Coefficient	SE of coefficient	*P* value
Visfatin 1st trimester	1.018	0.024	0.015
HsCRP 1st trimester	0.157	0.024	0.099

[a] The term "coefficient" is the generally used term for the effect of each predictor (independent variable) on the respective dependent variable in a linear regression analysis.

First trimester maternal weight and neonatal insulin secretion

Valsamakis G. et al submitted



Obesity management in pregnancy

Institute of Medicine recommendations 2009

Pre-gestational BMI (kg/m²)	Recommended gestational weight gain (kg)
<18.5	14-20
18.5-24.9	12.5-17.5
25-29.9	7.5-12.5
>30	5.5-10

Διατροφή στην εγκυμοσύνη και έμβρυο

Energy underreporting in pregnancy
(McGowan CA Eur J Clin Nutr 2012)

- Three-day food diaries were collected from 260 healthy pregnant women sampled 14 weeks gestation
- Up to 45% of pregnant women may be underreporting daily energy intake(EI).
- having a body mass index (BMI) of 25 kg/m^2 compared with a BMI <25 kg/m^2 was the main predictor of energy underreporting

Maternal behaviors during pregnancy impact offspring obesity risk

(Phelan S et al. Exp Diabetes Res 2012)

- 153 normal weight and 132 OW/OB women
- Effect of maternal behavior on offspring weight parameters at birth and 6 months
- Prenatal physical activity, depressive symptoms, and sleep-related variables did not significantly predict offspring weight outcomes

Model predicting birth weight and gestational weight gain –GWG-of normal weight mothers (2) (Phelan S et al. Exp Diabetes Res 2012)

	B	CI for B	Beta	*P-value*	P-value GWG
Pre-pregnancy BMI	0.02	-0.04, 0.09	0.06	0.43	0.69
Multi-parity	0.33	0.02, 0.63	0.15	0.004	0.04
Daily calories	0.002	0.0001, 0.004	0.16	0.04	0.10

Model predicting weight for age z-scores at 6 months, and gestational weight gain –GWG-of normal weight mothers (3)

(Phelan S et al. Exp Diabetes Res 2012)

	B	CI for B	Beta	P-value	P-value for GWG
Pre-pregnancy BMI	0.04	-0.05, 0.13	0.08	0.34	0.31
multiparity	0.62	0.01, 1.2	0.18	0.05	0.04
%kcal from fat early in pregnancy	-0.06	-0.09, -0.03	-0.35	0.0001	0.001
%kcal from sweets early in pregnancy	-0.02	-0.04, 0.003	-0.15	0.10	0.14

Maternal behaviors during pregnancy impact offspring obesity risk: Model predicting weight at birth, and gestational weight gain –GWG-of OW/OB mothers (4)

(Phelan S et al. Exp Diabetes Res 2012)

B	B	CI for B	Beta	P-value	P-value for GWG
Pre-pregnancy BMI	0.005	-0.02, 0.03	0.03	0.73	0.03
multiparity	0.20	-0.11, 0.50	0.10	0.21	0.13
%Kcal from sweets early in pregnancy	0.02	0.003, 0.04	0.19	0.004	0.06
Perceived stress early in pregnancy	0.04	-0.02, 0.09	0.10	0.18	0.16

Model predicting weight for age z-scores at 6 months, and gestational weight gain – GWG-of OW/OB mothers (5)

(Phelan S et al. Exp Diabetes Res 2012)

	B	CI for B	Beta	P-value	P-value for GWG
Prepregnancy BMI	0.009	-0.03, 0.05	0.044	0.639	0.42
%Kcal from sweets early in pregnancy and increases in %kcal from protein	0.04	0.02, 0.06	0.296	0.002	0.006
Restraint early in pregnancy	-0.04	-0.09, 0.01	-0.144	0.140	0.12
Increases in perceived stress	0.06	-0.02, 0.13	0.146	0.124	0.19

Maternal trans fatty acid intake and fetal growth.

(Cohen JF et al. Am J Clin Nutr 2011)

- studied 1369 mother-child pairs
- using a validated food-frequency questionnaire in each of the first and second trimesters
- A higher maternal intake of trans fatty acids, especially 16:1t and 18:2tc, during the second trimester of pregnancy was associated with greater fetal growth

The Dietary Glycemic Index during Pregnancy: Influence on Infant Birth Weight

(Scholl TO et al Am J Epidemiol 2004)

- a dietary glycemic index in the lowest quintile was associated with lower infant birth weight, a reduction of more than 100 g.

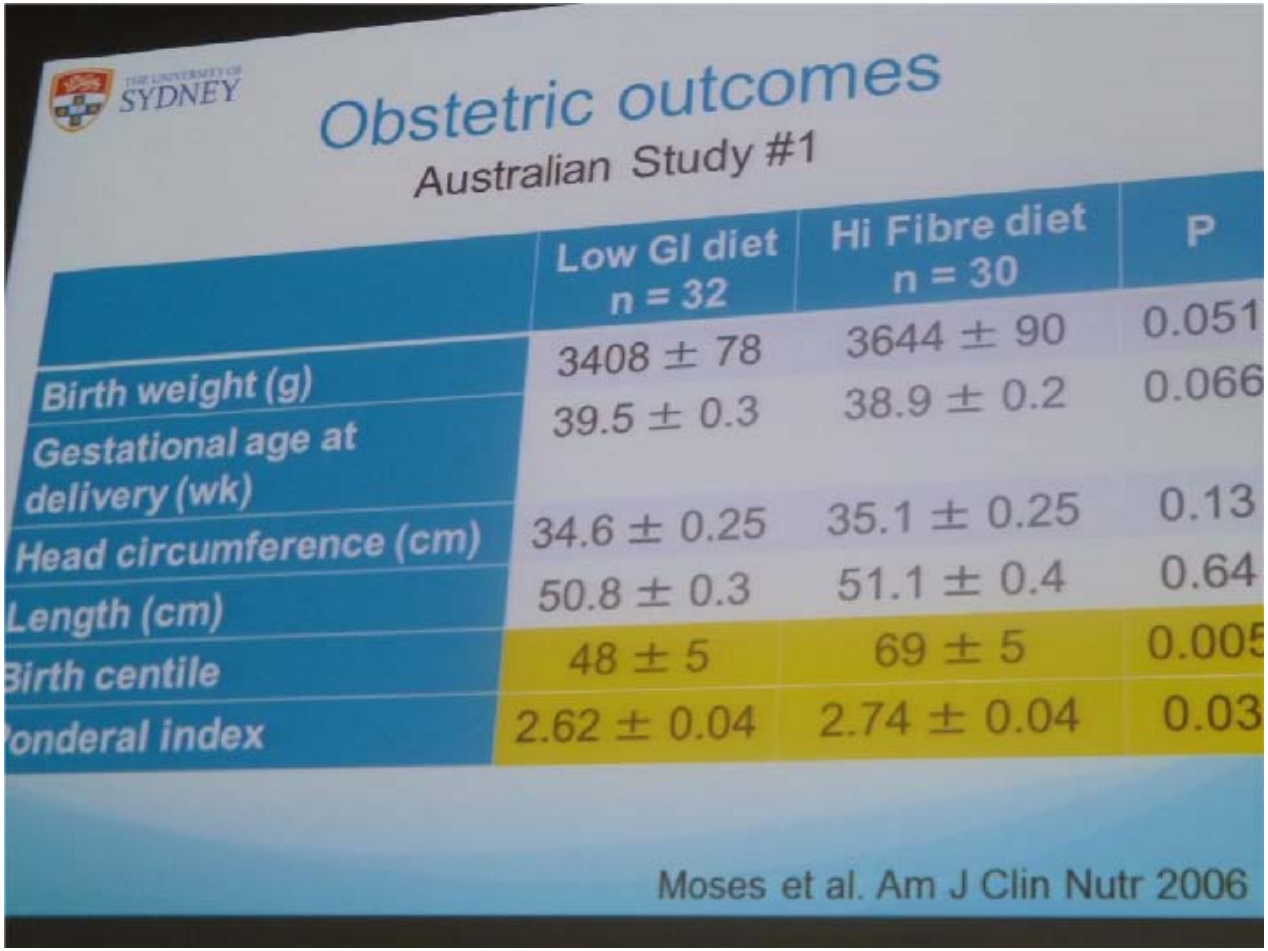
- there was no association between the highest quintile of the dietary glycemic index and the birthweight of her infant.

The Dietary Glycemic Index during Pregnancy: Influence on Infant Birth Weight, Fetal Growth

(Scholl TO et al Am J Epidemiol 2004)

	Birth weight (gr)		Birth weight (gr)	
	Coefficient	95% CI	Coefficient	95% CI
High GI (>85)	38.4 (34.1) gr	-28.4, 105.2	50.0 (34.0)	-16.6, 116.7
Low GI (<71)	-105.6 (34) gr	-39.0, -172	-116.2 (33.83)	-50.0, -182.5

Low GI diet and pregnancy outcomes

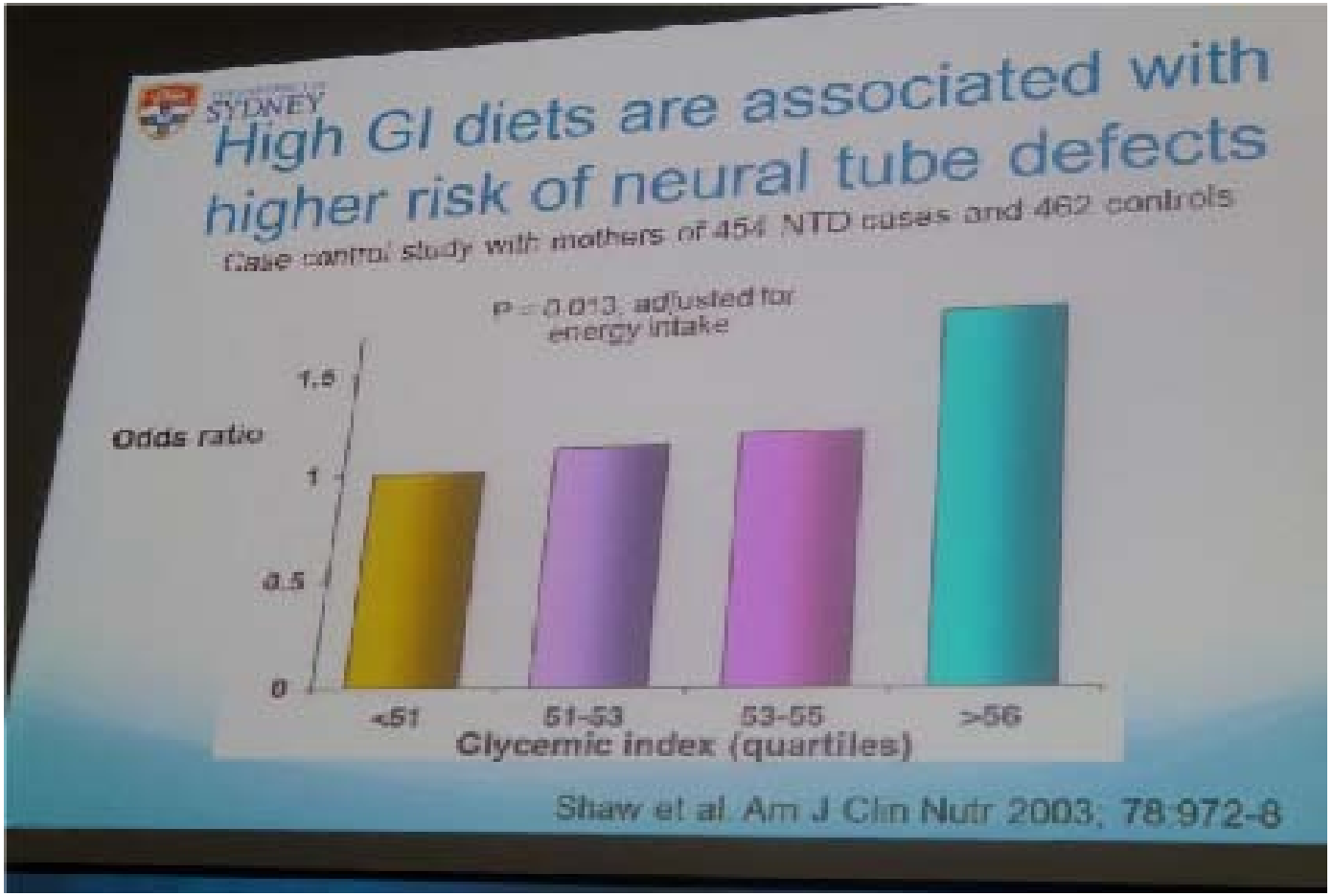


Low GI diets in healthy pregnancy DIP Salzburg 2011

- In healthy pregnancy Low GI diets

1. Reduced birth weight in 2 out of 3 studies
2. Reduced early delivery in 1 study
3. Linked to lower GDM risk in 1 study

High GI diets and CNS



Βαριατρική χειρουργική προ της εγκυμοσύνης

Outcome of pregnancies after weight loss surgery

Kominiarek MA et al. Obstet Gynecol Clin North Am. 2010
Marceau P et al . Obes Surg. 2004

- out of 783 women who had successfully undergone Bilio-Pancreatic Diversion

1. 251 postoperative pregnancies
2. in 132 women resulting in 166 infants
3. 47.0% of patients who were unable to become pregnant pre-op were successful post-op
4. 90 out of 109 women (82.6%) reported an appropriate weight gain (9.1 +/- 5.9 kg)

Outcome of pregnancies after weight loss surgery (2)

Kominiarek MA et al. Obstet Gynecol Clin North Am. 2010
Marceau P et al . Obes Surg. 2004

- The incidence of fetal macrosomia decreased from 34.8 to 7.7%
- increase in normal-weight babies from 62.1 to 82.7%.
- The elevated miscarriage rate (26.0%) in these obese women persisted after surgery.

Παρακολούθηση των παχύσαρκων εγκύων

A randomized trial of the effects of dietary counseling on gestational weight gain and glucose metabolism in obese pregnant women (S Wolff et al Int J Obes 2008)

- Fifty nondiabetic nonsmoking Caucasian obese pregnant women were randomized into

1. intervention group (n=23,age 28±4 years, pre-pregnant body mass index (BMI) 35±4
2. control group (n=27, 30±5 years, BMI 35±3.

- randomized controlled intervention study, designed to restrict the gestational weight gain to 6–7 kg

A randomized trial of the effects of dietary counseling on gestational weight gain and glucose metabolism in obese pregnant women (S Wolff et al Int J Obes 2008) (2)

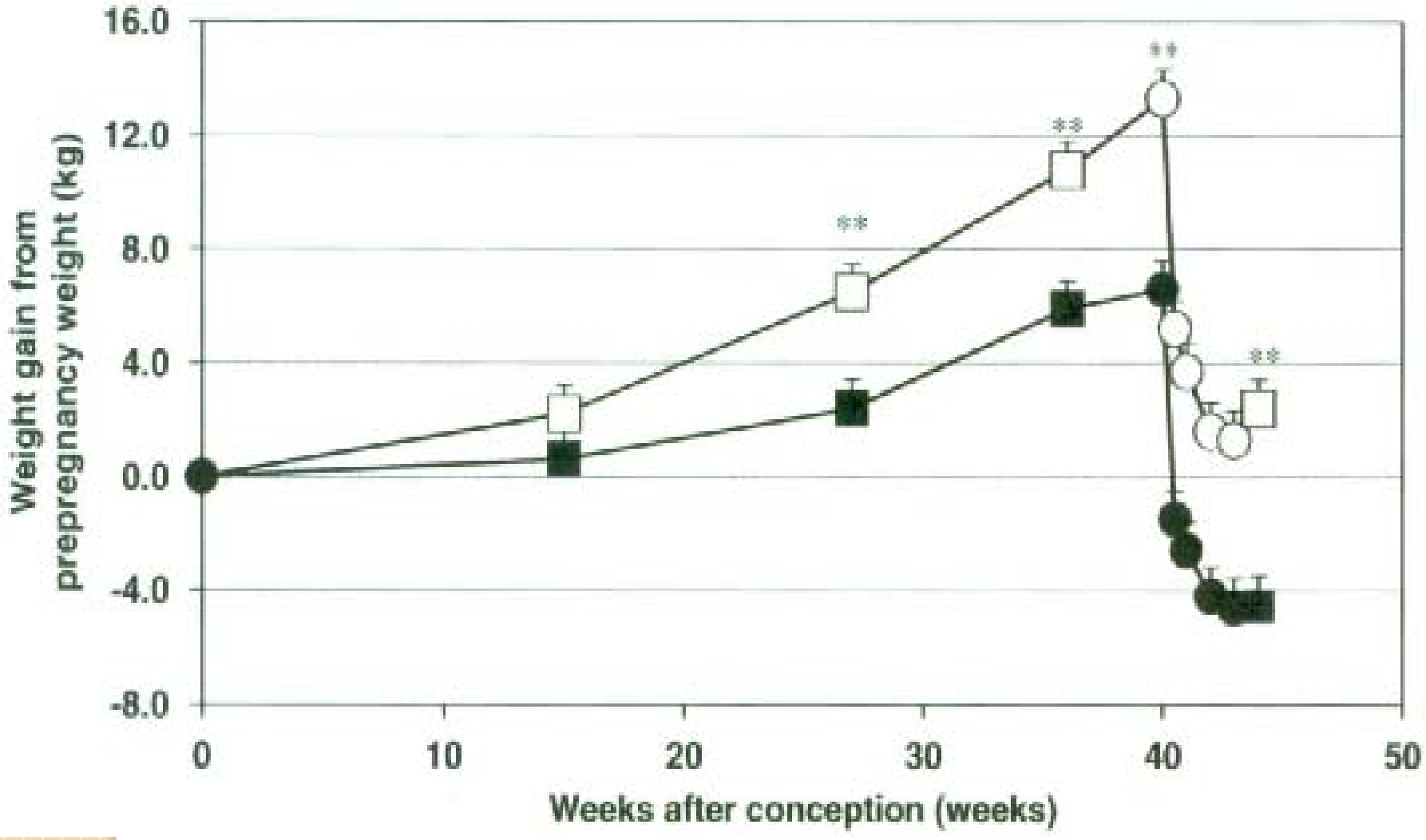
- Maternal weight measured at inclusion (15 weeks), at 27 weeks, and 36 weeks
- intervention group received 10 consultations of 1 h each with a trained dietitian
- instructed to eat a healthy diet (fat intake: max 30 energy percent (%), protein intake: 15–20 %, carbohydrate intake: 50–55 %)

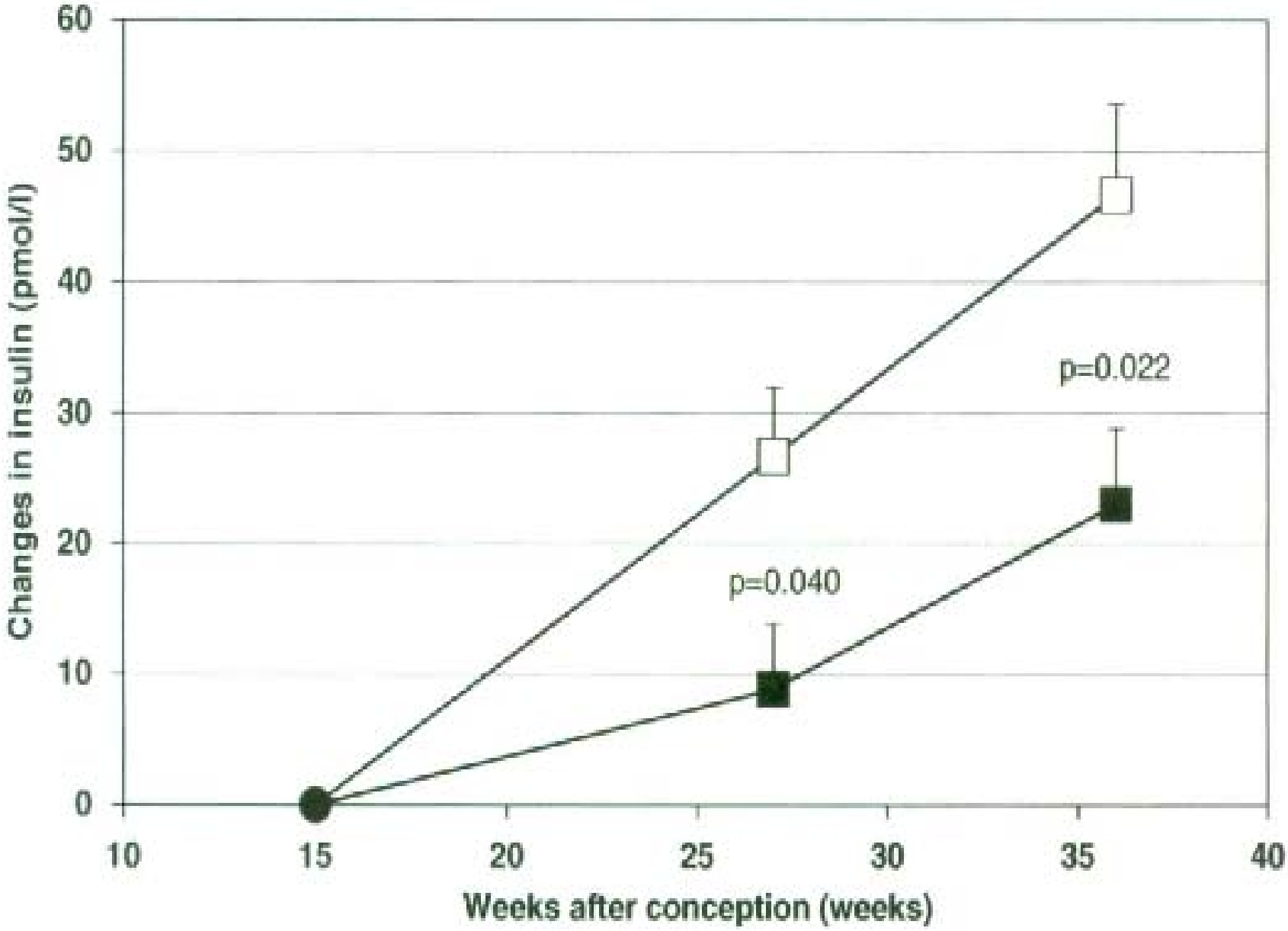
- The control group had no consultations with the dietitian and had no restrictions on energy intake or gestational weight gain.

A randomized trial of the effects of dietary counseling on gestational weight gain and glucose metabolism in obese pregnant women (3)

(S Wolff et al Int J Obes 2008)

	27 weeks gestation	36 weeks gestation
	Intervention vs control	Intervention vs control
Weight gain		6.6 kg vs 13.3 kg (p=0.002)
Insulin change	-20% (p=0.04)	-23% (p=0.022)
Glucose change		-8% (p=0.02)
Leptin change	-20% (p=0.004)	


16.0
12.0
8.0
4.0
0.0
-4.0
-8.0
Weight gain from prepregnancy weight (kg)
0
10
20
30
40
50
Weeks after conception (weeks)
**
**
**
**


60
50
40
30
20
10
0
Changes in insulin (pmol/l)
p=0.022
p=0.040
10
15
20
25
30
35
40
Weeks after conception (weeks)

Effect of second and third-trimester gestational weight gain rate on maternal and neonatal outcomes

Durie DE, et al. Obstet Gynecol. 2011

- To estimate the effect of second- and third-trimester rate of gestational weight gain on pregnancy outcomes using the revised Institute of Medicine guidelines.
- Of 73,977 women, 4% underweight, 48% normal weight, 24% overweight, and 24% obese: 13% class I, 6% class II, and 5% class III
- Women were classified as having less than, within, or greater than recommended rates of gain.

Effect of second and third-trimester rate of gestational weight gain on maternal and neonatal outcomes (2)

- CONCLUSION:

1. Suboptimal second- and third-trimester rates of gestational weight gain in the most obese women, even with net weight loss, do not increase the odds of small-for-gestational-age neonates.
2. Excessive rates of gestational weight gain increase the odds of large-for-gestational-age neonates regardless of BMI

Gestational weight loss (GWL) has adverse affects

In a retrospective analysis of the 5551 cases, 83 cases (1.5%) with GWL were found.

1) **smaller neonatal birth weights,**
2) **Smaller placental weights,**
3) **shorter umbilical cord length in cases**
4) **Preterm delivery more frequently**
5) **small for gestational age (SGA) infants more frequently [odds ratio (OR) 6.3; 95% confidence interval (CI) 3.3, 12.1] in 10.8% of the cases and 1.8% of the control (OR 6.6; 95% CI 1.7, 25.1**.

Conclusion: **Gestational weight loss is associated with SGA, small placenta, short umbilical cord length, preterm delivery**

Hasegawa J et al. J Matern Fetal Neonatal Med. 2012 Feb 21. [Epub ahead of print]

Συμπεράσματα

Best predictors of poor fetal outcomes

- The WHO Collaborative Study on Maternal Anthropometry and Pregnancy Outcomes (WHO, 1995a; Kelly *et al.,* 1996) reviewed information on 110 000 births from 20 countries
- pre-pregnancy weight plus weight gain was the most significant predictor of LBW and IUGR (with odds ratios of 2.5 and 3.1, respectively).

Summary

1)Brooten D et al. J Am Acad Nurs Pract 2012, 2) IASO

- Obesity per se is a risk factor for various complications during pregnancy
- The need for prenatal nutritional counseling to reduce the intake of calories, fats, sweets, and snacks;
- increase intake of vegetables, fruits, foods with iron, folate, and fiber.
- There are no studies to support the link between low GWG and SGA and ketonemia or ketonuria and delayed neurodevelopment of the offspring

Summary

- GWG in all obese women should be stratified based on pre-pregnancy BMI
- Pregnancy outcome in obese women might benefit from restricted weight gain during pregnancy
- Intervention studies during pregnancy on diet, weight restriction and exercise are needed

P.M. Catalano, JCEM 2003