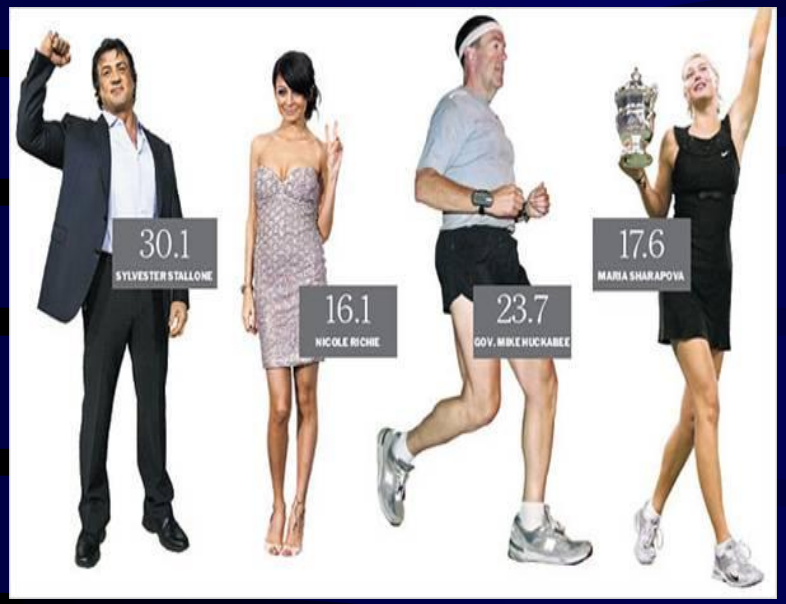
Thin-fat Indian phenotype
Clinical Implications

Dr Anand Pandit, Pune

Thin-fat Indian
Impossible!

Adiposity (body fat %)
Vs
Obesity (body mass index)



Body Mass Index

$$BMI = \frac{\text{Weight (kg)}}{[\text{Height (m)}]^2}$$

- The ‘gold standard’ of obesity
- ‘Easy’ to measure
- Devised to eliminate the effect of height on mass
- Influenced the thinking in risk for NCD
- Difficulties comparing across populations
- Weight and height have different determinants

WHO definition Obesity

- **Overweight: BMI >25**
- **Obese >30, Morbid > 40**
- **Based on European data**
- **Indians are susceptible at lower BMI**
- **WHO Expet Consultation 2004:**
  - **Public health related action in Asians at a BMI $\geq$ 23 kg/m^2**

Obesity

- Excess weight
- Excess weight for height
- Excess body fat
- Excess fat where it shouldn’t be (ectopic): liver, muscle, pancreatic B-cell…..
- Excess problems: diabetes, hypertension, osteoarthritis, sleep apnoea …….

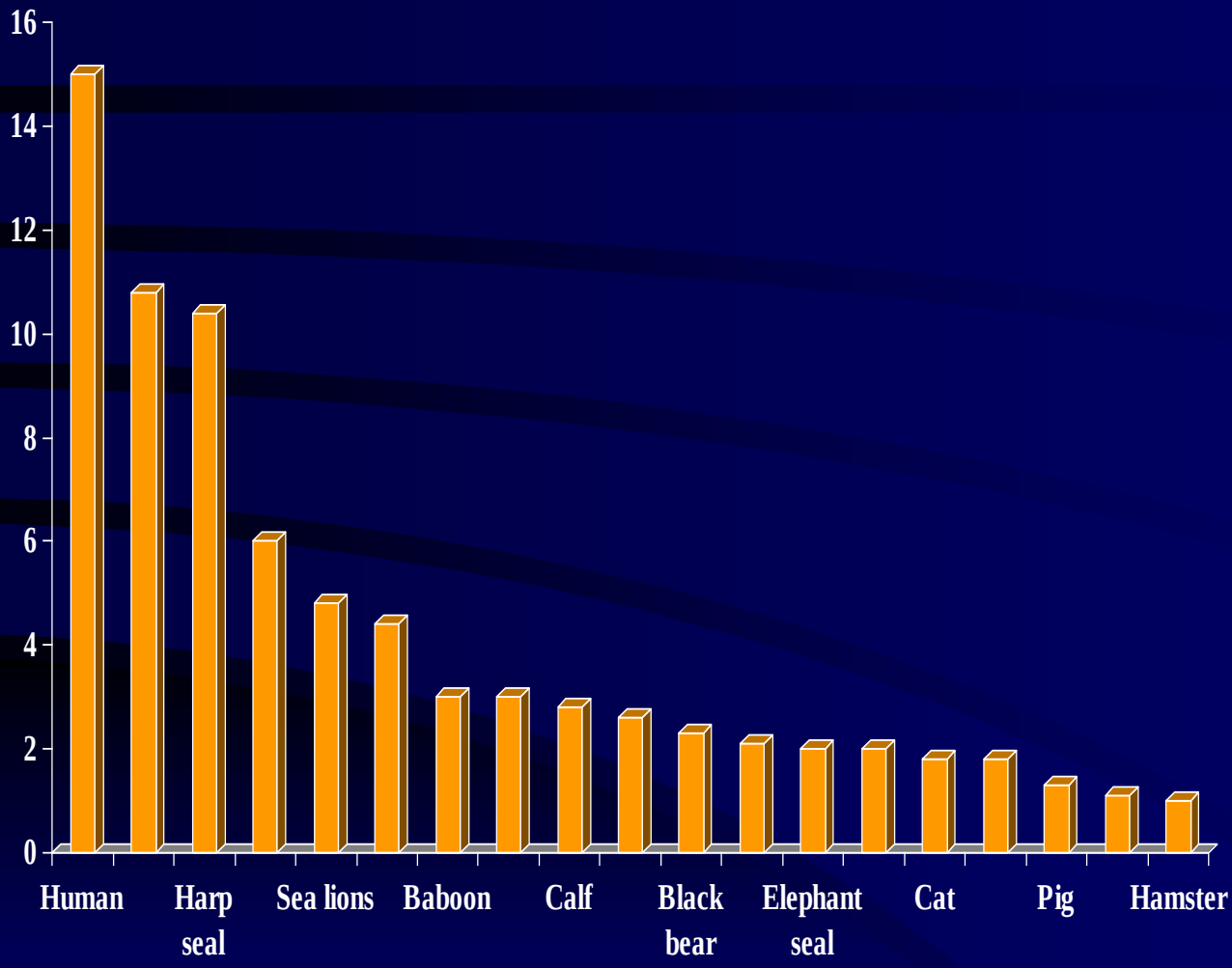
Obesity: More than weight?

- **Body composition**
- **Body fat percent (Adiposity)**
- **Fat tissue secretes fatty acids and hormones which affect metabolism, blood vessels, immune system etc…….**
- **Fat in different places behaves differently**

Obesity & Adiposity: When does it begin?

- It is increasing rapidly in children, especially urban affluent (~10%)
- In young people
- In old people
- Diet, physical inactivity, stress
- What are the susceptibility factors?
- When does it first manifest?

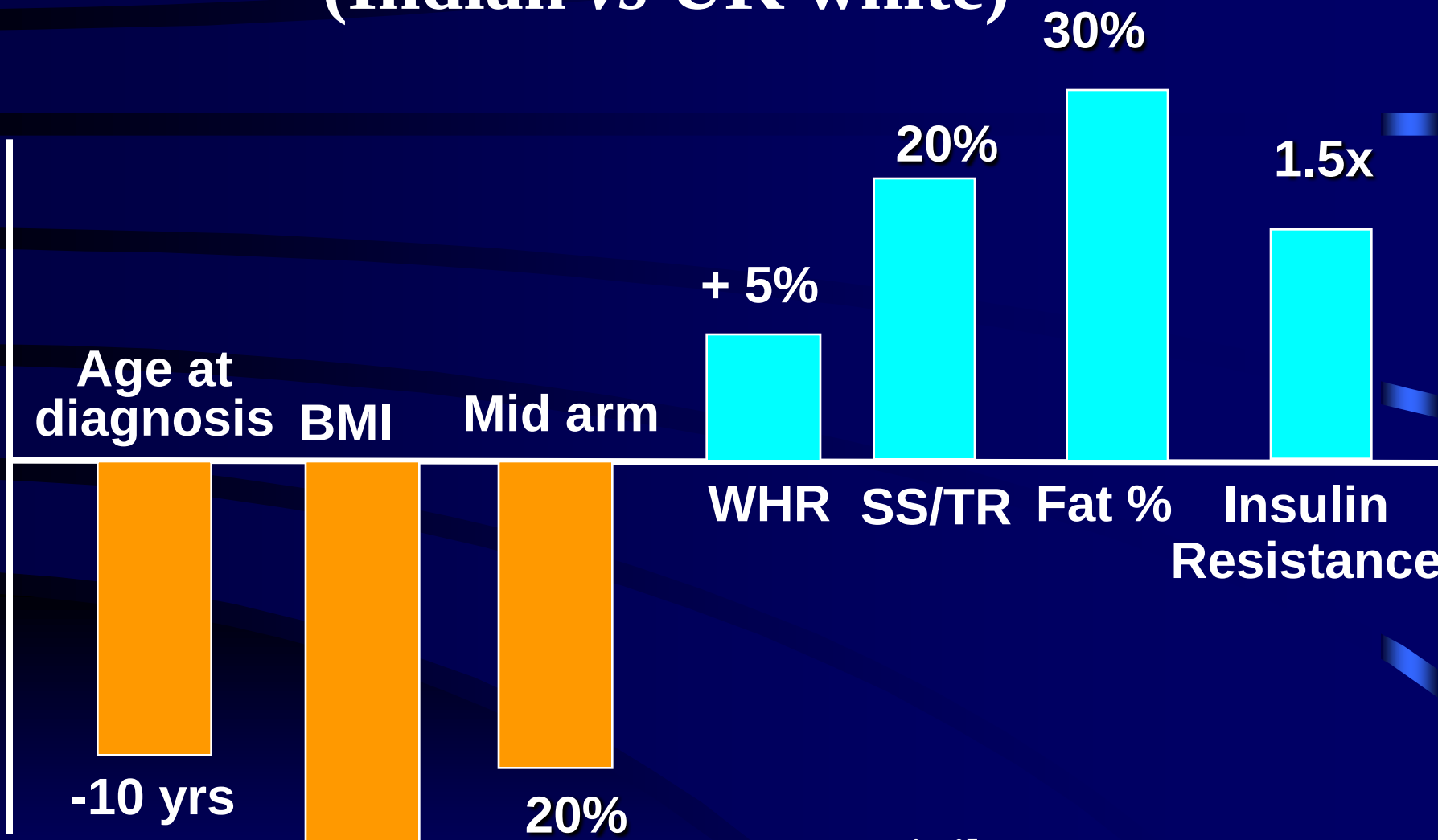
Percentage fat at birth in mammals



Kuzawa CW. Yrbk Phys Anthropol 1998.41:177-

Newly diagnosed Type 2 DM

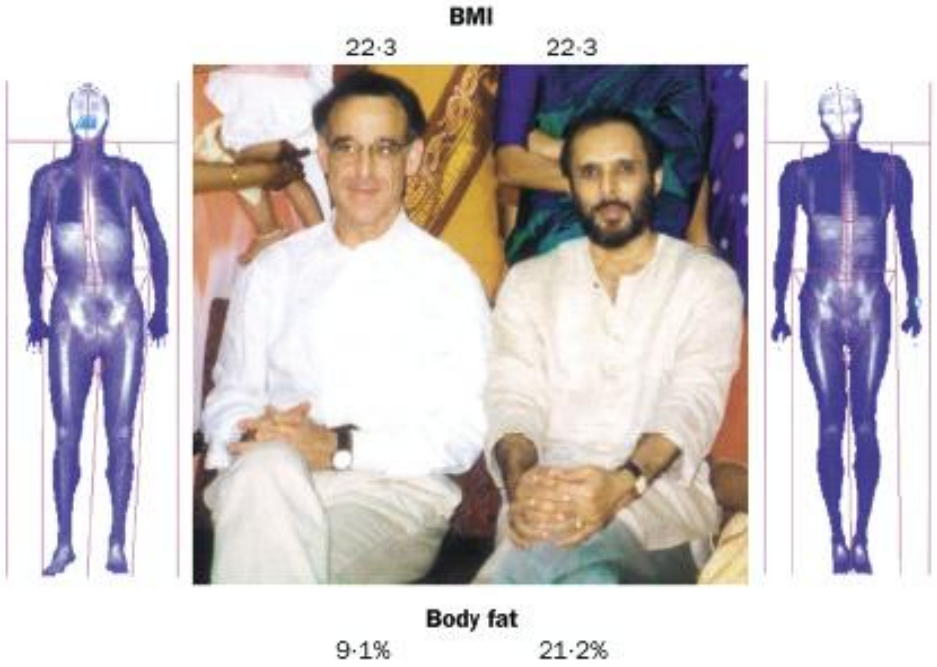
(Indian *vs* UK white)



Yajnik CS, Nutr Rev 2001

The Y-Y paradox

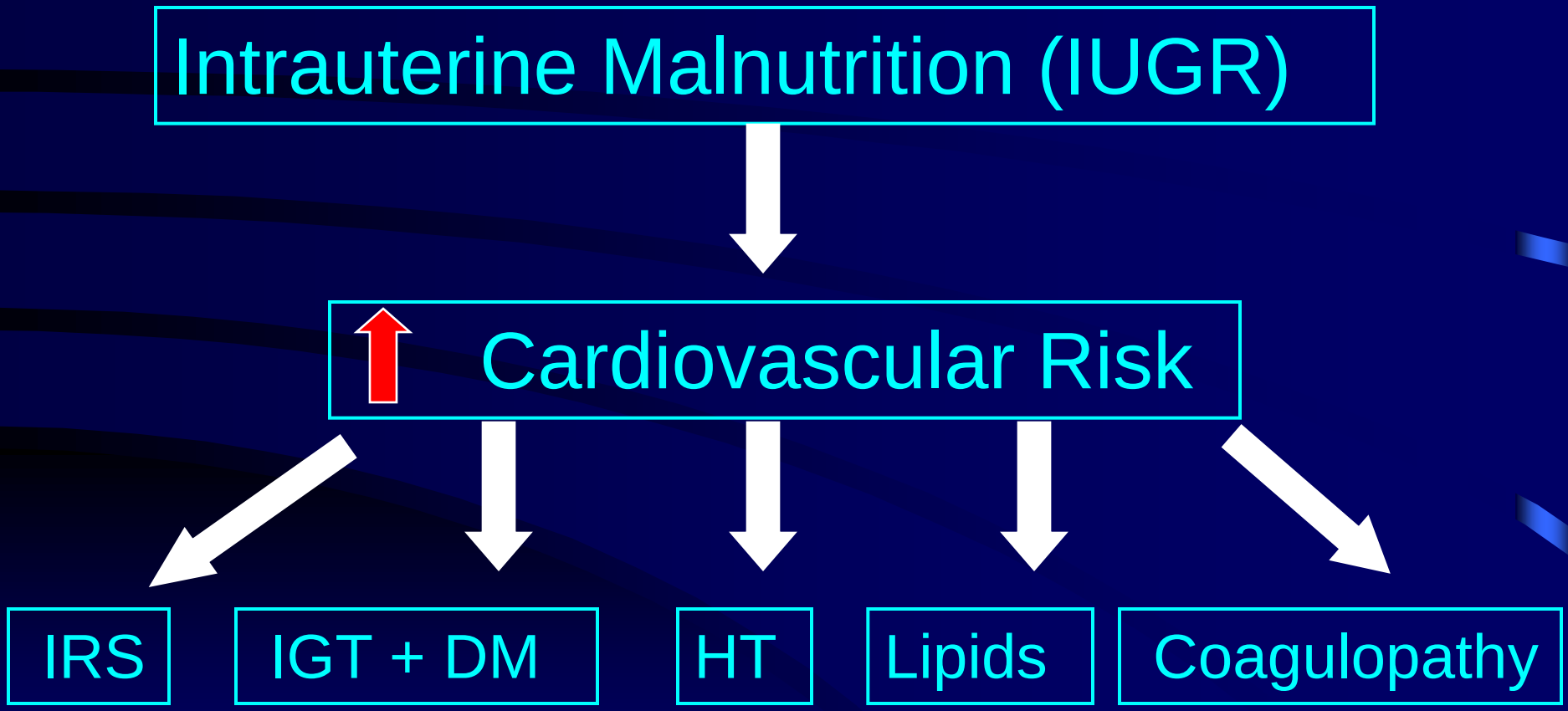
Chittaranjan S Yajnik, John S Yudkin



The two authors share a near identical body-mass index (BMI), but as dual X-ray absorptiometry imagery shows that is where the similarity ends. The first author (figure, right) has substantially more body fat than the second author (figure, left). Lifestyle may be relevant: the second author runs marathons whereas the first author's main exercise is running to beat the closing doors of the elevator in the hospital every morning. The contribution of genes to such adiposity is yet to be determined, although the possible relevance of intrauterine undernutrition is supported by the first author's low birthweight. The image is a useful reminder of the limitations of BMI as a measure of adiposity across populations.

Diabetes Unit, KEM Hospital Research Centre, Rasta Peth, Pune 411011, India (C S Yajnik MD); **International Health and Medical Education Centre, University College London, UK** (J S Yudkin FRCP)

Barker's Hypothesis (Thrifty Phenotype) (Small Baby Syndrome)



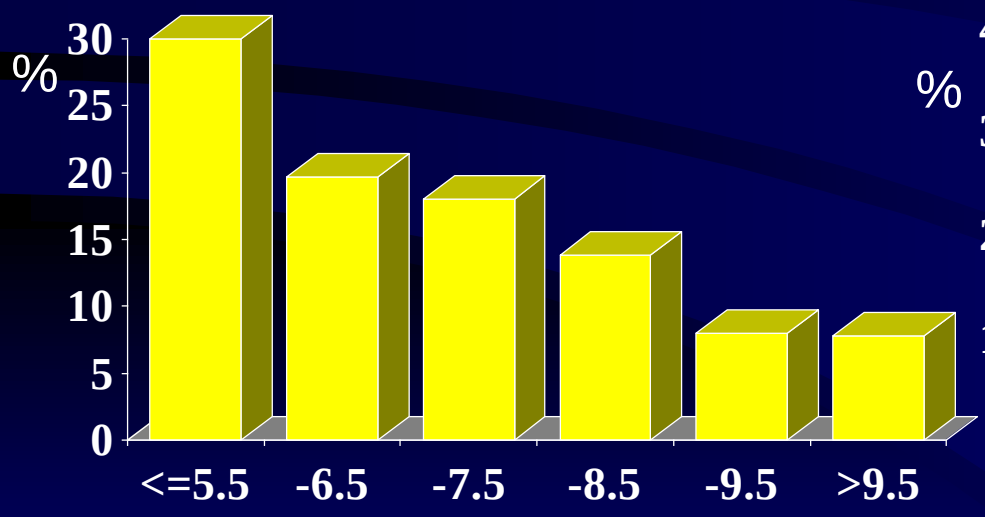
Hertfordshire, UK

Men aged 59-70 yrs
(n=408)

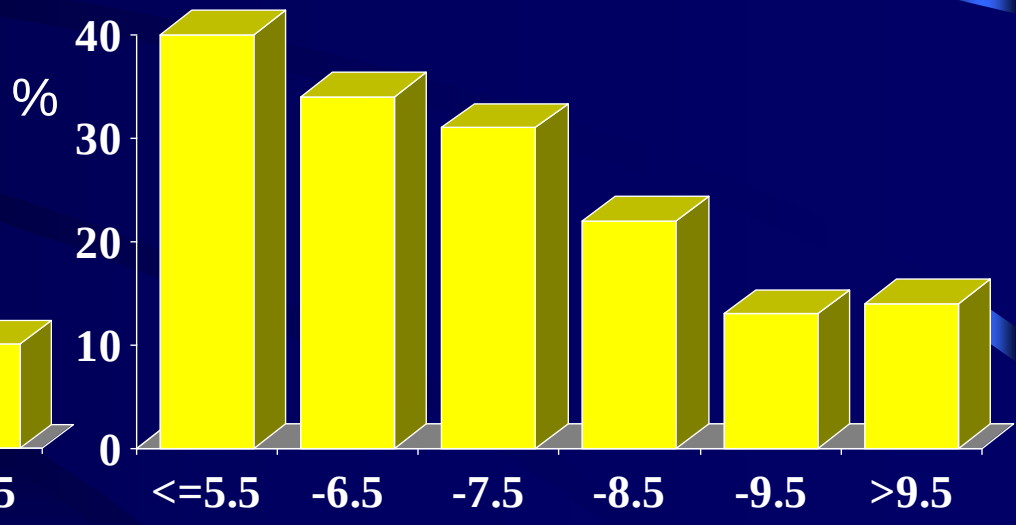
Men aged 64 yrs
(n=370)

*

SYNDROME X



IGT + DM



Birthweight (lbs)

*p<0.05

Hales CN et al, BMJ,

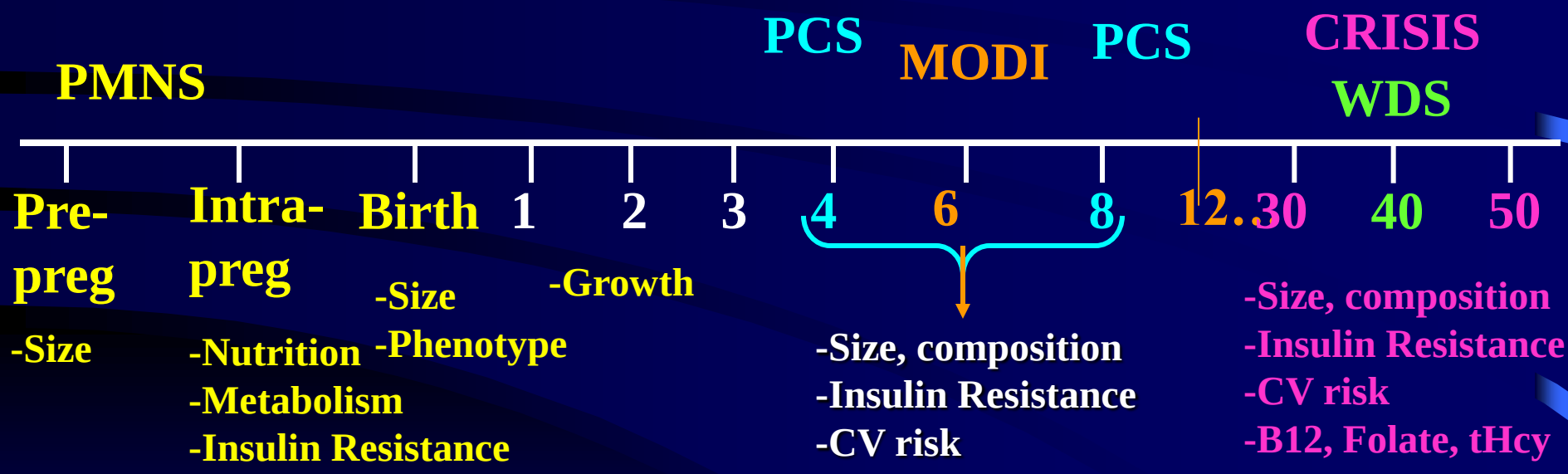
Barkerology and India

- Smallest babies in the world
- Widespread maternal malnutrition, one of the highest maternal mortality
- Rapidly rising epidemic of T2DM and CHD

Relevance of ‘Barkers Hypotheis’ to India

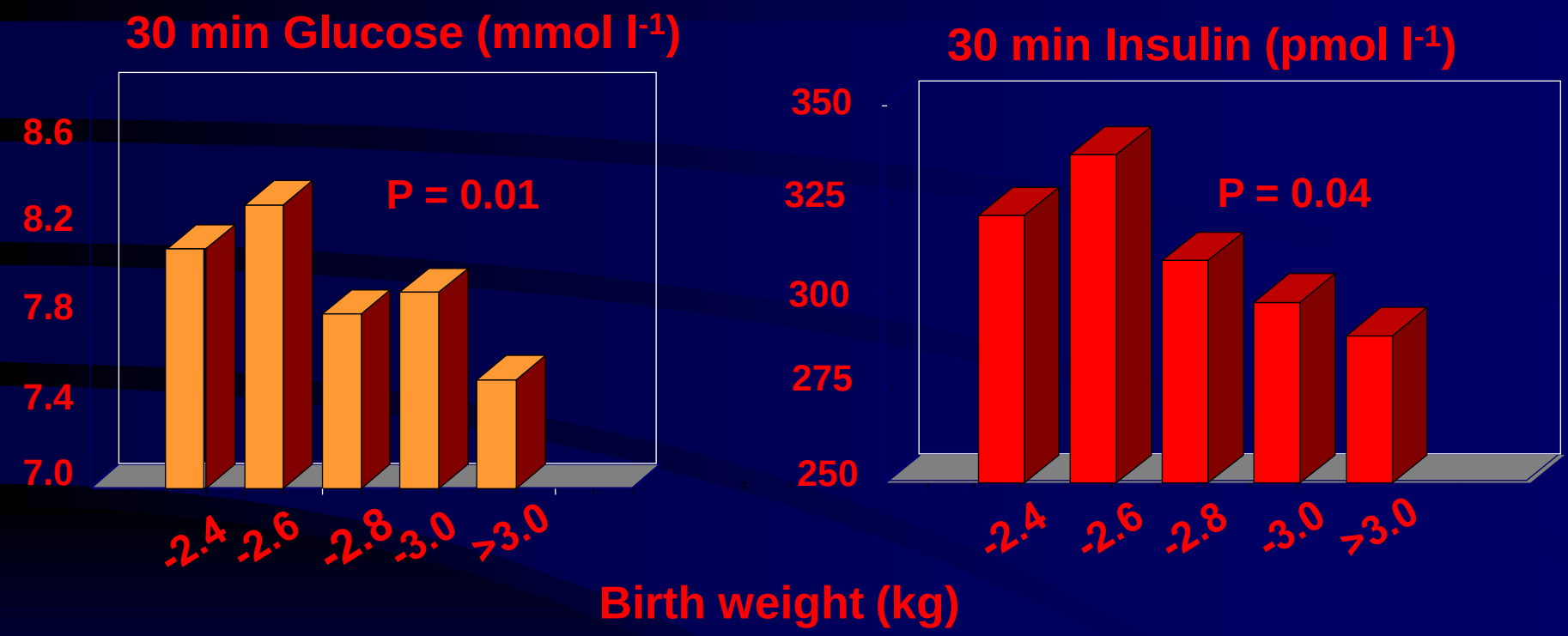
- Indian babies are the smallest in the world
- Infant and childhood deaths are declining
- Life expectancy increasing
- Infectious diseases declining
- Rapid urbanisation

K.E.M. Hospital & Research Centre
Diabetes Unit
Epidemiological Studies



Pune Children's Study (1992-94)

Age 4 years

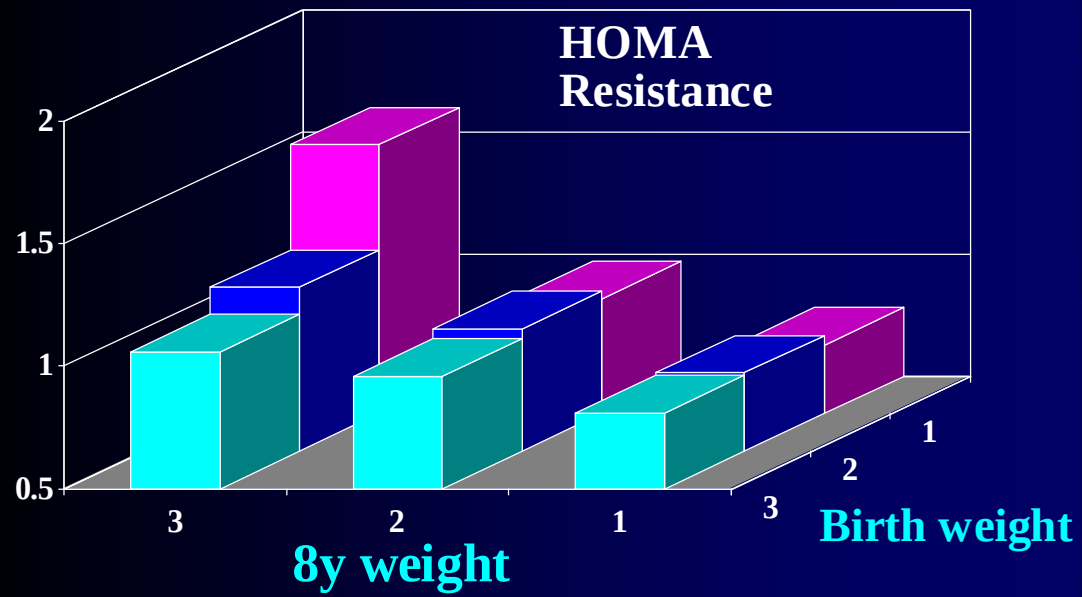


Yajnik et al, Diabet Med 1995

8y Old (PCS)

Birthweight - Current Size Risk of T2D & CVD

Insulin Resistance



Also true for

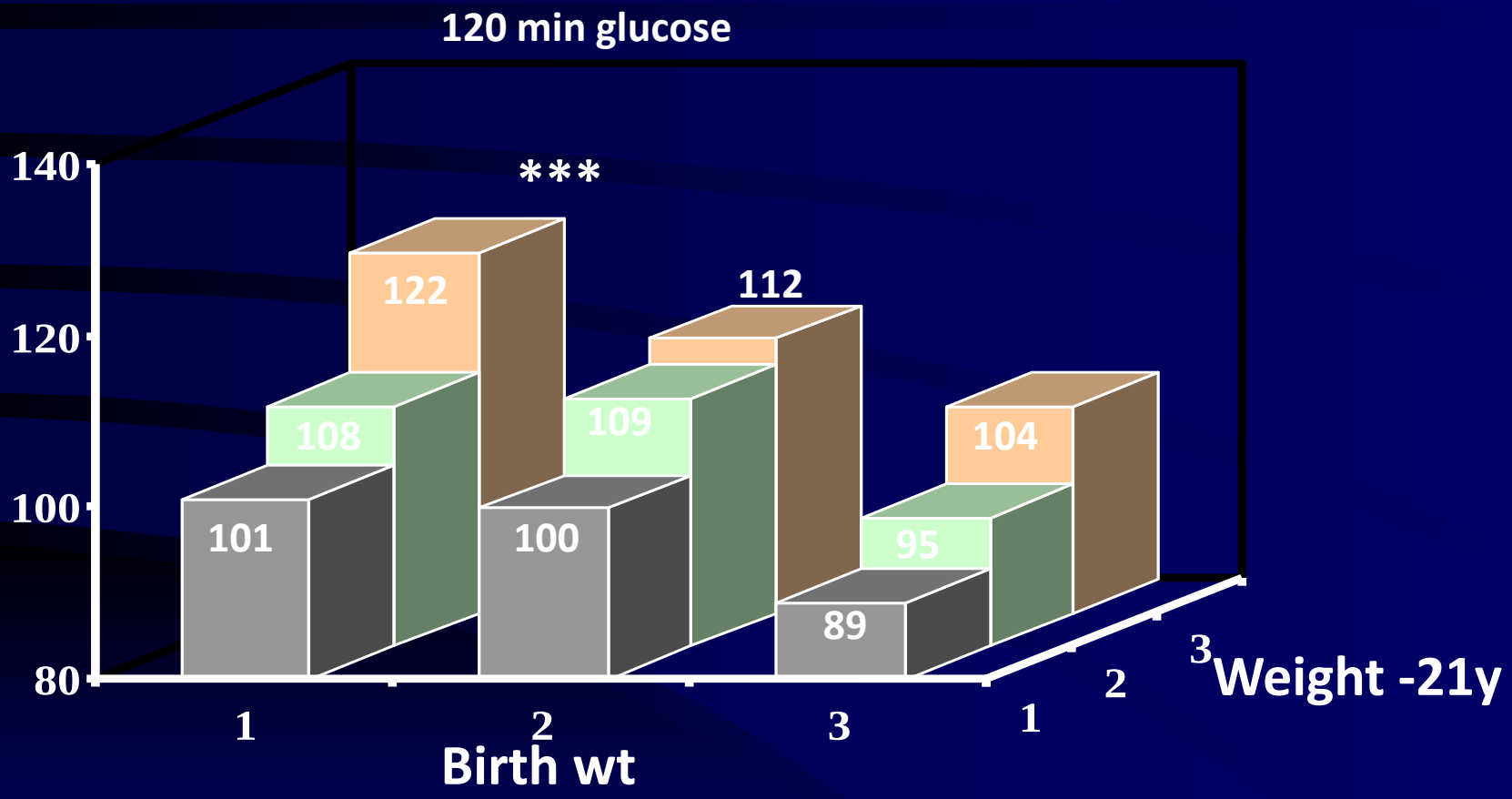
- Current fat mass
- Current height

&

- HOMA-β
- 30 min Insulin
- Systolic BP
- STR, Body fat %
- Cholesterol
- Leptin

Bavdekar et al, Diabetes, 1999

CVD risk factors in PCS children at 21y
Born Small Grown Big



- Similar results were obtained for cholesterol and % body fat by DXA
- Insulin sensitivity was lowest

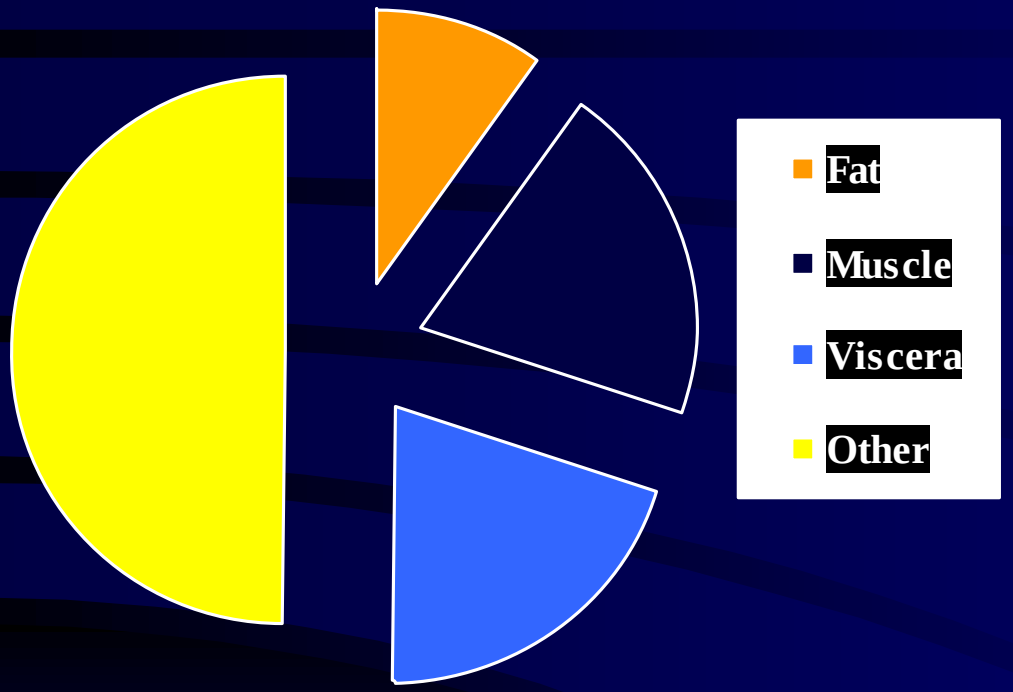
Pune and London Newborns Pair-matched for birth weight

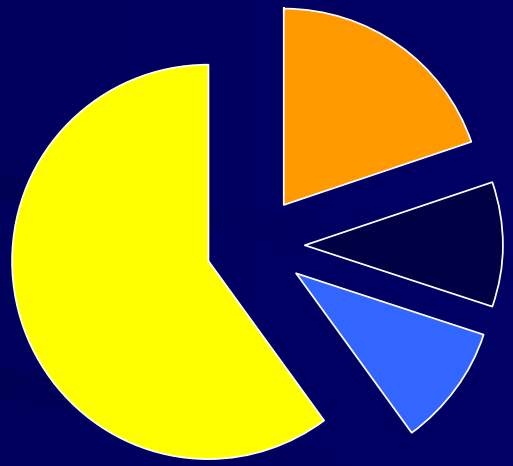
	Pune	London	P-value
Gestational age	39.6	40.0	0.33
Anthropometry			
Birthweight (g)	3100	3100	0.82
Birth length (cm)	49.0	49.7	0.03
Head (cm)	34.0	34.1	0.26
Mid arm (cm)	10.2	10.6	0.02
Subscapular (mm)	4.4	4.1	0.03
Triceps (mm)	4.7	5.0	0.10
Cord plasma biochemistry			
Glucose (mmol/L)	4.7	4.3	0.72
Insulin (pmol/L)	55.5	13.9	0.002
Leptin (ng/mL)	10.4	4.6	0.022

Thrifty Phenotype : Indian babies Compared to Western babies

1) Small in all measurements
2) Head and length preserved (95%)
3) Soft tissues deficient
   a) Muscle : Most
   b) Abdomen viscera : Intermediate
   c) Fat : Least affected
4) Placenta, smallest foetal organ

Body Composition of Newborn





White Caucasian, 3500 g

Indian, 2700 g

Yajnik et al, JCEM, 2002
Yajnik et al, Int J Ob, 2003

Thin-fat Indian Baby

- Indian newborn babies are 800g lighter but have more fat than the European babies
- The ‘thin fat’ Indian baby

Implications

- *Indians will not win Olympics!*
- *Health of young girls paramount*
- *Intergenerational prevention*
- *Post-reproductive strategies have limitations*
- *New paradigm of long-latency nutritional disorders, contributing to NCD*

Comments

- **Indian babies are small and ‘thin’ due to poor muscle & visceral growth *in utero* but have central adiposity.**
- **Maternal nutritional transition and food intake during pregnancy seem to be major determinants of baby’s phenotype**
- **(Over)Feeding malnourished mothers may exaggerate this phenotype**
- **Poor muscle mass and excess (central) adiposity may lead to insulin resistance**
- **Poor development of liver, pancreas and kidneys could have profound metabolic and endocrine implications**

Summary

- There is an epidemic of obesity and adiposity in the world, also in India
- The epidemic is causing a diabetes and heart disease epidemic
- Young are increasingly affected
- Our past history and current affluence both contribute
- Maternal nutrition and health are important factors
- We must begin our efforts very early!

Think about your Great Grandchildren