PRETERM INFANTS: NUTRITION BEFORE AND AFTER DISCHARGE

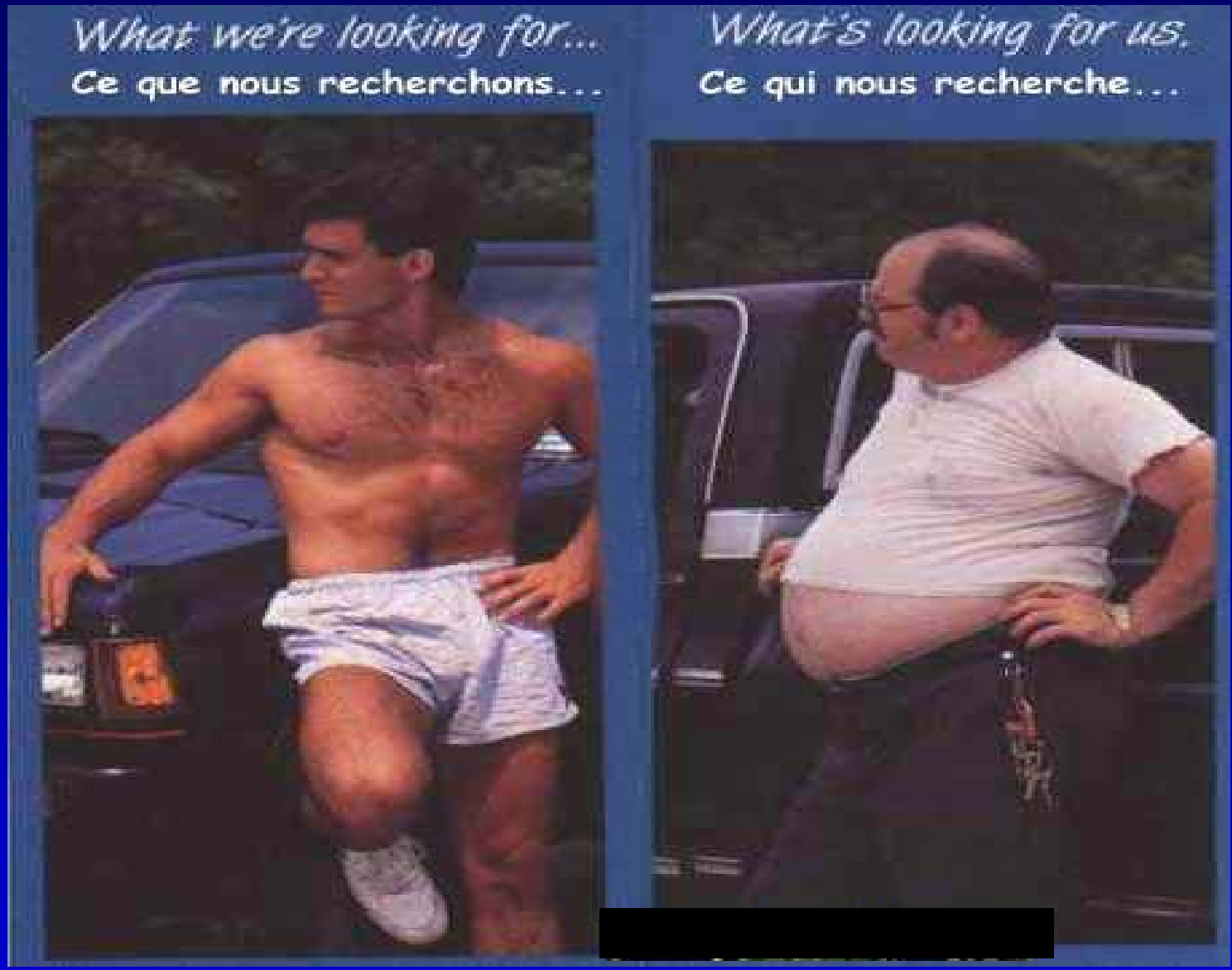
Yes, that was a "one size fits all" title

We will focus on

- ***EXTRAUTERINE GROWTH RETARDATION***
- ***NEONATAL NUTRITION AND OUTCOME***

SHOULD WE BE INTERESTED ?

AS YOU KNOW, MEN COME IN DIFFERENT SHAPES



And the importance of proper nutrition should be obvious

LET'S TAKE A LOOK AT OUR BABIES' GROWTH

Intrauterine Growth vs Extrauterine Growth

Compared to a fetus of same age, a preterm infant reaches a weight of 2 Kg with these delays

Gestational age	*Delay (weeks)*
24-25 wks.	*5.5*
26-27 wks.	*5*
28-29 wks.	*4*

Ehrenkrantz RA et al Pediatrics 104:280,1999

FINE, BUT HOW ARE THEY DOING AT DISCHARGE ?

AT DISCHARGE

- **Malnutrition Is quite frequent**

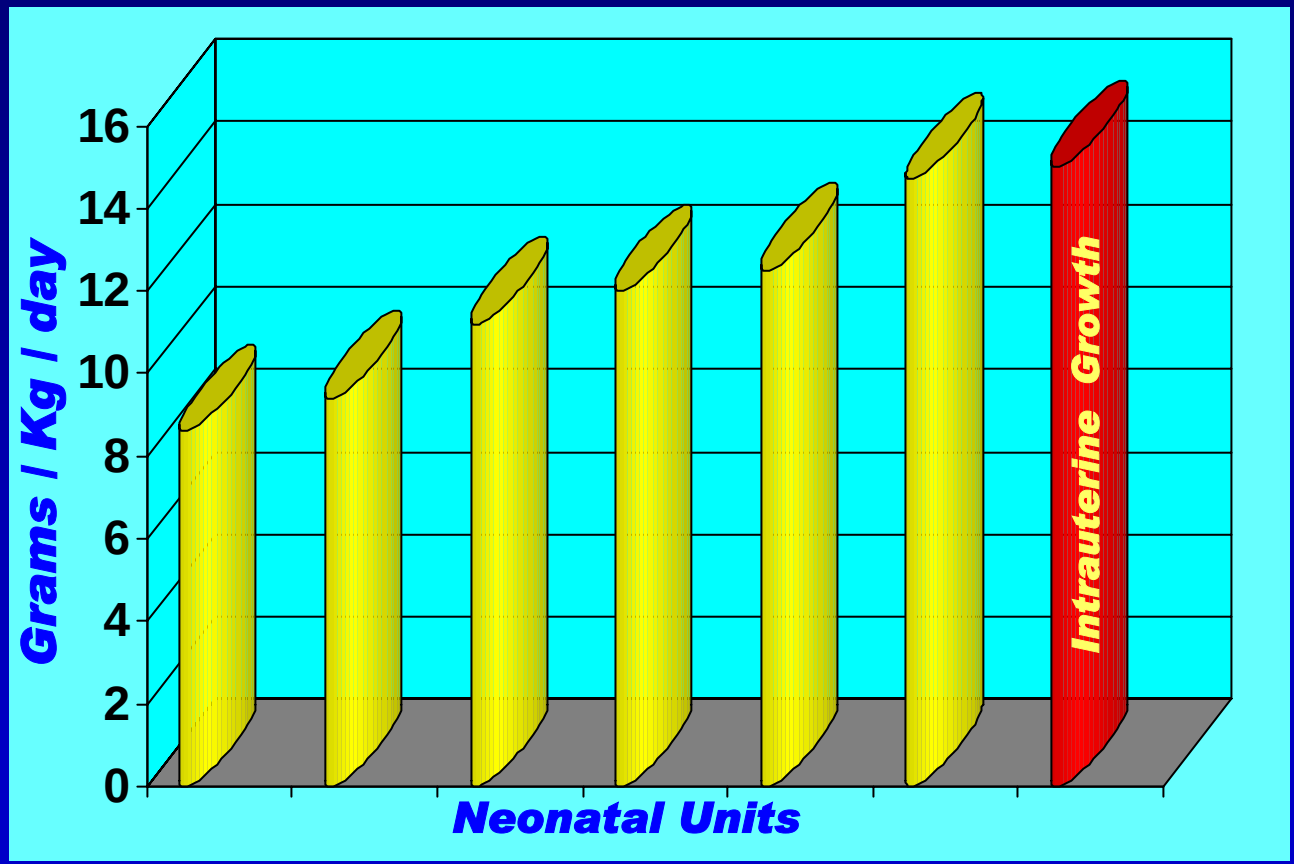
  In 97% of newborns <1500 g weight at discharge is < 10° percentile (we are producing SGAs)

- **But it may not be innevitable**

  There is significant variability among NICUs (we may do something about it)

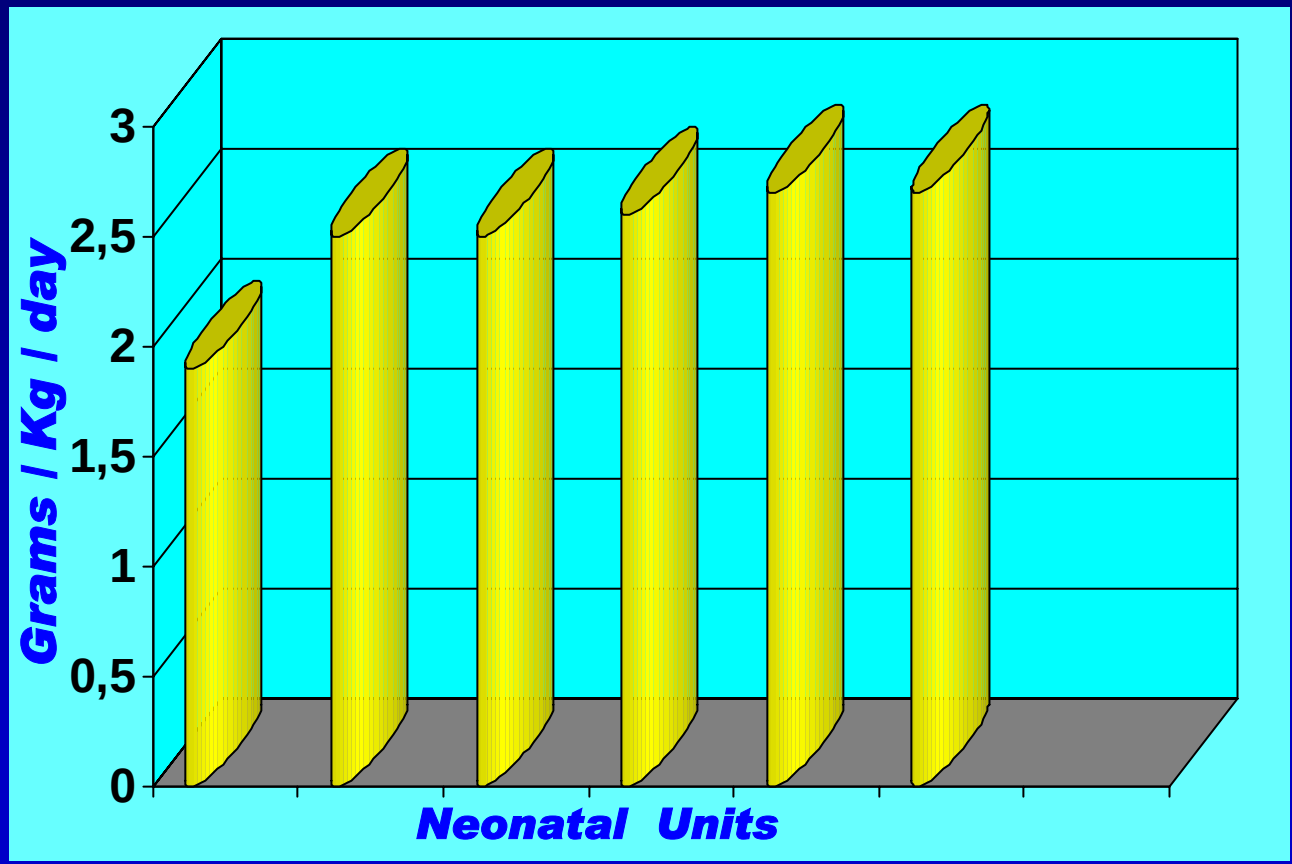
Lemons JA et al. Pediatrics 2001;101:1
Olsen IE et al. Pediatrics 2002;110:1125

WEIGHT GAIN IN THE FIRST 28 DAYS IN 6 NEONATAL UNITS



Olsen IE et al. Pediatrics 110: 6, 1125-1132, 2002

PROTEIN INTAKE AT 14 DAYS OF LIFE IN 6 NICUs



Olsen IE et al. Pediatrics 110: 6, 1125-1132, 2002

DOES IT MATTER ?

Perhaps.....

- ***Infants with Intrauterine Growth Retardation are at risk of developing Sindrome X in adulthood.***

- ***It is unknown if infants with Extrauterine Growth Retardation run similar risks***

TALK IS CHEAP

ANY HARD DATA AVAILABLE ?

GROWTH OF VLBW INFANTS AT 12 MONTHS

122 Neonates < 1500 grams

30%	Weight	< 5° percentile
21%	Length	< 5° percentile
14%	Head Circ.	< 5 percentile

Ernst et al J Pediatr 117:S156, 1990

OK, BUT THEY MAY CATCH UP LATER

GROWTH OF VLBW INFANTS AT 8 YEARS

249 Neonates < 1500 grams

Weight Deficit	- 5 Kg
Length Deficit	- 4 cm
Head Circ. Deficit	- 1.3 cm

Hack M et al J Pediatr 122:887, 1993

WHAT ABOUT ADULT AGE ?

EX-VLBW GROWTH AT 20 YEARS

- **Females** — no differences
- **Males** — Height: - 0.4 z score; Weight: - 0.4 z score
- **SGA Males** — 21% heigth < 2SD; 32% weigth < 2SD

Hack M. Et al Pediatrics 122e:30,2003

Somatic growth may be suboptimal,
But how about the brain ?

GROWTH RETARDATION AND OUTCOME

In newborns < 1500 g :

Neuromotor development at 2 years

Is negatively affected by

poor post-natal growth (< 10° percentile)

Latal-Hajinal B et al J Pediatr 143:163-170,2003

GROWTH RETARDATION AND OUTCOME

- Poor growth predicts poor motor and and cognitive outcome at 7 years of age.
- Growth restriction is largely postnatal

Cook RWI et al. Arch Dis Child 88:482,2003

ASSOCIATION DOES NOT IMPLY A CAUSE AND EFFECT RELATIONSHIP

NUTRITION AND OUTCOME

46 Neonates < 1500 g and SGA

Increased caloric intake in first 10 days, is associated with:

- ***Catch-up growth of head circ. at 12 mos.***
- ***Higher DQ / IQ at 18 months and 6 years***
- ***Normal head circumference in adulthood***

Brandt I et al J Pediatr 142: 463,2003

CAN WE DO BETTER ?

A CHANGE OF POLICY

1. ***Parenteral Nutrition***
2. ***Enteral Nutrition***

PARENTERAL NUTRITION

What happens In the fetus		What (usually) happens in the neonate
+++	Aminoacids	+ -
++	Glucose	+++
+-	Lipids	++

WHAT DOES IT MEAN ?

Each day without aminoacids,
our newborn:

1) Loses 1 g/Kg of endogenous proteins

2) Does not accrue 2 g/Kg/day of proteins
(intrauterine accretion rate)

PARENTERAL NUTRITION

1. Start immediately with 2 g /kg / day of Aminoacids

2. Then move on to a complete TPN solution at 48 to 72 hours of life

Thureen PJ et al Pediatr Res 53:24-32,2003
Wilson DC et al Arch Dis Child 77:F4-F11,1997
Murdoch N et al. Arch Dis Child 73:F8-F12,1995

ENTERAL NUTRITION

1. **Minimal Enteral Feeding** (10 - 20 mL/Kg/day) within 48 hours

2. Increase up to **4 g/Kg/day** of proteins in < 1000 g
   3.5 g/Kg/die of proteins in1000-1499 g

3. Fortified HM or 80 Kcal Formula

Note: Adding **1 g/Kg/day** of **proteins** allows a weight **gain** of **4.1 g/Kg/day**

Thureen PJ. NeoReviews e45, 1999
Olsen IE et al. Pediatrics 110:1125-1132,2002

ANY RESULTS ?

STUDY POPULATION

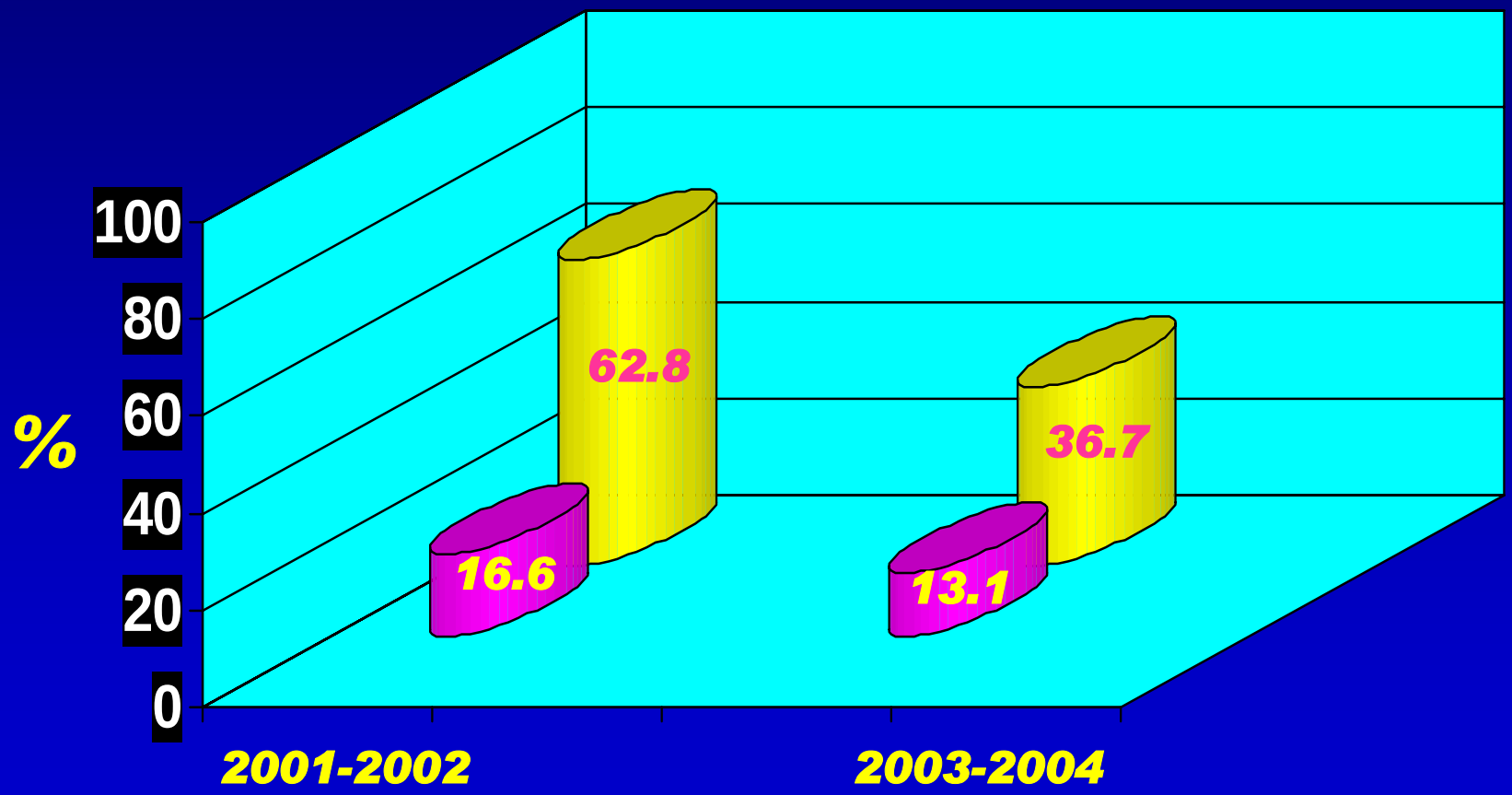
	2001-2002 (n:54)	2003-2004 (n:61)
G. Age (wks)	29.9	28.8
B.Weight (grams)	1169	1060

Preliminary Results

	2001-2002 (n:54)	2003-2004 (n:61)
Aminoacids I.V. (days)	2.4	1.3
Enteral Feedings (days)	6	3
Full Enteral Feedings (days)	25	17
Length of Stay (days)	63	57

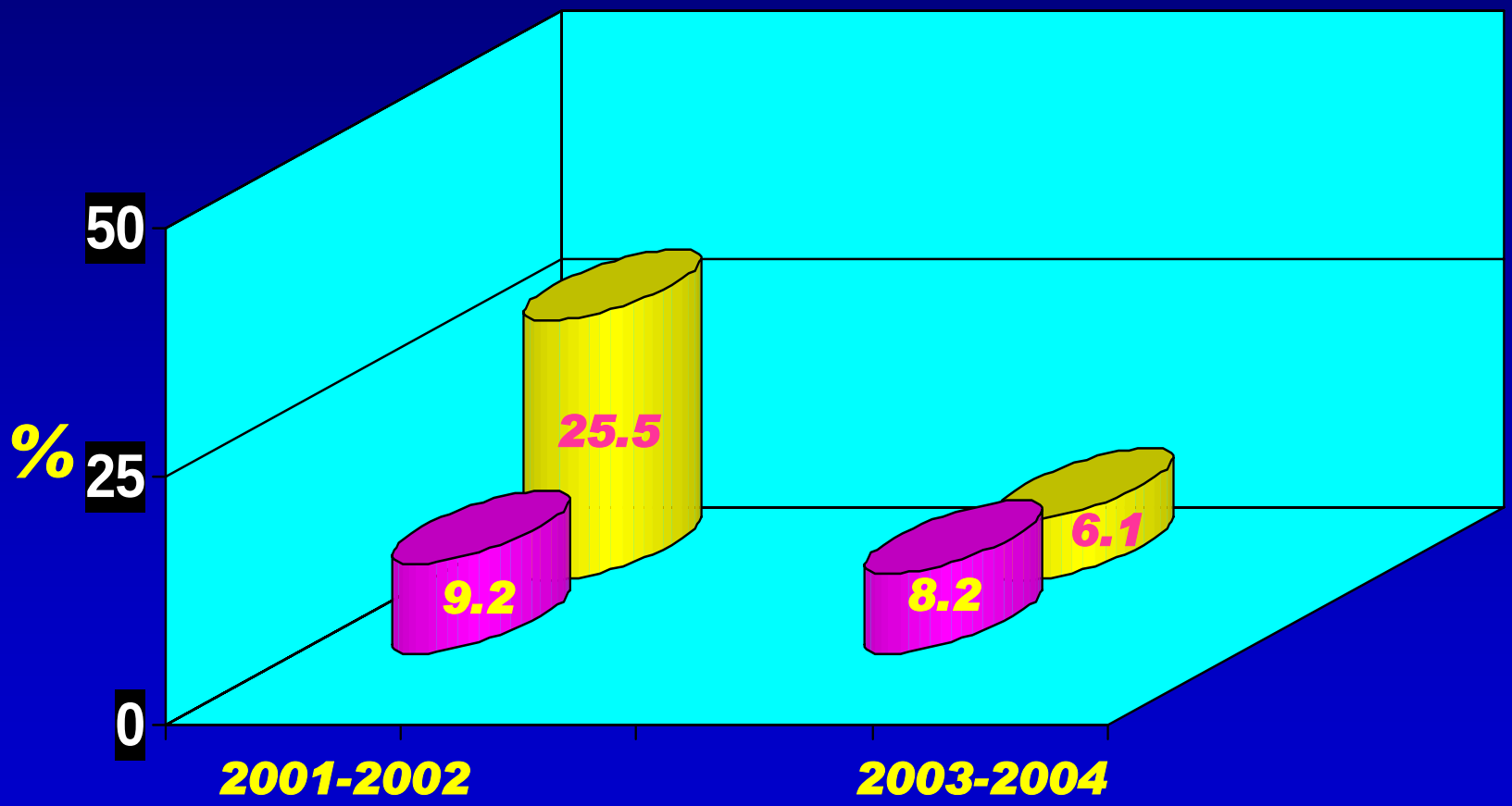
WEIGHT < 3rd Percentile

Birth vs Discharge



HEAD CIRCUMFERENCE < 3rd Percentile

Birth vs Discharge



To Summarize

1. Old habits die hard
   (considerable room for improvement)

2. Extrauterine growth retardation is not inevitable in all VLBW infants

HOW ABOUT NUTRITION AFTER DISCHARGE ?

HUMAN MILK

Or

FORMULA

WHAT CAN WE DO IF OUR INFANT IS FORMULA-FED ?

POST – DISCHARGE FORMULA (72 kcal / dL)

Vs

PRETERM FORMULA (80 kcal / dL)

Preterm Formula
(80 kCal / dL)

POST-DISCHARGE NUTRITION

Preterm Formula 80 kCal / dL

- 86 healthy neonates < 1750 g
- Discharged prior to 40 wks
- Randomized to 3 groups
  1. 80 kCal formula until 40 wk and for 6 months
  2. 67 kCal formula until 40 wk and for 6 months
  3. 80 kCal formula until 40 wk, then 67 kCal for 6 months
- Controlled diet only during the first 6 months

Cooke RJ et al. Pediatr Res 43: 335, 1998
Cooke RJ et al. Pediatr Res 46: 461, 1999

POST-DISCHARGE NUTRITION
Results at 12 months

Infants fed an 80 kcal formula for 6 months
Compared to the other 2 groups, showed:

1. **Higher growth rate (weight, length, head c.)**
2. **Increased bone mineral content (BMC)**
3. **Increased lean and fat mass**

Cooke RJ et al. Pediatr Res 43: 335, 1998
Cooke RJ et al. Pediatr Res 46: 461, 1999

Post – Discharge Formula (72 kCal / dL)

POST-DISCHARGE NUTRITION

Post-discharge formula (72 kCal / dL)

229 Neonates < 1750 g fed in first 9 mos
72 kcal formula vs 68 kCal formula

- At 9 months of age
  Higher BMC

- At 18 months of age:
  No difference in growth
  (weight, length and head c.)

Lucas A et al. Pediatrics 108:703,2001
Lucas A, et al. Arch Dis Child 67:324-327,1992

HUMAN MILK

HUMAN MILK AT DISCHARGE

1. Discontinue fortifier prior to discharge

2. After 1-2 weeks check the following

Growth	≥ 20 g/ die ?
Alk Phosphatase	< 500 IU/mL ?
Serum P	> 4.5 mg/mL ?
BUN	> 5 mg/dL ?

3. The answer is yes to all questions
   No supplements required

4. The answer is no even to one question:
   resume fortifier / supplement at least until weight is 3.3 – 3.5 Kg or longer

SHOULD WE REALLY CARE ?
AFTER ALL, THEY HAVE
A LIFETIME AHEAD

NEONATAL NUTRITION AND OUTCOME

LONG TERM OUTCOME

In former preterm infants, at 17 years of age:

- ***The number of days needed to regain birthweight is negatively related to BMC at 17 years***

- ***The rate of weight gain is positively related to adult BMC***

Weiler HA et al. Early Hum Dev 67:101,2002

From Neonatology to Geriatrics ?

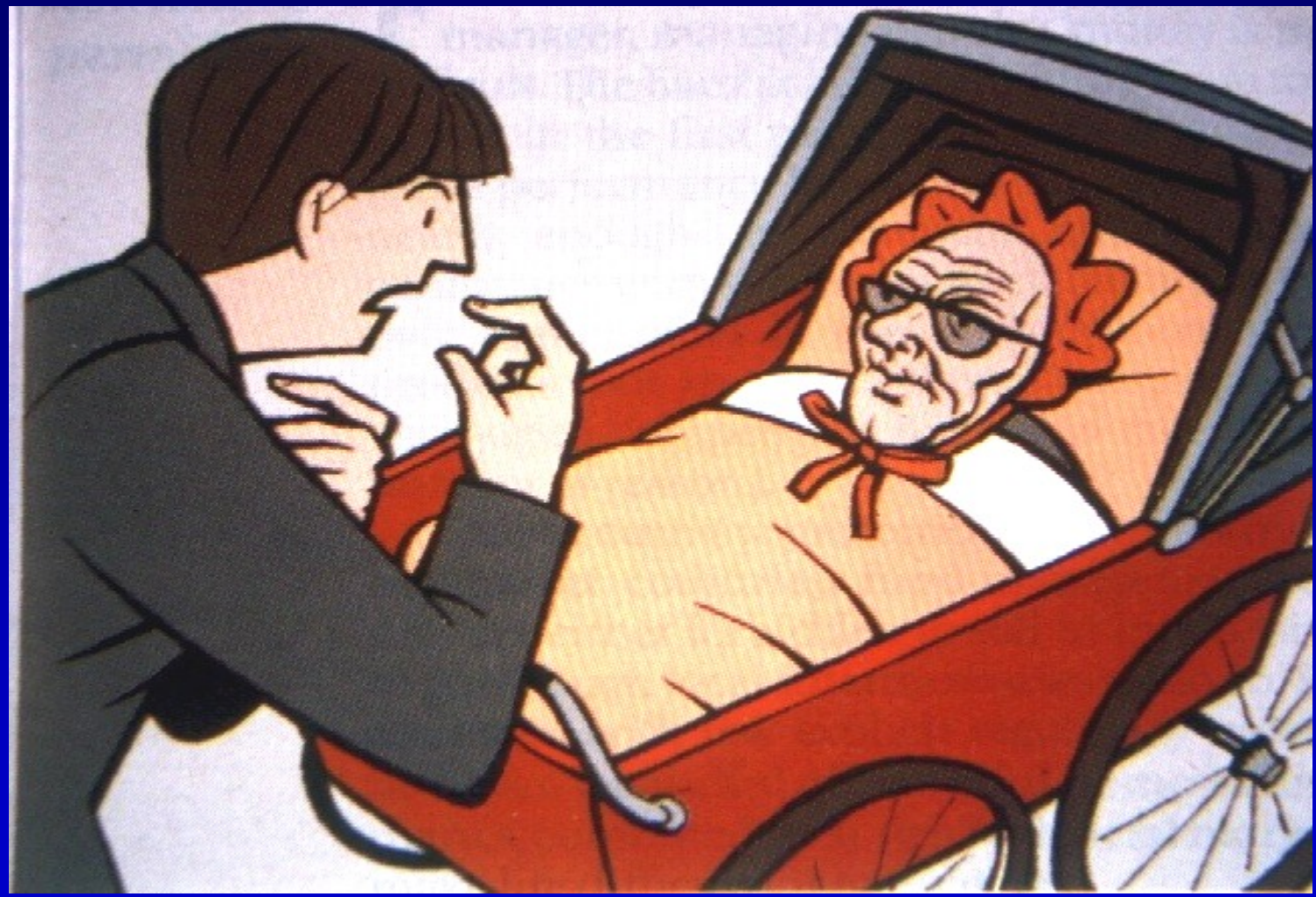
Infantile Growth and Bone Mass

In men and women aged 63 – 73 years

Bone mass (BMC) at femoral neck and Lumbar spine is related to weight at 1 year of age

Cooper C et al Ann Rheum Dis 56:17, 1997

SO LOOK CAREFULLY AT THE NEXT INFANT YOU SEE



DIET and OUTCOME - 2

Feeding a 80 kCal formula for a limited time (1 month in hospital) has an effect on verbal QI a 8 anni

- 80 kcal Formula Verbal IQ 97.6
- Term formula Verbal IQ 92.7

Lucas A et al. BMJ 317:1481-1487, 1998