



Long term consequences for the offspring of IUGR

Carrapato MRG

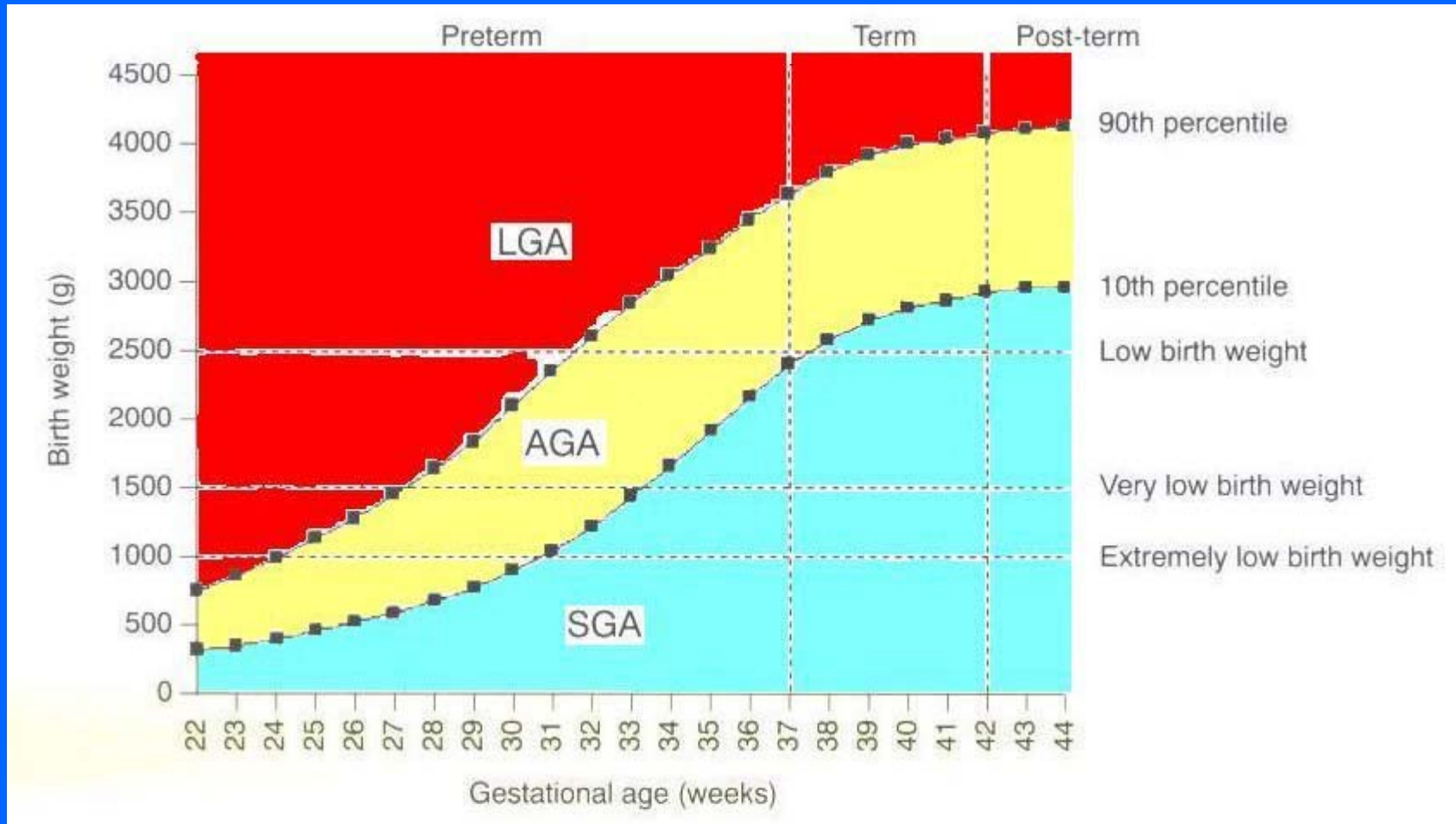
Long term consequences for the offspring of IUGR

IUGR vs SGA

Long term consequences for the offspring of IUGR

IUGR is an obstetric diagnosis

Long term consequences for the offspring of IUGR



Long term consequences for the offspring of IUGR

SGA: weight/GA!...

Long term consequences for the offspring of IUGR

SGA may or may not be an IUGR

Long term consequences for the offspring of IUGR

Ponderal Index (PI) = weight (g) / length (cm)³ *100

Long term consequences for the offspring of IUGR

SGA

- **Symmetrical (PI>2,2)**
- **Asymmetrical (PI<2,2)**

Long term consequences for the offspring of IUGR

Correlation between antenatal assessment and neonatal outcomes (N = 66)

IUGR 10/66 (15,1%) vs SGA 14/66 (21,2%)

PI<10th 10/66 (15,1%)

Long term consequences for the offspring of IUGR

Correlation between antenatal assessment and neonatal outcomes (N=66)

IUGR 10/66 (15,1%) vs SGA 14/66 (21,2%)

PI < 10th 10/66 (15,1%)

IUGR 10/66 (15,1%)

Babies BW > 10th - 3/10

Babies PI > 10th - 4/10

Carrapato et al 2007

Long term consequences for the offspring of IUGR

The immediate problems

The midterm complications

The long term consequences for the offspring of IUGR

Long term consequences for the offspring of IUGR

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Long term consequences for the offspring of IUGR

“FACTS”

- **The immediate (neonatal) problems of IUGR**
 - **↑PMR**
 - **Birth adaptation complications**
 - **Hypoglycaemia**
 - **Hypothermia**
 - **Coagulation defects**
 - **Immunological deficiencies**

(IUGR + Prem: ↑CLD↑NEC)

Long term consequences for the offspring of IUGR

The immediate problems

The midterm complications

The long term consequences for the offspring of IUGR

Long term consequences for the offspring of IUGR

“ CONTROVERSIAL ”

- **Midterm complications**

- **Neurological disorders (CP) >32 wks**

- **Cognitive Impairment**

- **Learning disabilities**

< 32 wks

*Fang S, Pallot EK, Monset-Couchard M,
Hutton JL, Kok JH, Topp M, Wallace F*

Long term consequences for the offspring of IUGR

The immediate problems

The midterm complications

The long term consequences for the offspring of IUGR

Long term consequences for the offspring of IUGR

“CONSENSUAL”

- Adult Metabolic Syndrome
 - Epidemiological studies have shown “supporting” evidence between LBW and the later developments of the adult metabolic syndrome of obesity, insulin resistance/type 2 diabetes, CVD, and related disorders

*Barker DJP, Leon DA, Stein CE,
Frankel S, Ritch-Edwards JW*

Long term consequences for the offspring of IUGR

“CONSENSUAL”...

BUT!!

Long term consequences for the offspring of IUGR

Too many 'loopholes' if not contradictions

(Retrospective) data "adjusted" to fit the circumstances: In men weight at 1 year (but not LBW) correlates with CHD

Long term consequences for the offspring of IUGR

Questions

WHY, will IUGR determine future outcome?

HOW and WHEN?

CAN it be modulated?

IS IUGR all the same?

Will the CAUSE of IUGR matter?

INDUCE labor?

Will early POSTNATAL feeding matter?

Will GENDER matter?

Will (timing of) CATCH UP make a difference?

Long term consequences for the offspring of IUGR

Questions

WHY, will IUGR determine future outcome?

Long term consequences for the offspring of IUGR

Fetal Growth

Genes

Environment

Pregnancy weight
Maternal Nutrition
PET
Stress

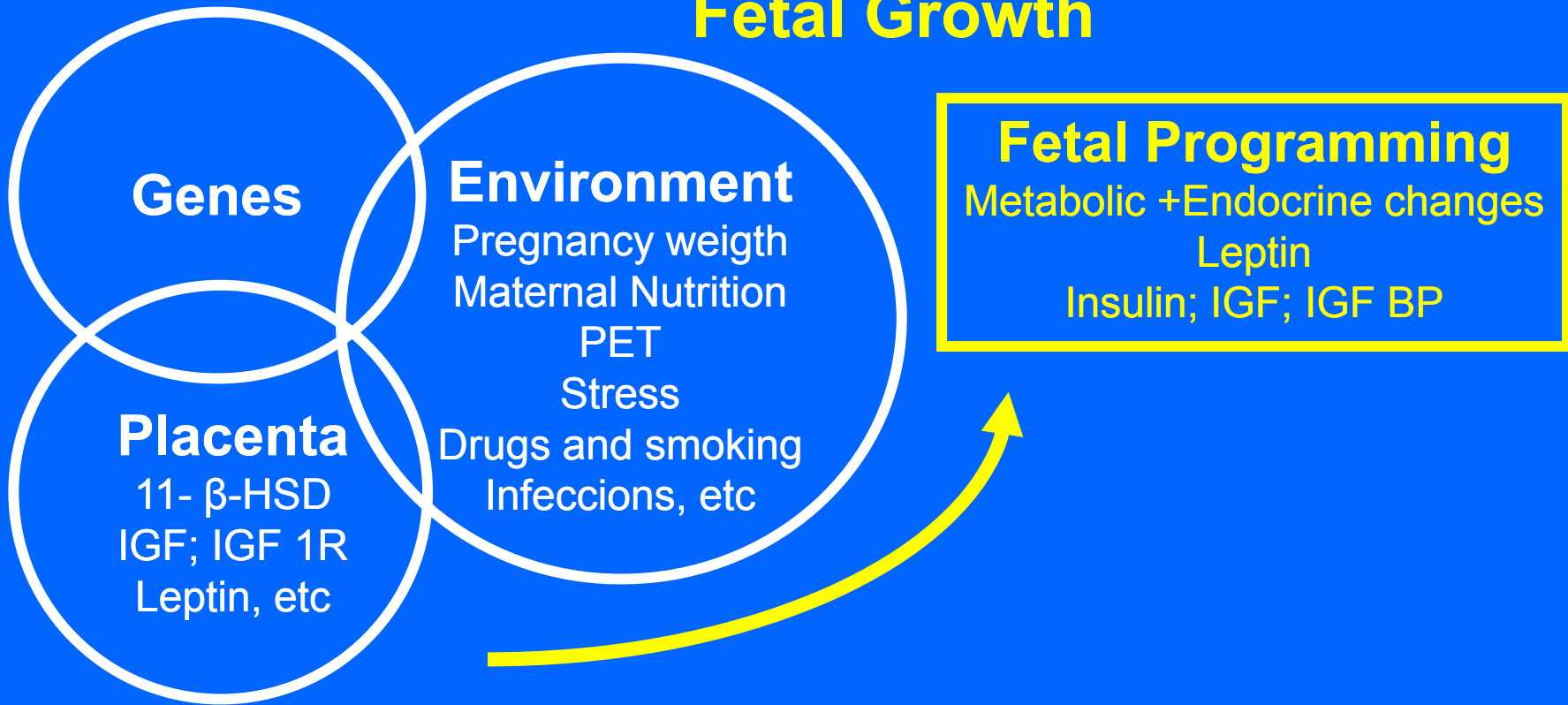
Placenta

11- β -HSD
IGF; IGF 1R
Leptin, etc

Drugs and smoking
Infections, etc

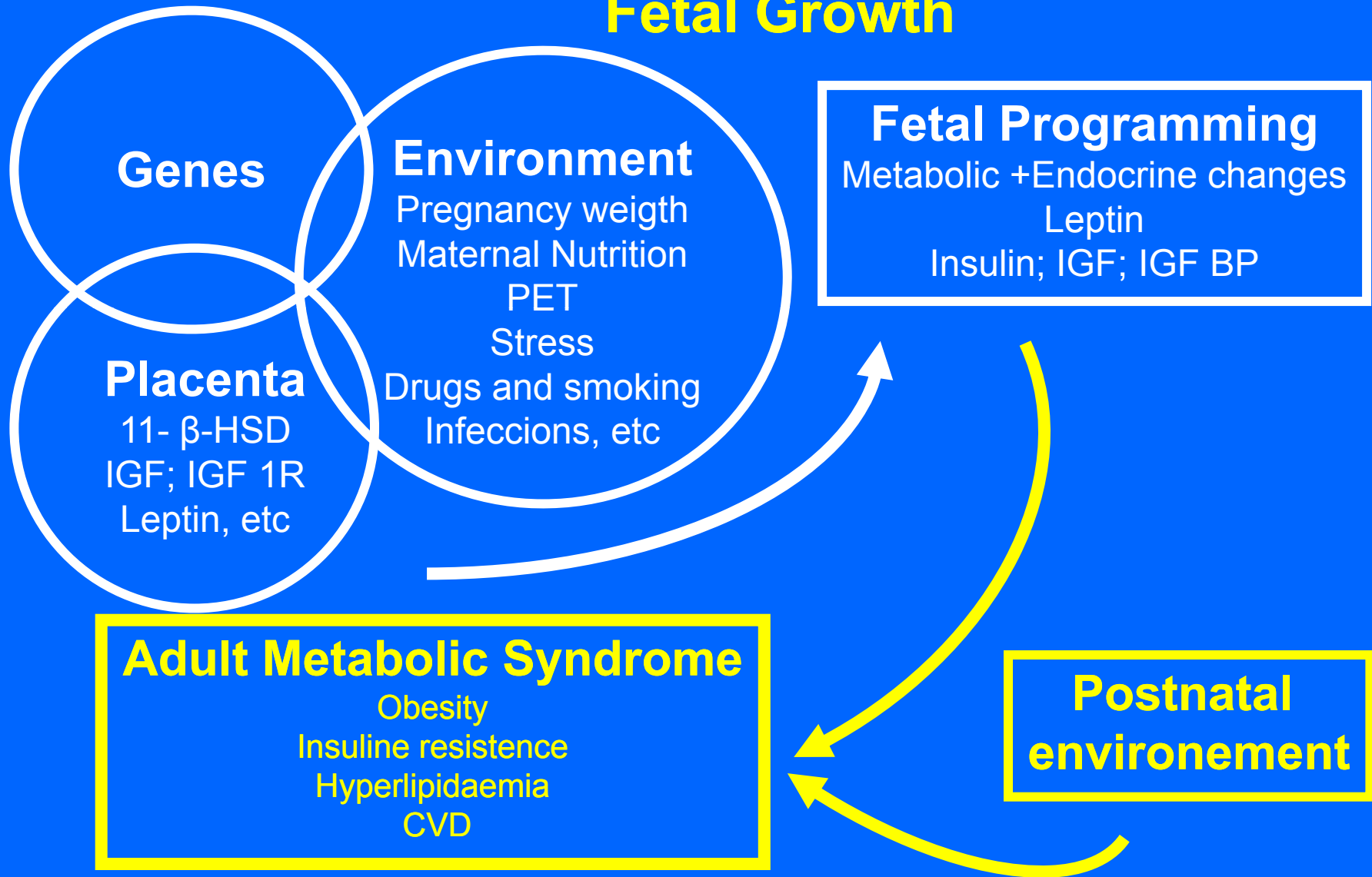
Long term consequences for the offspring of IUGR

Fetal Growth



Long term consequences for the offspring of IUGR

Fetal Growth



Adapted from *Holmång A*

Long term consequences for the offspring of IUGR

“Programming”

Long term consequences for the offspring of IUGR

Programming

“... A process whereby a stimulus or insult at a critical period of development has lasting or lifelong effects”

Lucas A

Long term consequences for the offspring of IUGR

Programming

“... A process whereby a stimulus or insult at a critical period of development has lasting or lifelong effects”

Lucas A

“...Fetuses' adaptation to undernutrition are associated to fetal, placental and hormonal changes operating at different stages of pregnancy”

Barker DJP

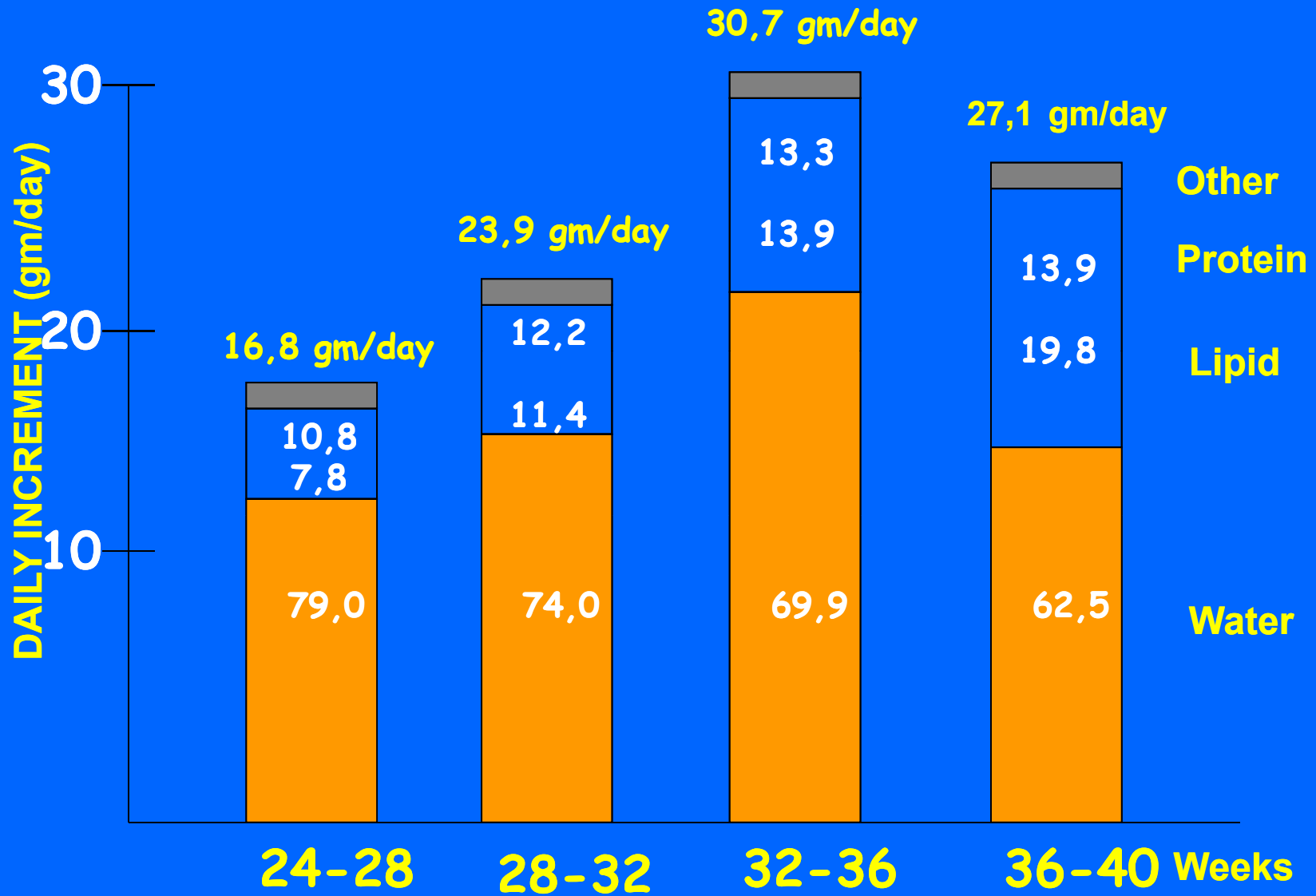
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Long term consequences for the offspring of IUGR



Long term consequences for the offspring of IUGR

It is therefore quite conceivable that different events at different times of gestation may alter body composition and function

Long term consequences for the offspring of IUGR

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Long term consequences for the offspring of IUGR

...Dietary manipulation (protein supplementation, Mg, LCPUFAs, antioxidants, etc) O₂ supplementation, β -mimetics to promote fetal growth

Long term consequences for the offspring of IUGR

...Dietary manipulation (protein supplementation, Mg, LCPUFAs, antioxidants, etc) O₂ supplementation, β -mimetics to promote fetal growth

Quite disappointing!!

Long term consequences for the offspring of IUGR

Questions

WHY, will IUGR determine future outcome?

HOW and WHEN?

CAN it be modulated?

IS IUGR all the same?

Long term consequences for the offspring of IUGR

Symmetrical ($PI > 2,2$) vs Asymmetrical ($PI < 2,2$)
("brain sparing effect")?

Long term consequences for the offspring of IUGR

Questions

WHY, will IUGR determine future outcome?

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IS IUGR all the same?

Will the CAUSE of IUGR matter?

Long term consequences for the offspring of IUGR

Quite likely!!

Long term consequences for the offspring of IUGR

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IS IUGR all the same?

Will the CAUSE of IUGR matter?

INDUCE labor?

Long term consequences for the offspring of IUGR

... and in addition face prematurity?!

Long term consequences for the offspring of IUGR

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Will early POSTNATAL feeding matter?

Long term consequences for the offspring of IUGR

Quite possible!

Lucas A, Yu V, Carrapato MRG

Long term consequences for the offspring of IUGR

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Long term consequences for the offspring of IUGR

VLBW females catch up over males in weight, height, BMI at 20 years of age

Hack M

Long term consequences for the offspring of IUGR

VLBW females catch up over males in weight, height, BMI at 20 years of age

Is it an advantage?!

Long term consequences for the offspring of IUGR

VLBW females catch up over males in weight, height, BMI at 20 years of age

Is it an advantage?!

21% Overweight

15% Obese!!

Hack M

Long term consequences for the offspring of IUGR

Questions

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CAN it be modulated?

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Long term consequences for the offspring of IUGR

Anthropometry at follow-up at 5 years of age

Weight	Birth	5 years
	$\bar{X} \pm SD$	$\bar{X} \pm SD$
♀ p<0.0001	2.94 ± 0.73 (10-25th)	22.91 ± 4.85 (95th)
♂ p<0.0001	3.30 ± 0.53 (25th)	23.46 ± 4.74 (95th)

Long term consequences for the offspring of IUGR

Anthropometry at follow-up at 5 years of age SGA

Weight	Birth	5 years
	$\bar{X} \pm SD$	$\bar{X} \pm SD$
 p<0.0001	2.28 \pm 0.40 (<10th)	20.89 \pm 5.90 (75-90th)
 p<0.0001	2.53 \pm 0.30 (<10th)	26.50 \pm 8.34 (>95th)

Long term consequences for the offspring of IUGR

Anthropometry at follow-up at 5 years of age PI vs BMI

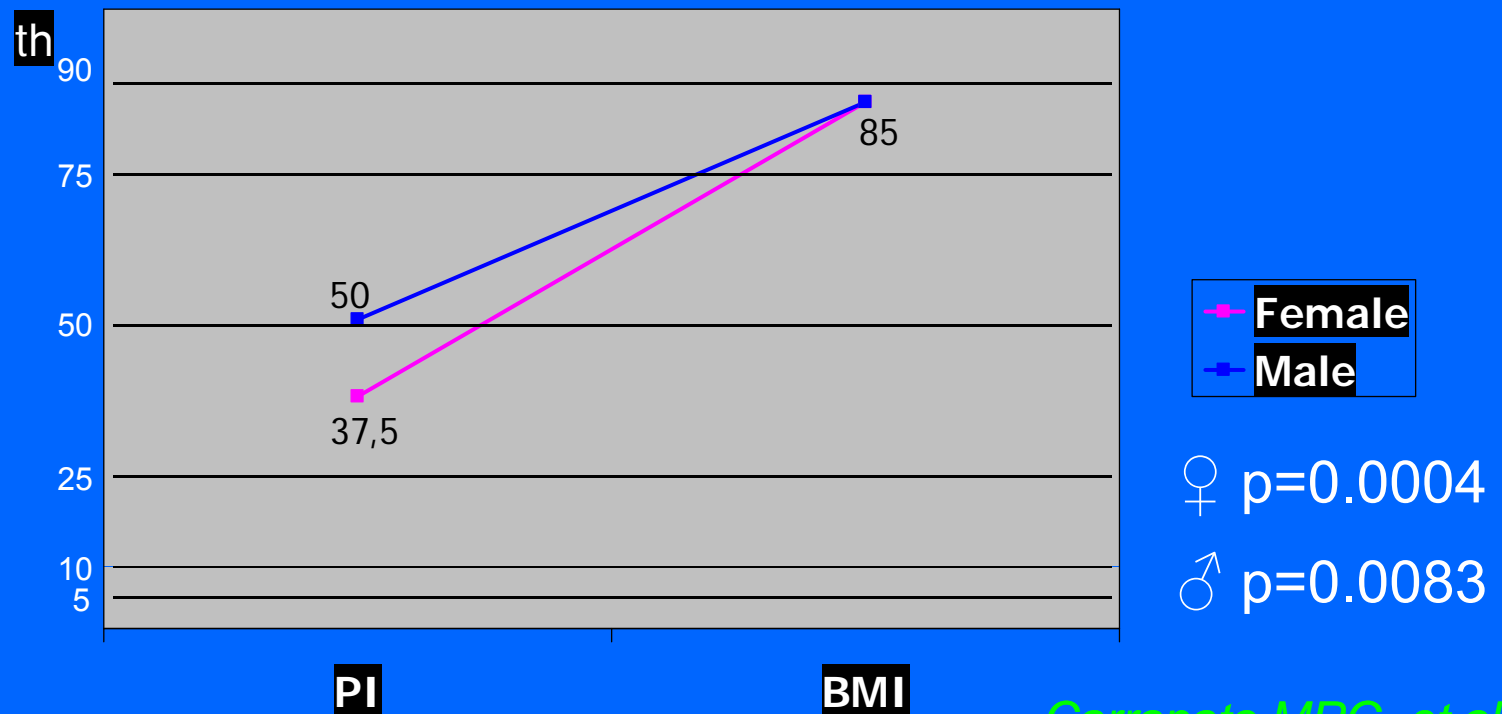
	PI	BMI
	$\bar{X} \pm SD$	$\bar{X} \pm SD$
♀	2,71 \pm 0,27 (25-50th)	16,89 \pm 2,63 (85th)
♂	2,73 \pm 0,24 (50th)	16,92 \pm 2,88 (85th)

♀ p=0.0004

♂ p=0.0083

Long term consequences for the offspring of IUGR

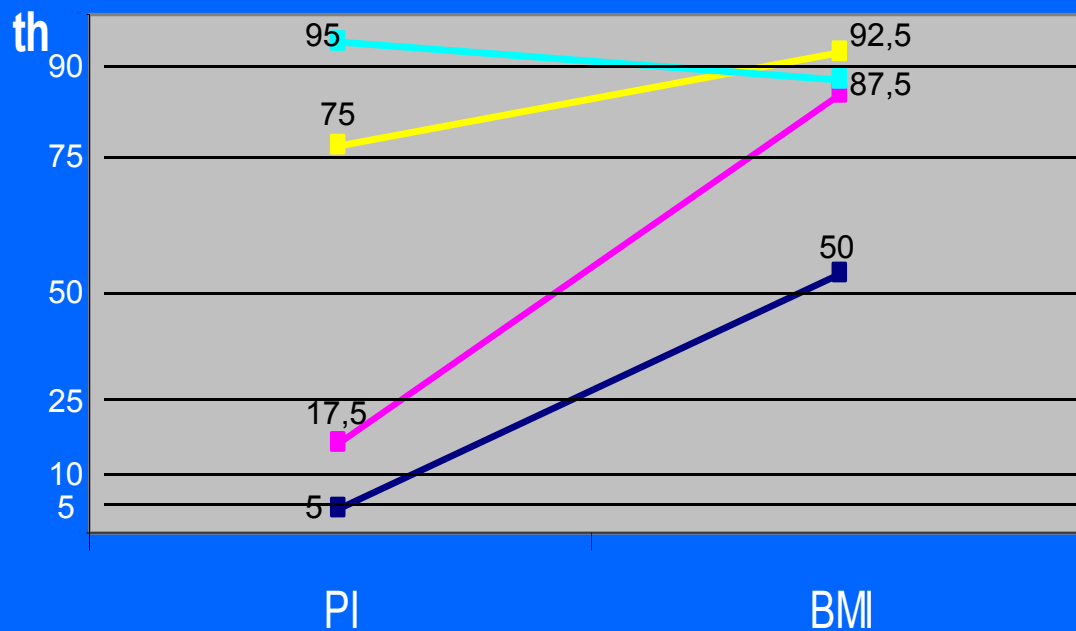
Anthropometry at follow-up at 5 years of age PI vs BMI



Carrapato MRG, et al

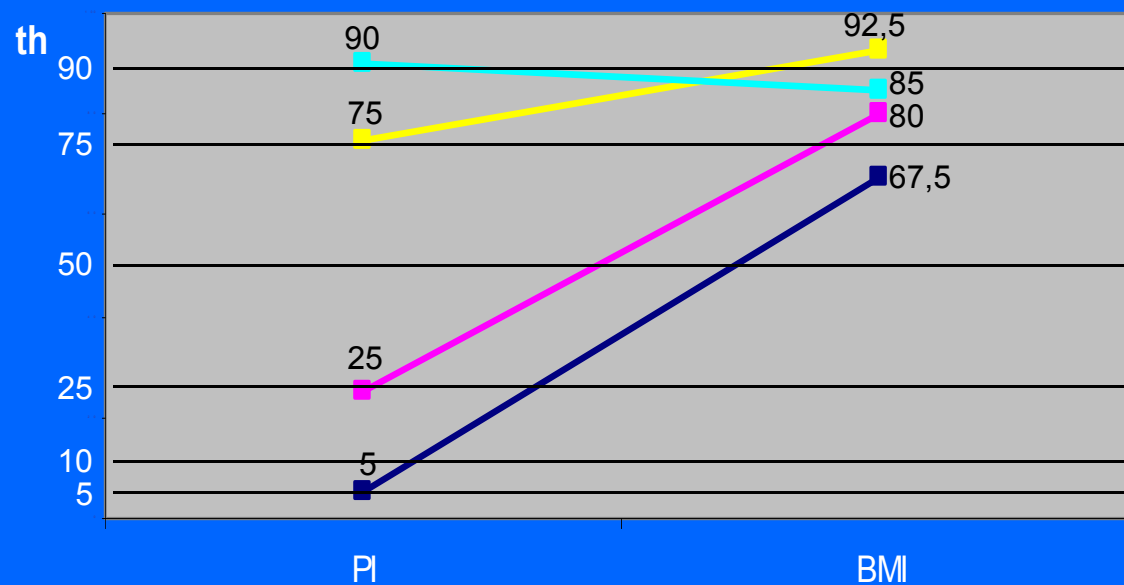
Long term consequences for the offspring of IUGR

Anthropometry at follow-up at 5 years of age PI vs BMI - Female



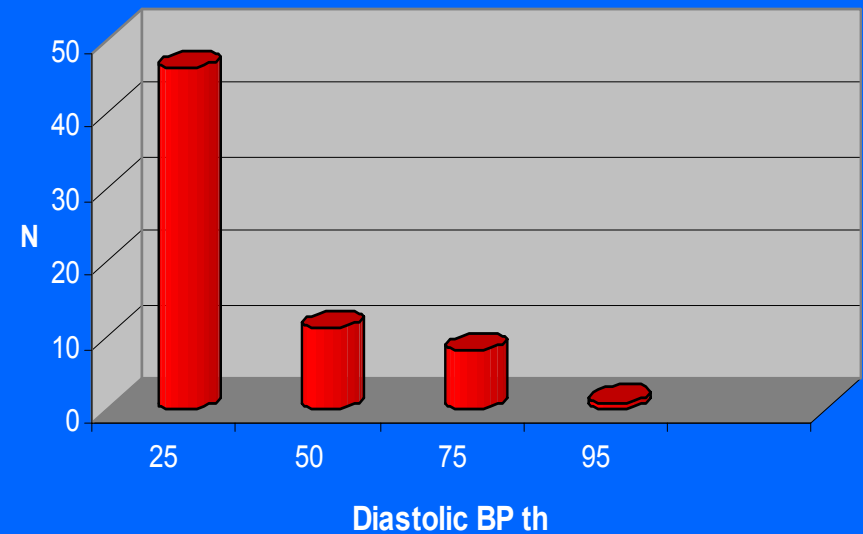
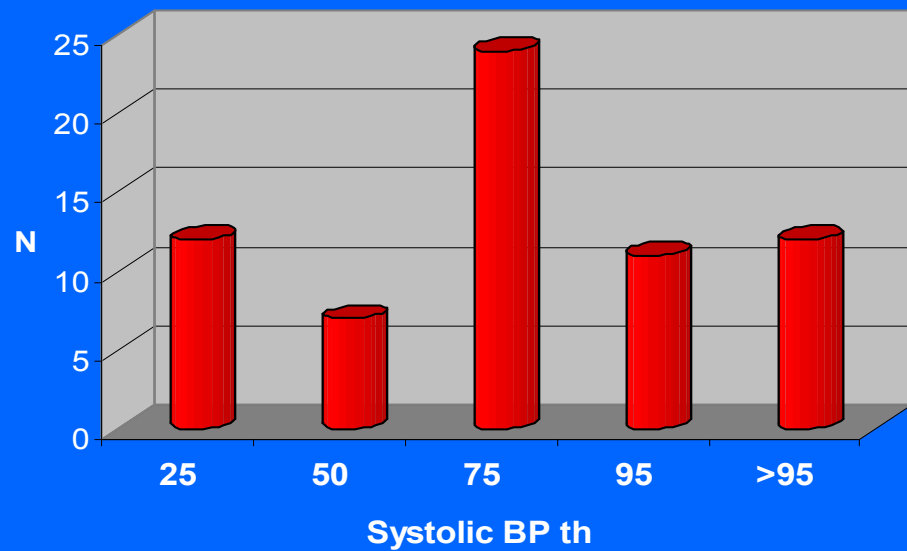
Long term consequences for the offspring of IUGR

Anthropometry at follow-up at 5 years of age PI vs BMI - Male



Long term consequences for the offspring of IUGR

Blood pressure at follow-up at 5 years of age Female and Male

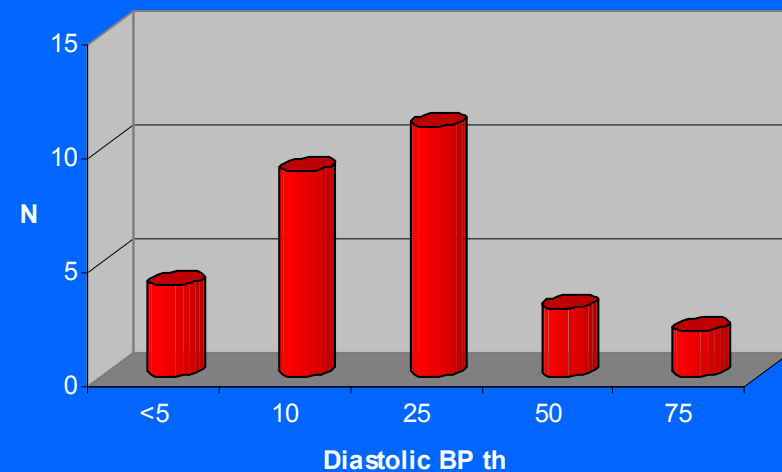
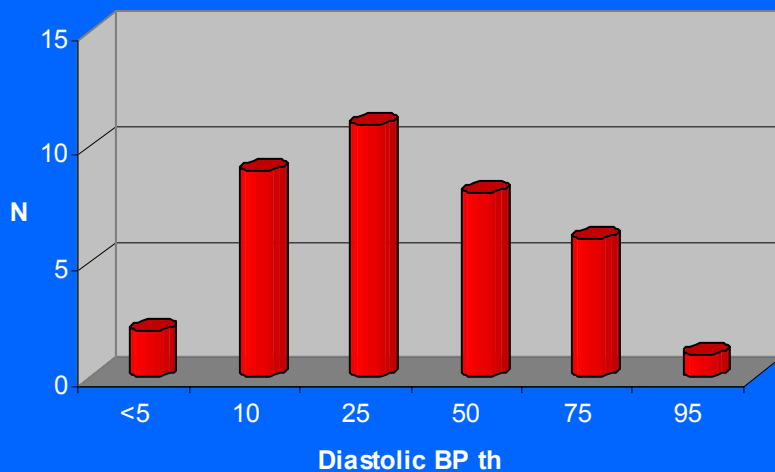
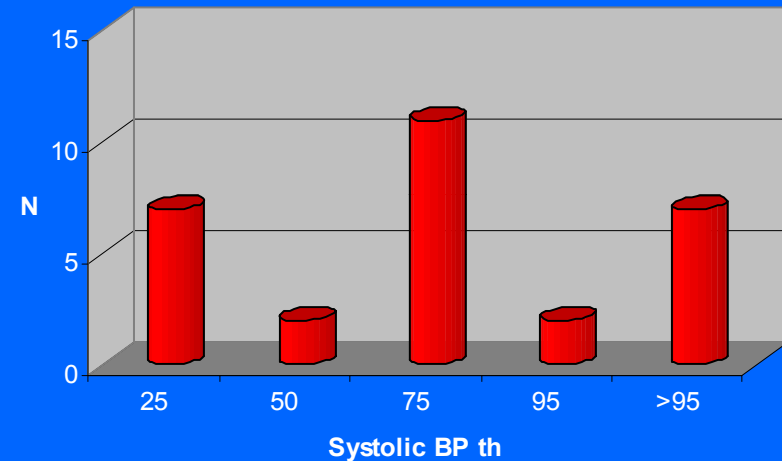
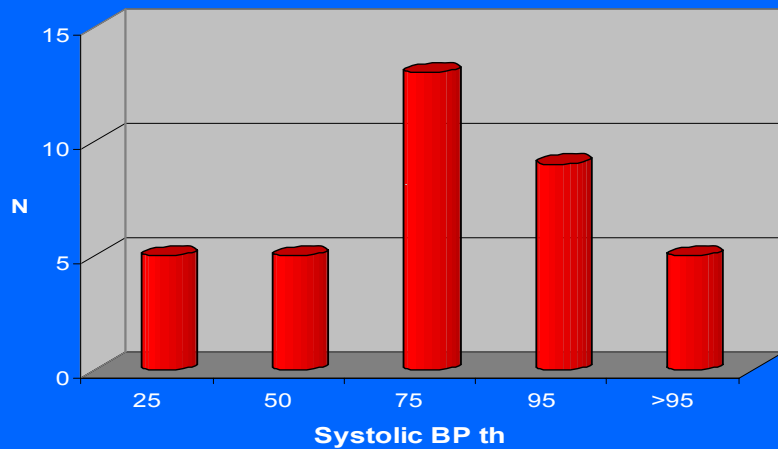


Long term consequences for the offspring of IUGR

Blood pressure at follow-up at 5 years of age

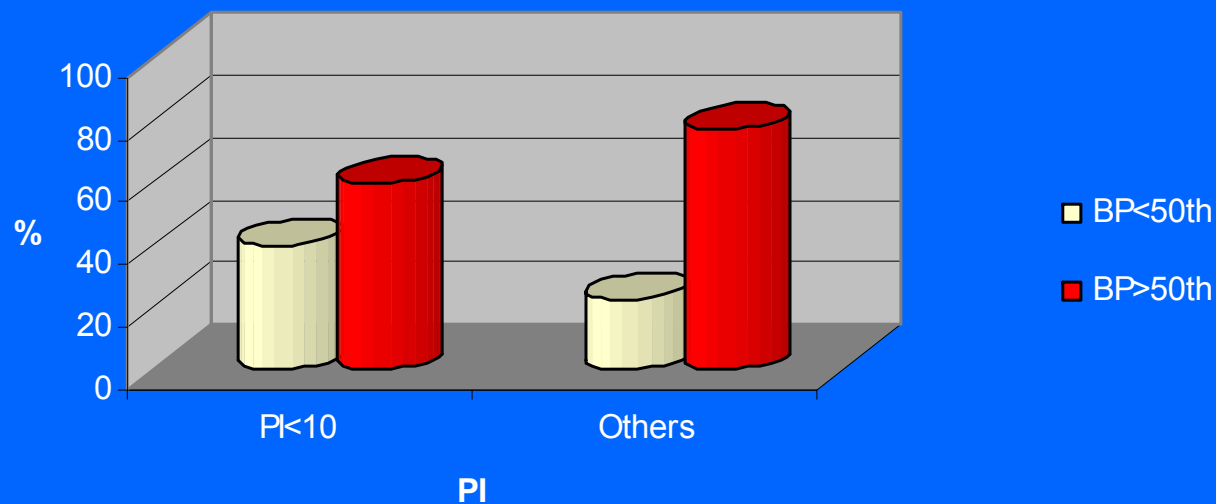
Female

Male



Long term consequences for the offspring of IUGR

Blood pressure at follow-up at 5 years of age PI vs BP



Long term consequences for the offspring of IUGR

- The offspring of gestosis, both boys and girls, at 5 years of age start to show significant signs of increased BMI especially those below the 10th at birth ($p < 0.0001$)
- A fair amount of children show BP above the 75th at 5 years of age

Long term consequences for the offspring of IUGR

“ CONCLUSION ”

IUGR may start before conception operating throughout intrauterine life, influenced by early neonatal nutrition and catch up and eventually leading to the latter development of the Adult Metabolic Syndrome!...