# Early Life Nutrition: A Strategy to Prevent Non-Communicable Diseases in the Community

**Widjaja Lukito**

President, Danone Institute Indonesia

**Bogor, 29 October 2014**

# Points for Discussions

- Magnitude of the problem
- Dimension of food and nutrition in health and disease and its implications on research directions
- Burden of today and tomorrow
- Forgetting the evidence?
- What next?

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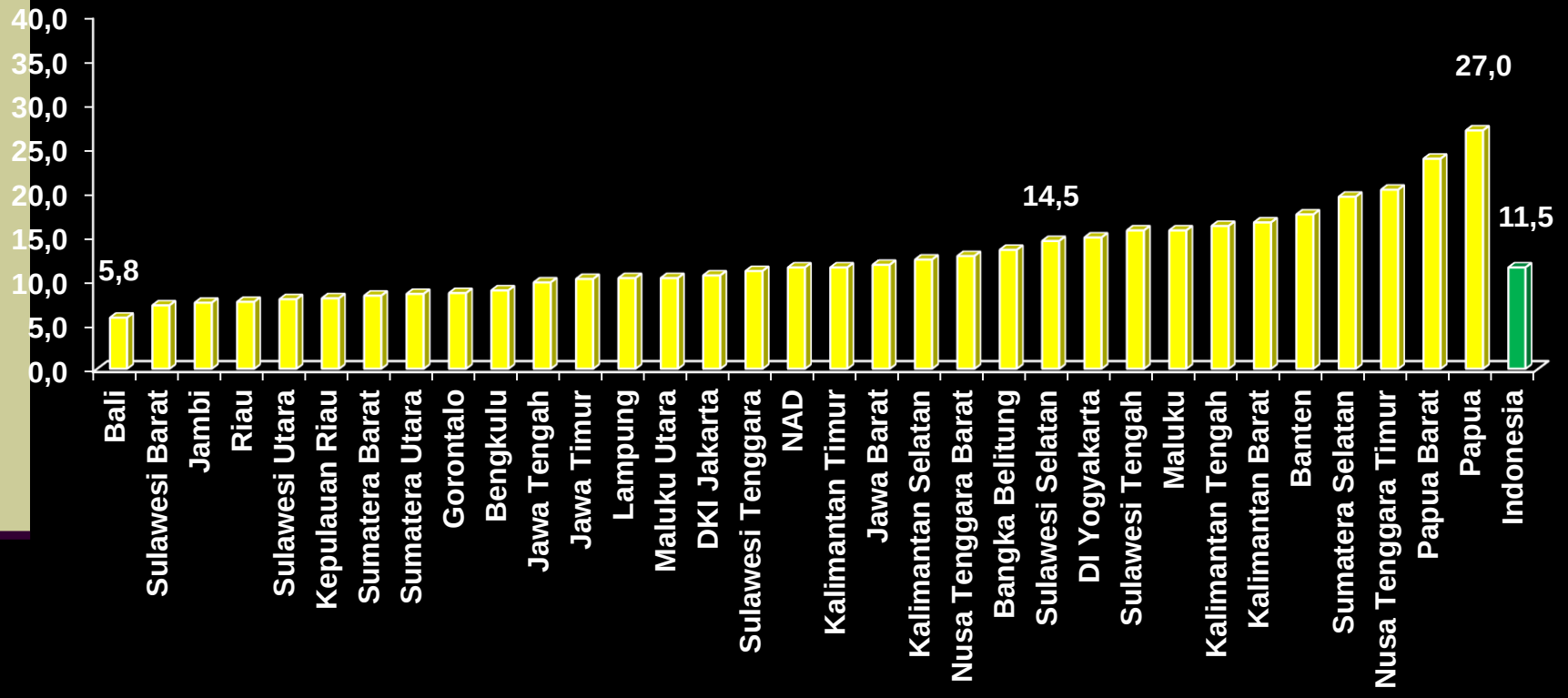
# Percentage of Low Birth Weight Infants, by Provinces, 2007

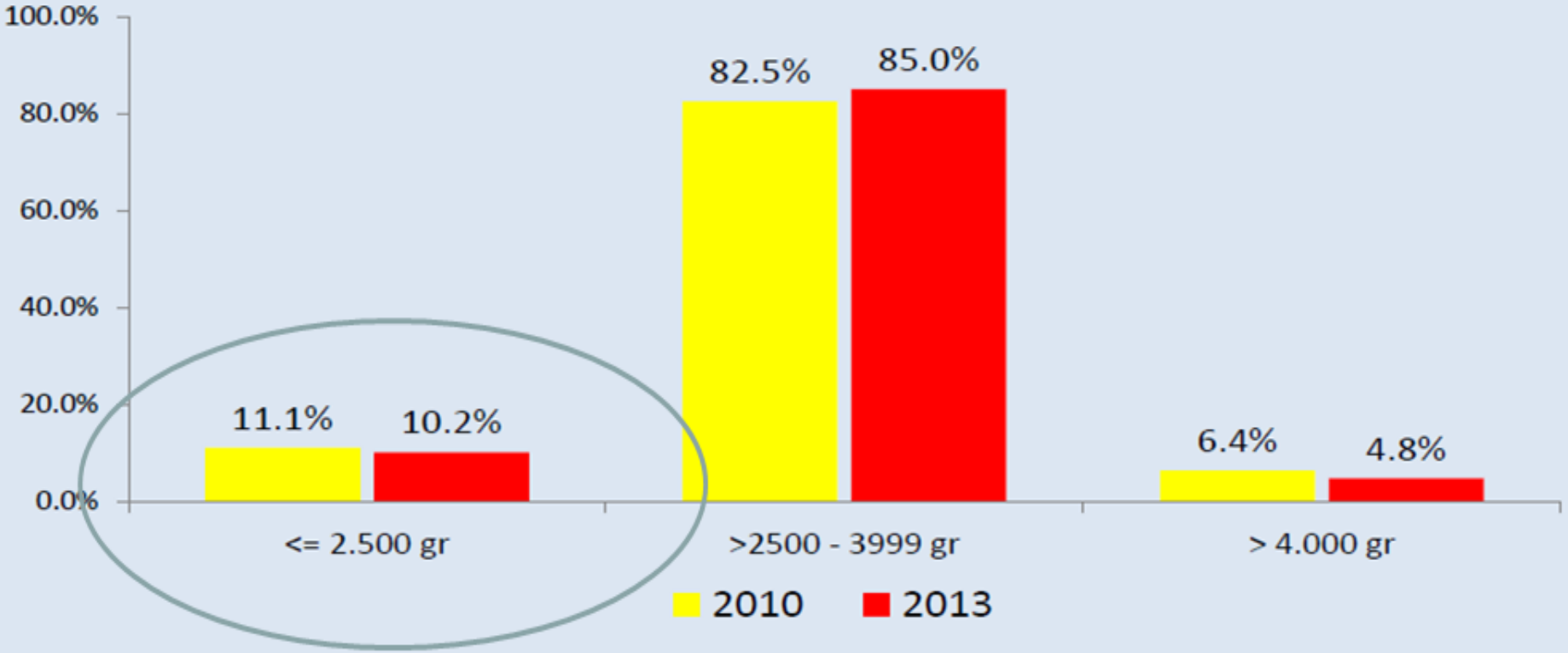



*Data Source: Baseline Health Research*

*National Health and Research Development Center, Ministry of Health, Republic of Indonesia, 2008*

# Figures on prevalence of low birth weight from RISKESDAS 2010 and 2013

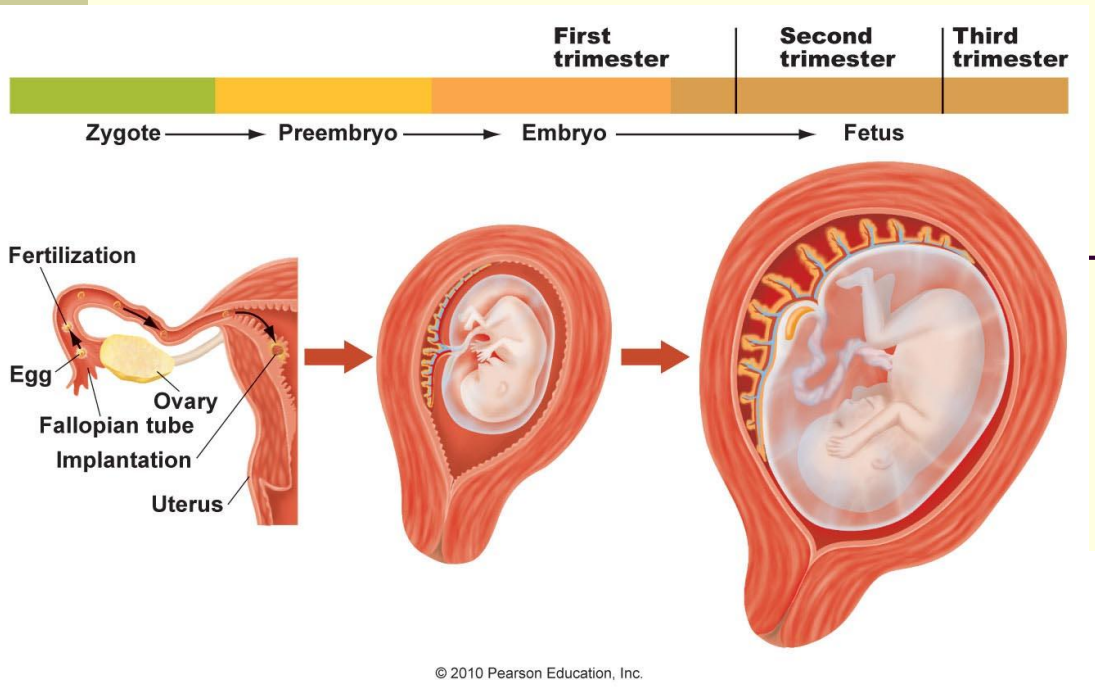
## Proporsi Berat Badan Lahir: 2010-2013*)

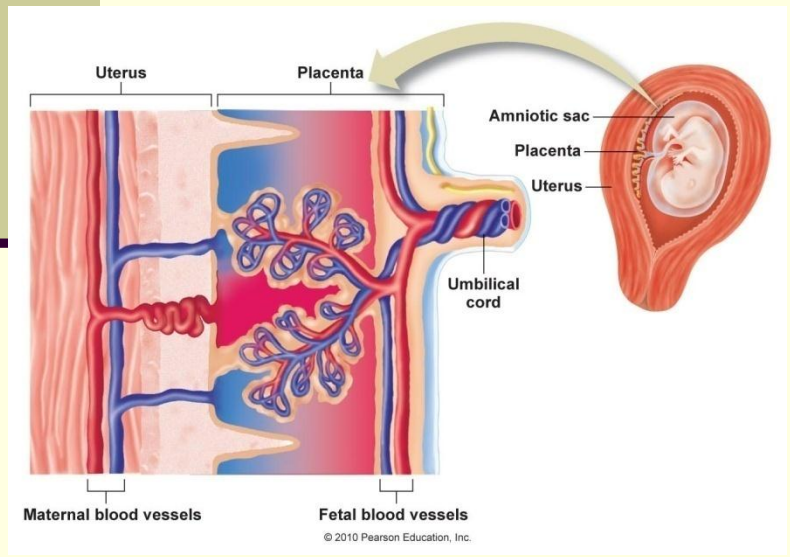


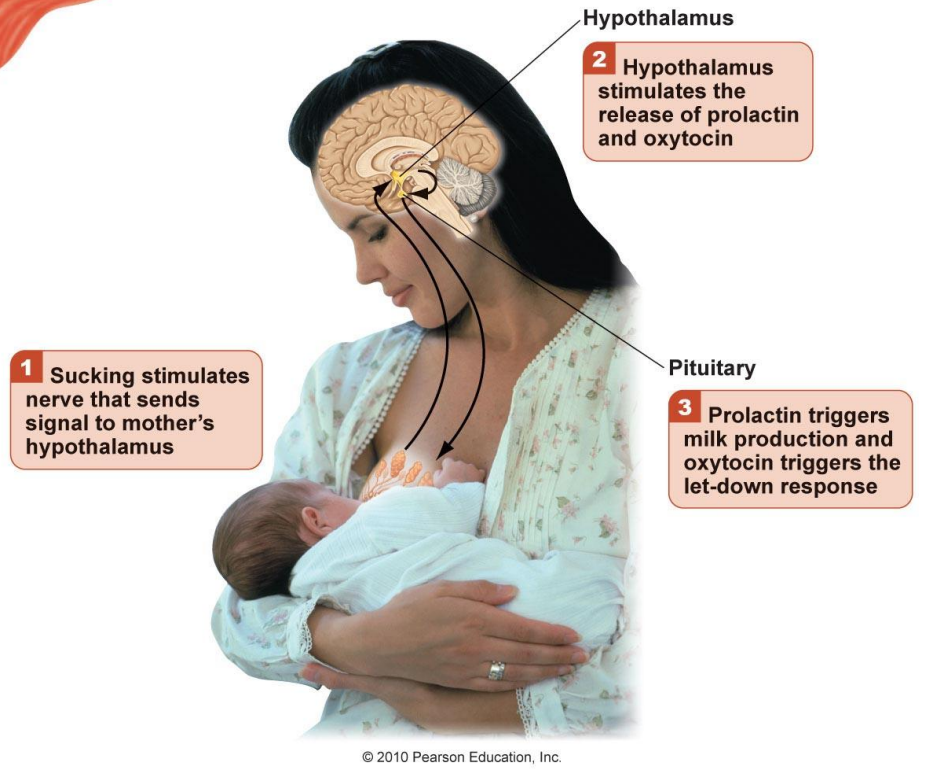

*) Berdasarkan 52,6% sampel balita yang punya catatan

Website: www.litbang.depkes.go.id

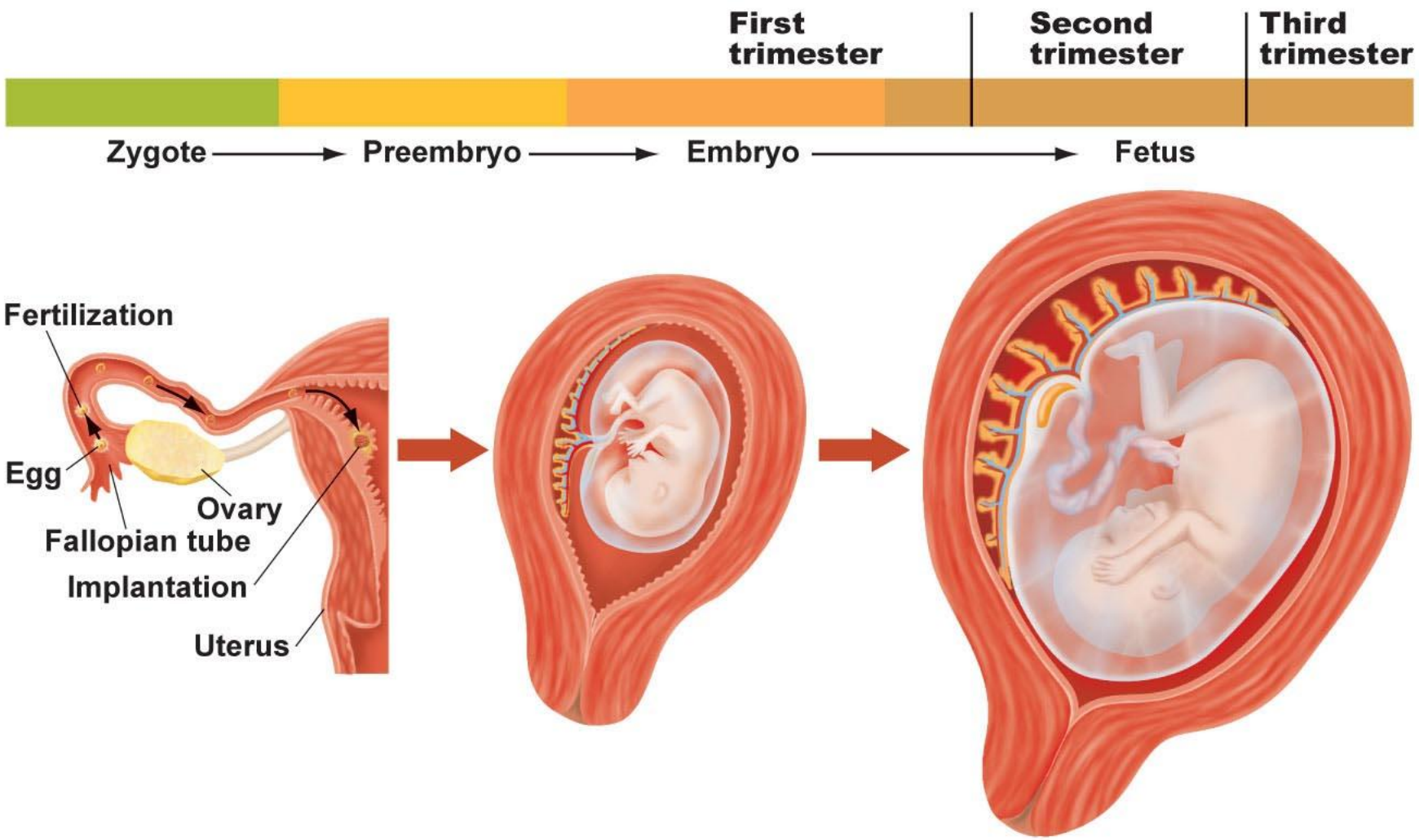
# Life Cycle ~~Nutrition:~~ Pregnancy through Infancy



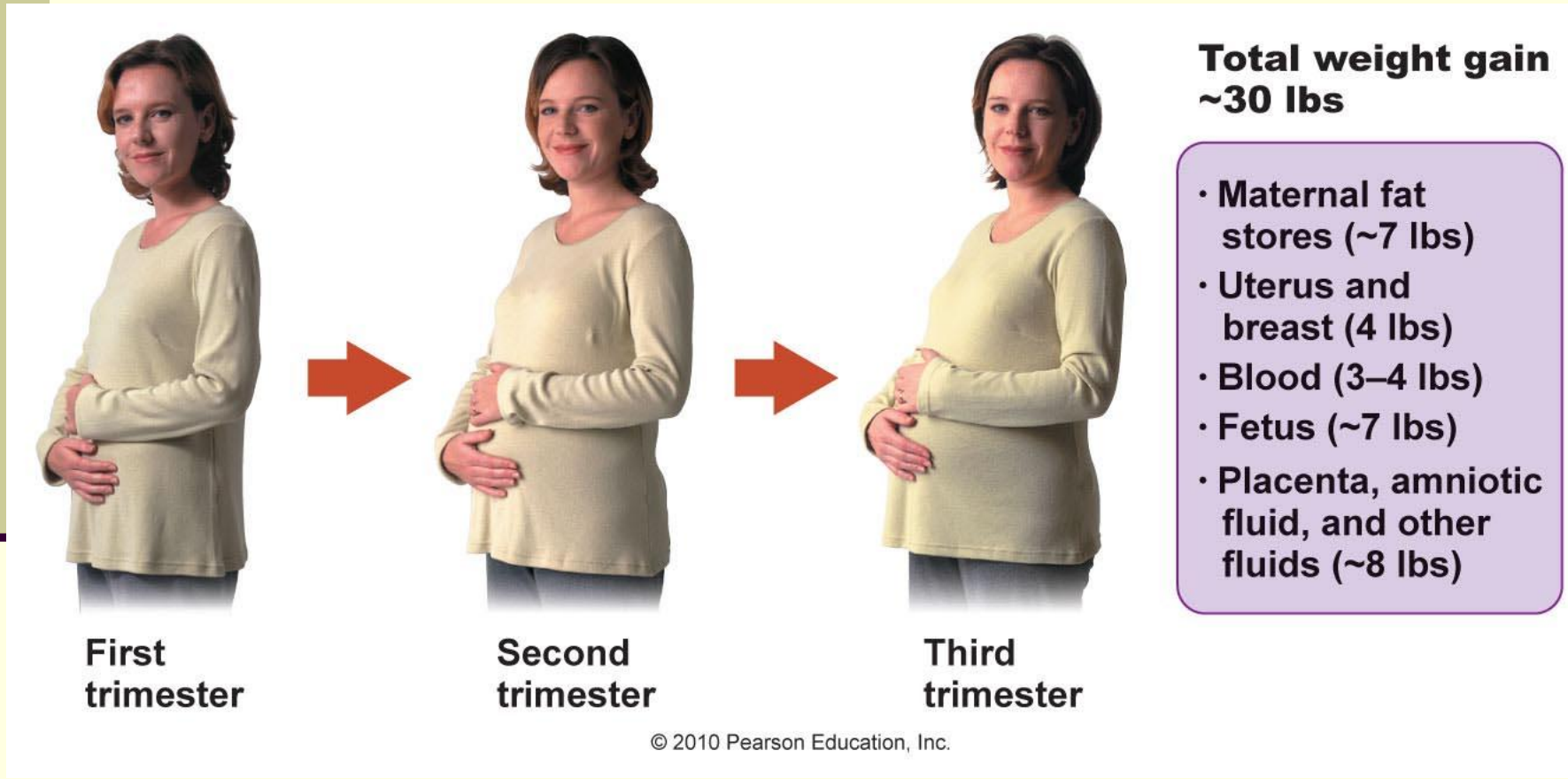



# Stages of Pregnancy and Fetal Development



# Components of Weight Gain During Pregnancy



# Recommended Weight Gain

| BMI $\frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$ | Weight Gain (kg) | Weight Gain (lbs) |
|---|---|---|
| Underweight<br>BMI < 18.5 | 12.7-18.2 | 28-40 |
| Normal Weight<br>BMI 19-24.9 | 11.4-15.9 | 25-35 |
| Overweight<br>BMI 25-29.9 | 6.8-11.4 | 15-25 |
| Obese<br>BMI > 30.0 | 6.8 | <15 |

*Institute of Medicine. Weight Gain During Pregnancy. National Academy Press. 1999.*

# Rate of Weight Gain

- Pattern of weight gain in pregnancy as important as total weight gain.
- Deviations from expected patterns of weight gain are signals for intervention.
- Pre-term birth doubles when 3rd trimester weight gain is low or inadequate.
- Pregnancy is an anabolic state, resulting in increased energy (300 kcal/day) and nutrient needs.

# Study on Nutritional Status and Food Pattern of Pre-Pregnant, Pregnant and Lactating Mothers in Bogor, West Java- Finding on nutrients deficiency

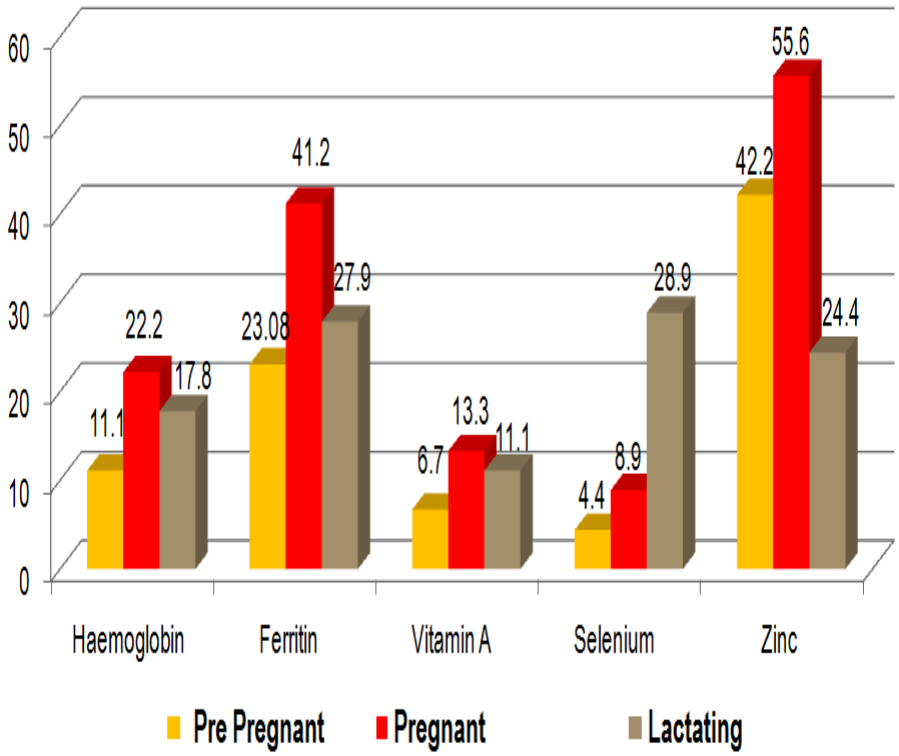
## Percentage of multiple micronutrients* deficient intake in combination with protein deficient intake

| Deficiency | Pre Pregnant (n=200) | Pregnant (n=203) | Lactating (n=220) |
|---|---|---|---|
| | n (%) | n (%) | n (%) |
| ≥ 3 micronutrients + protein | 52 (26) | 115 (56.7) | 73 (33.2) |
| 2 micronutrients + protein | 2 (1) | 1 (0.5) | 2 (0.9) |
| 1 micronutrient + protein | - | 1 (0.5) | - |
| **TOTAL** | **54 (27)** | **117 (57.6)** | **75 (34.1)** |

- ***Approx. 1 in 4 pre pregnant women have a too low protein intake and multiple micronutrient sintake***
- ***Approx. 6 out of 10 pregnant women have a too low protein and multiple micronutrient sintake***
- ***Approx. 1 out of 3 lactating women have a too low protein intake and multiple micronutrient sintake***

*Micronutrients include Iron, Vitamin A, Vitamin C, Folate, Zinc

## Percentage of subject with blood biomarkers for nutritional status below reference values



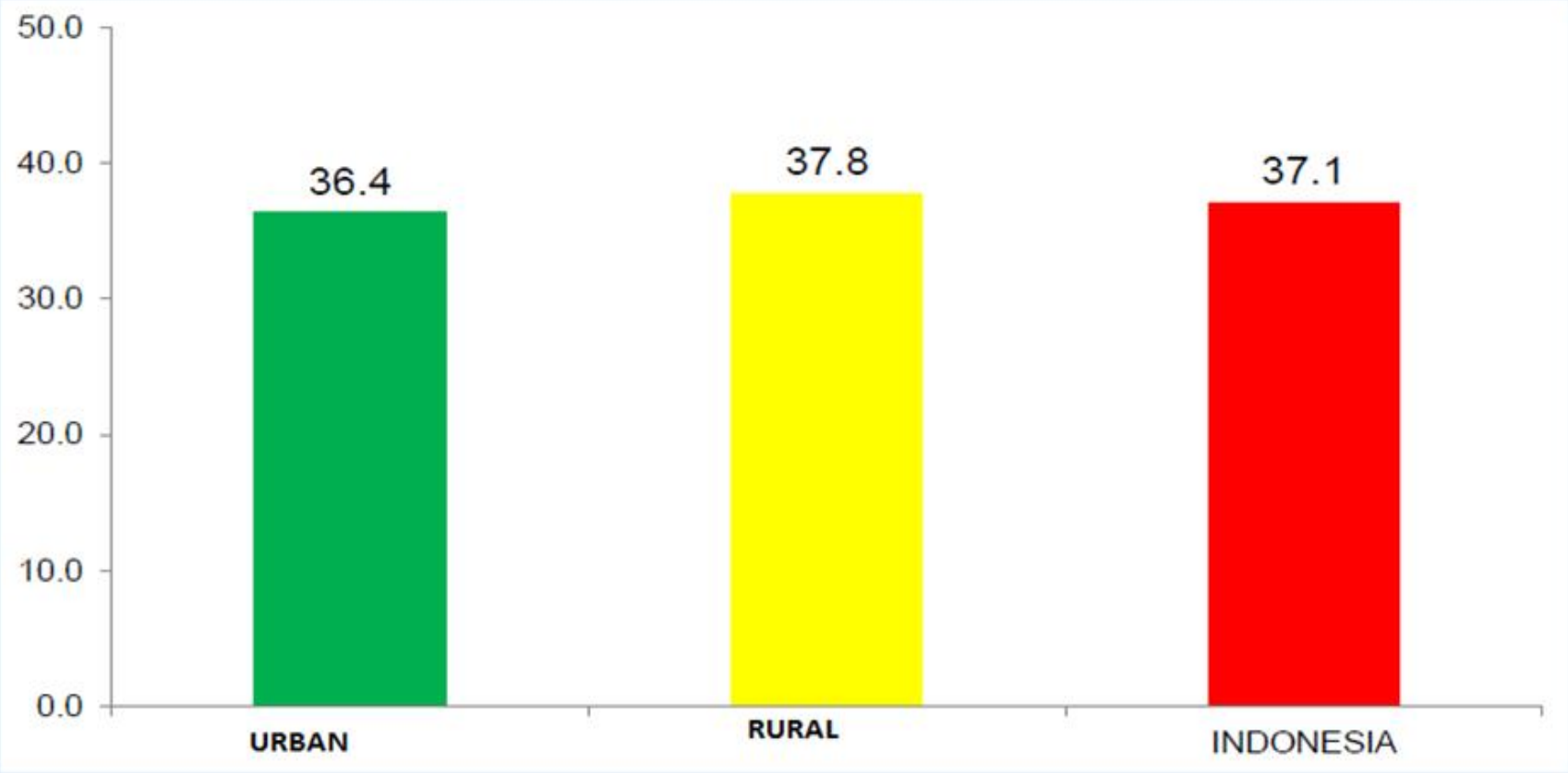

*1 out of 3* ***pre pregnant*** *women have iron and zinc status indicators < reference*

*~ 6 out of 10* ***pregnant*** *women have iron and zinc status indicators < reference*

*~ 1 out of 3* ***lactating*** *women have iron and zinc status indicators < reference*

# Proportion of pregnant women who was found anemic in RISKESDAS 2013

## Proporsi Anemia pada Ibu Hamil menurut Tempat Tinggal, 2013




*) Nilai rujukan menurut WHO/MNH/NHD/MNN/11.1,2011 dan Kemenkes,1999

**) *Cut off* points anemia Ibu Hamil, Hb < 11,0 g/dl

Website: www.litbang.depkes.go.id

# Penyebab Defisiensi Zat Besi: Diet (1)

- Low dietary iron intake
- Low iron bioavailability
  - Non-heme iron
  - Inhibitors

# Penyebab Defisiensi Zat Besi: Infestasi Parasit (2)

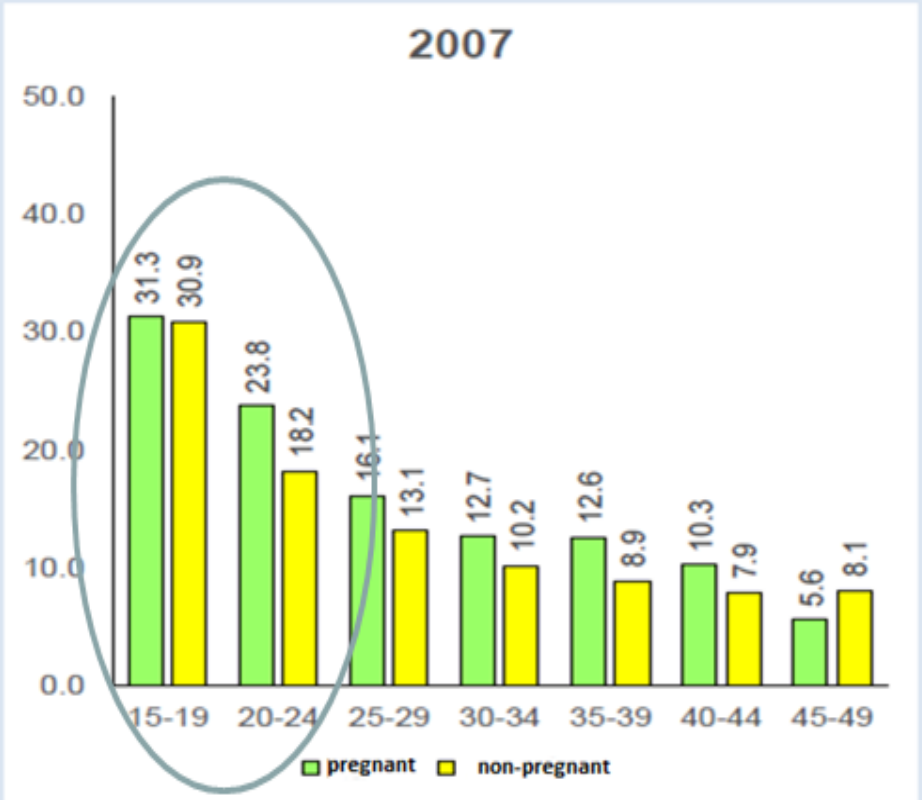
- Menyebabkan blood loss
- Meningkatkan iron loss

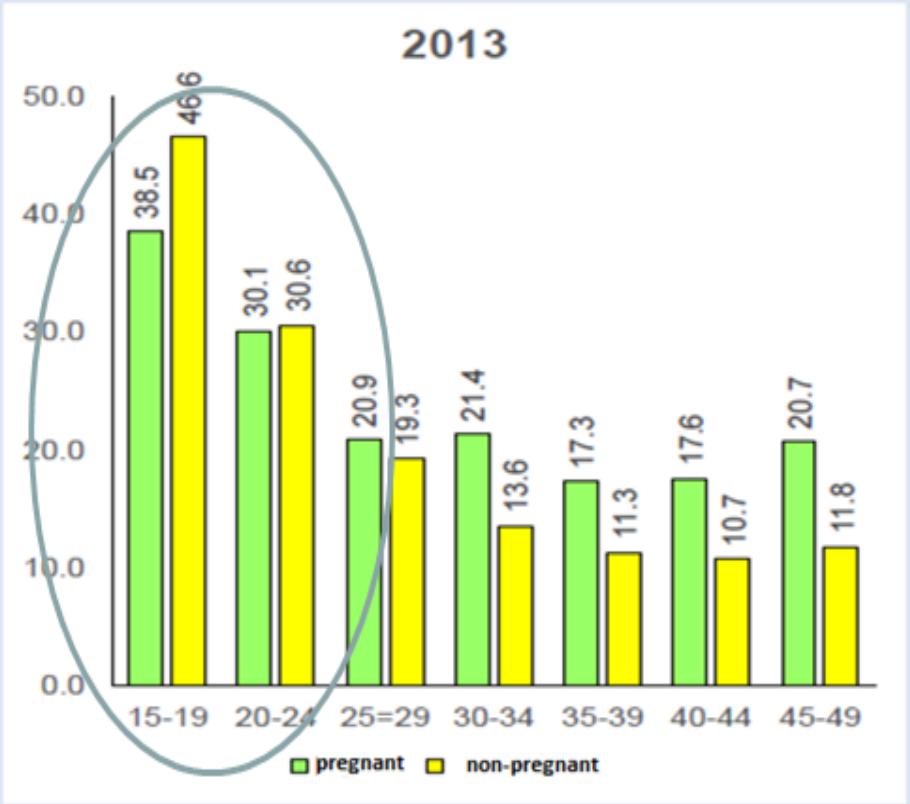
# Penyebab Defisiensi Zat Besi: Malaria (3)

- Menghancurkan sel darah merah
- Mengakibatkan anemia berat
- Meningkatkan risiko kehamilan

# Finding on prevalence of Chronic Energy Deficiency among Indonesia women at 15-45 year from RISKESDAS 2007 and 2013

## Proporsi Wanita Usia Subur Risiko Kurang Energi Kronis (KEK)*) : 2007 & 2013

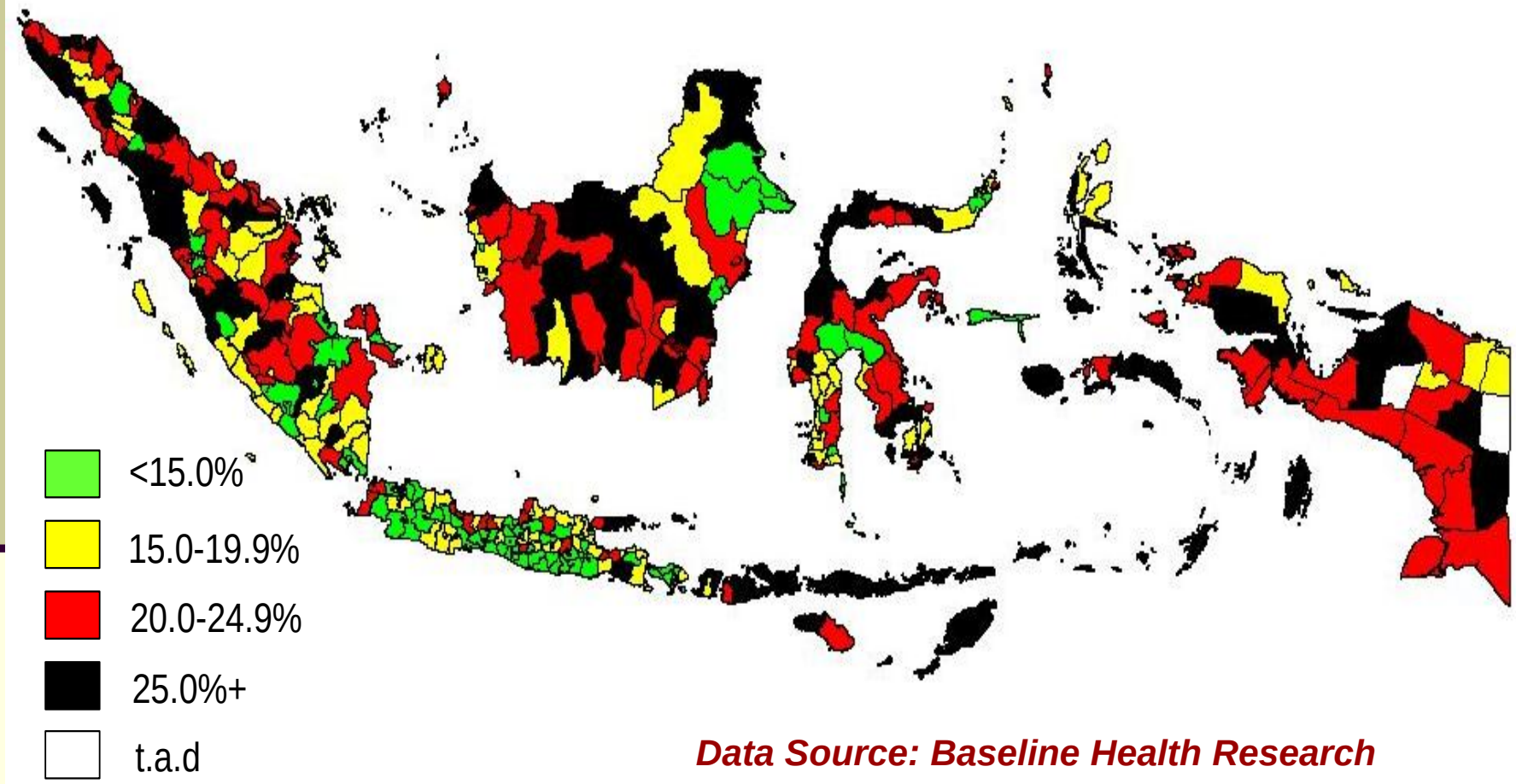



*) Risiko KEK – jika Lingkar lengan atas (LILA)<23,5 cm

Website: www.litbang.depkes.go.id

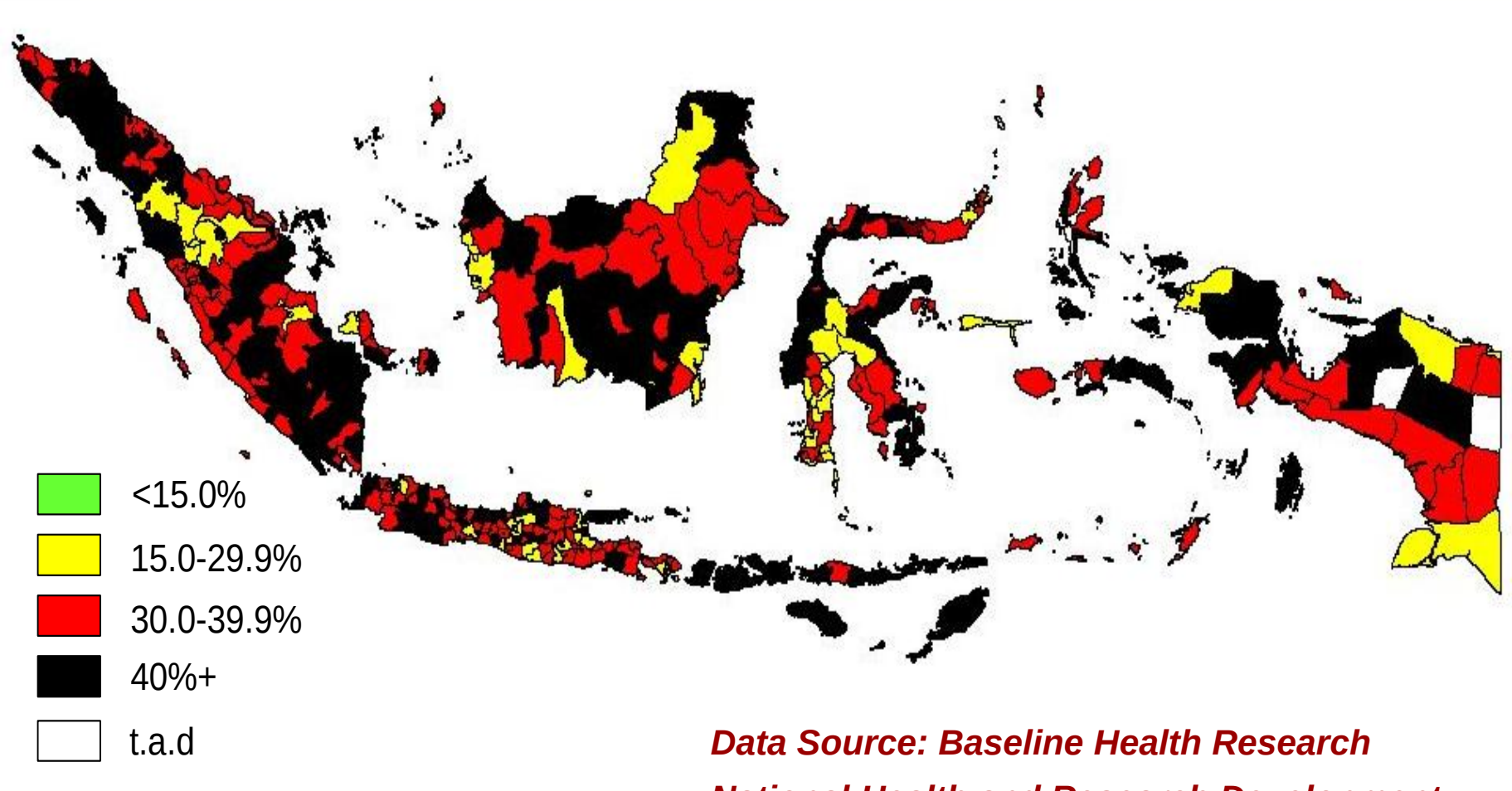
# Prevalence of Under-nutrition (Weight for Age), by Districts/Cities, 2007




***Data Source: Baseline Health Research***

***National Health and Research Development Center, Ministry of Health, Republic of Indonesia, 2008***

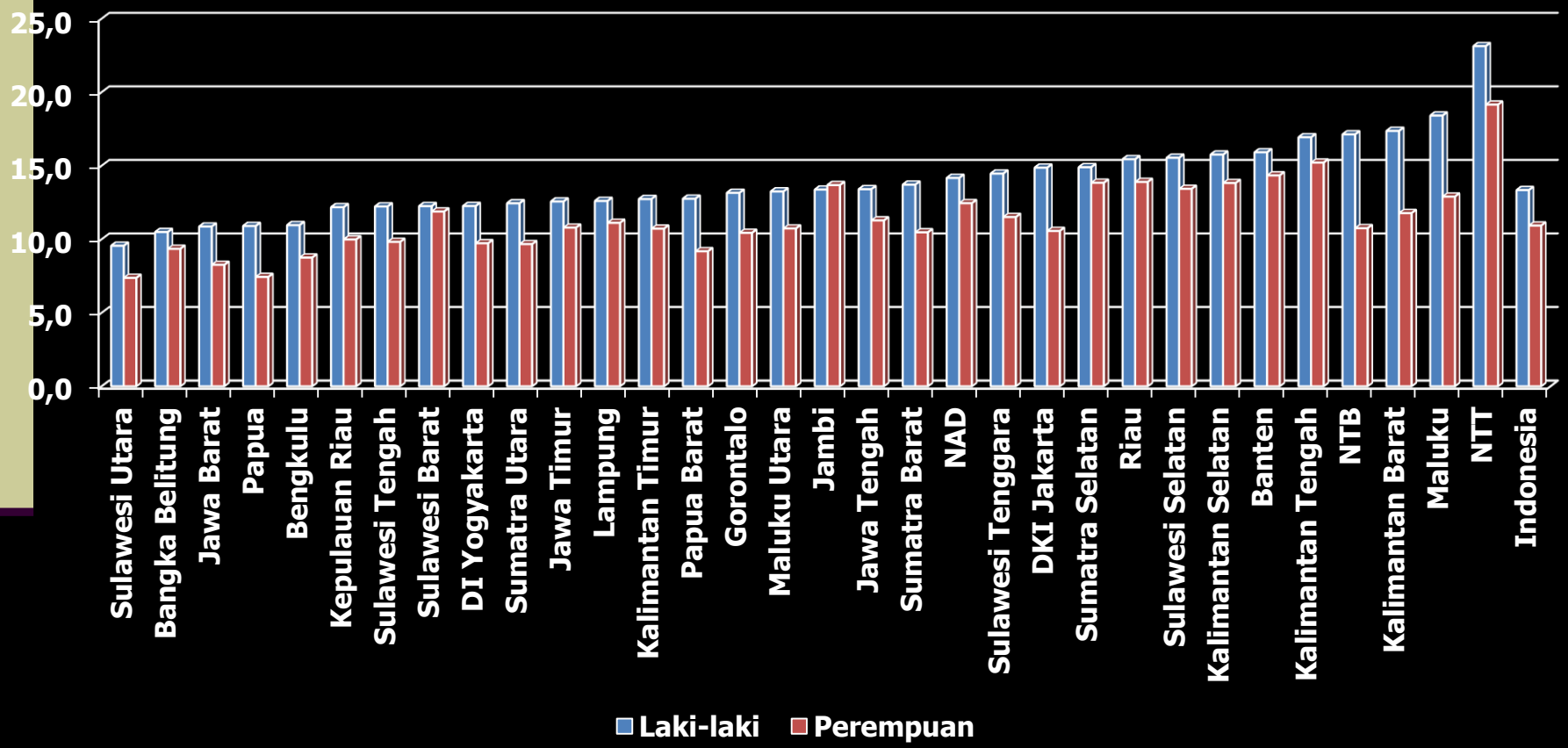
# Prevalence of Stunting (Height for Age), by Districts/Cities, 2007




***Data Source: Baseline Health Research***

***National Health and Research Development Center, Ministry of Health, Republic of Indonesia, 2008***

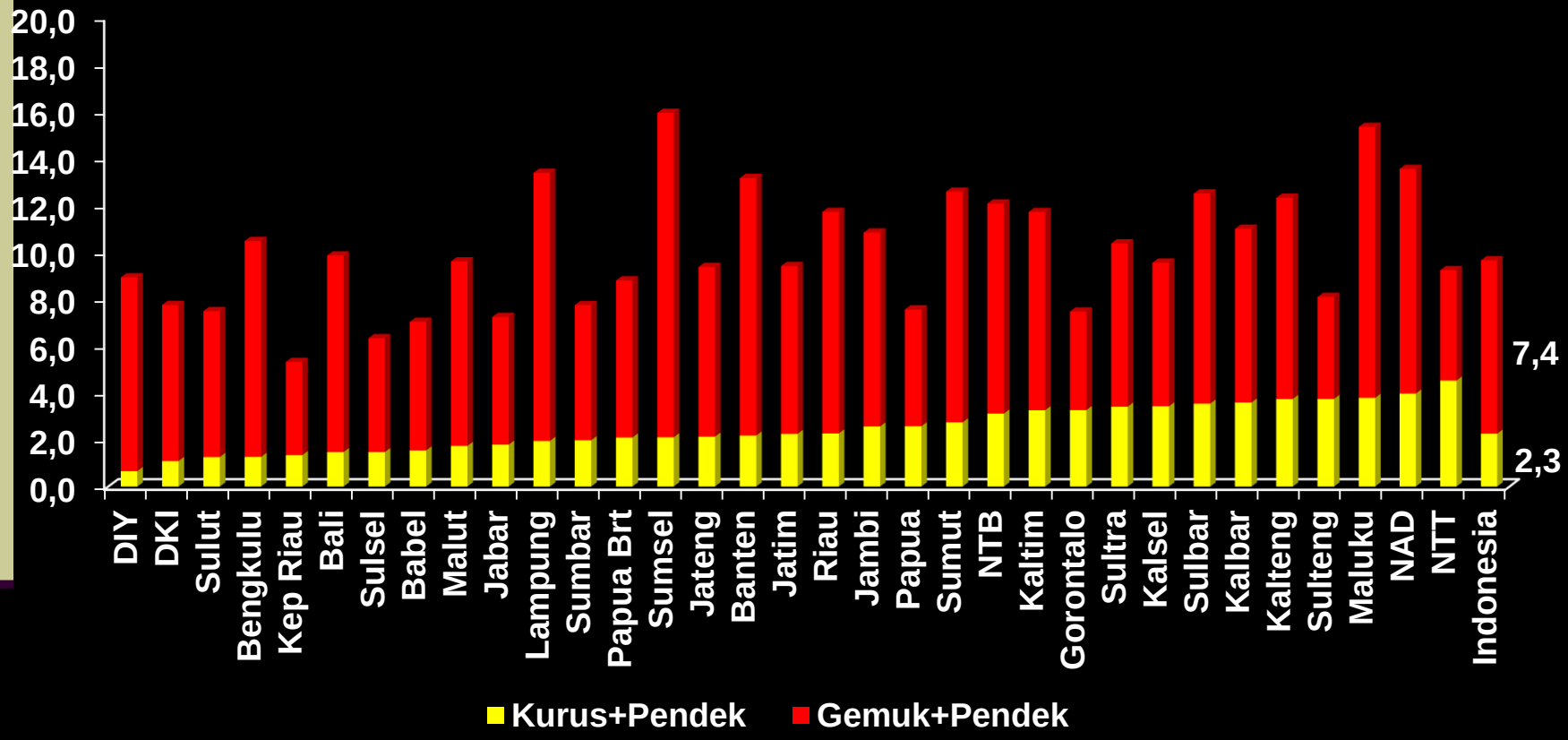
# Prevalence of Wasting in Young Children (6-14 yo), by Provinces, 2007




*Data Source: Baseline Health Research*

*National Health and Research Development Center, Ministry of Health, Republic of Indonesia, 2008*

# Double Burden of Nutritional Problems in Indonesia, 2007




*Data Source: Baseline Health Research*

*National Health and Research Development Center, Ministry of Health, Republic of Indonesia, 2008*

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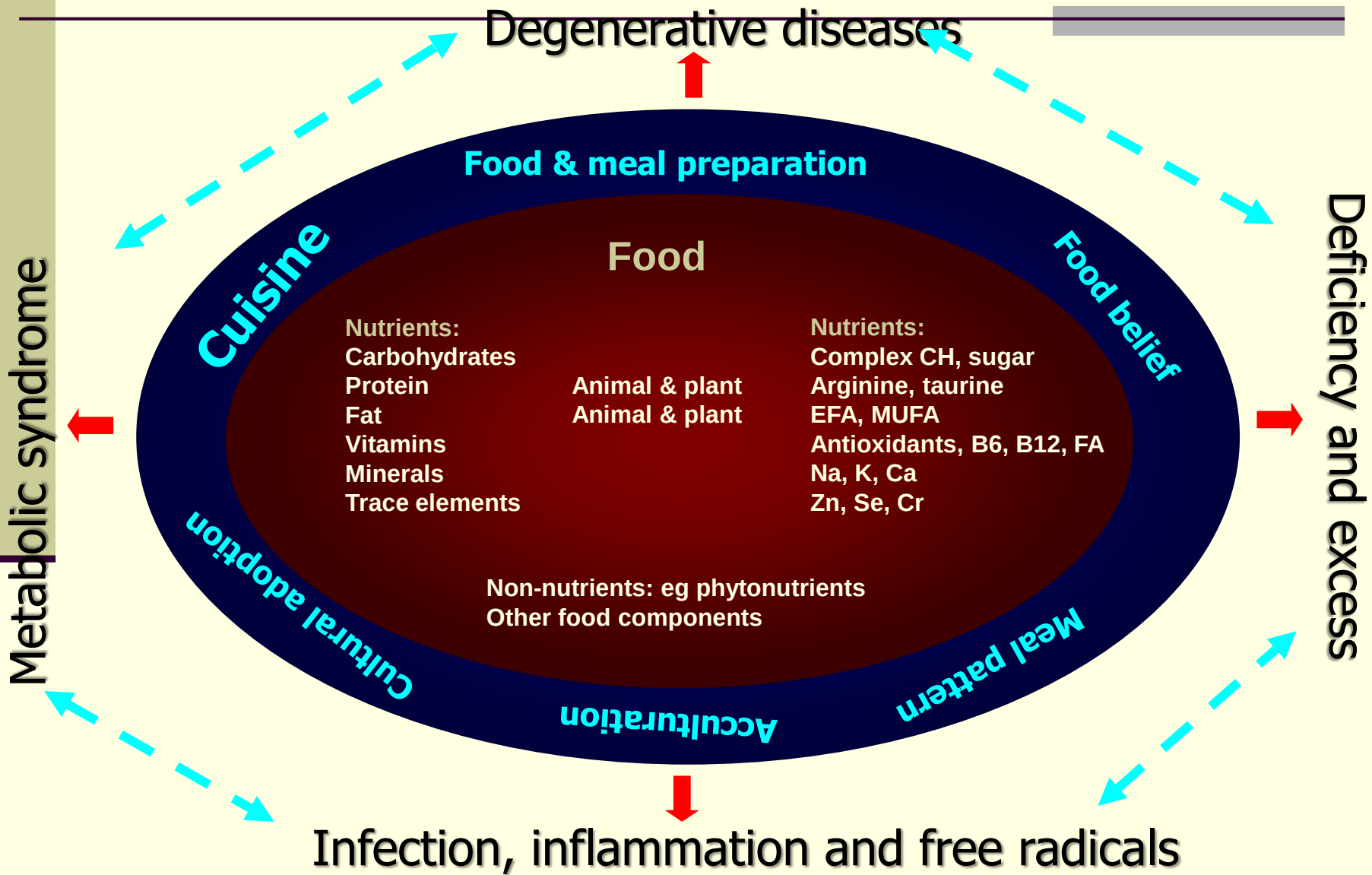
# Dimension of Food and Nutrition in Health and Disease



# Present and Future Paradigms in 'Nutrition and Health' Research (1)

- New outlook on under- and over- nutrition using life cycle approach – consideration as 'one package' for long-term health
- Integration of community development using eco-nutritional approach (not only within the view of nutritional sciences to the physiological and metabolic flow of nutrients) to achieve sustainable solutions for nutrition-related health problems

# Present and Future Paradigms in 'Nutrition and Health' Research (2)

- Enhancement of the adoption of research findings into program implementation

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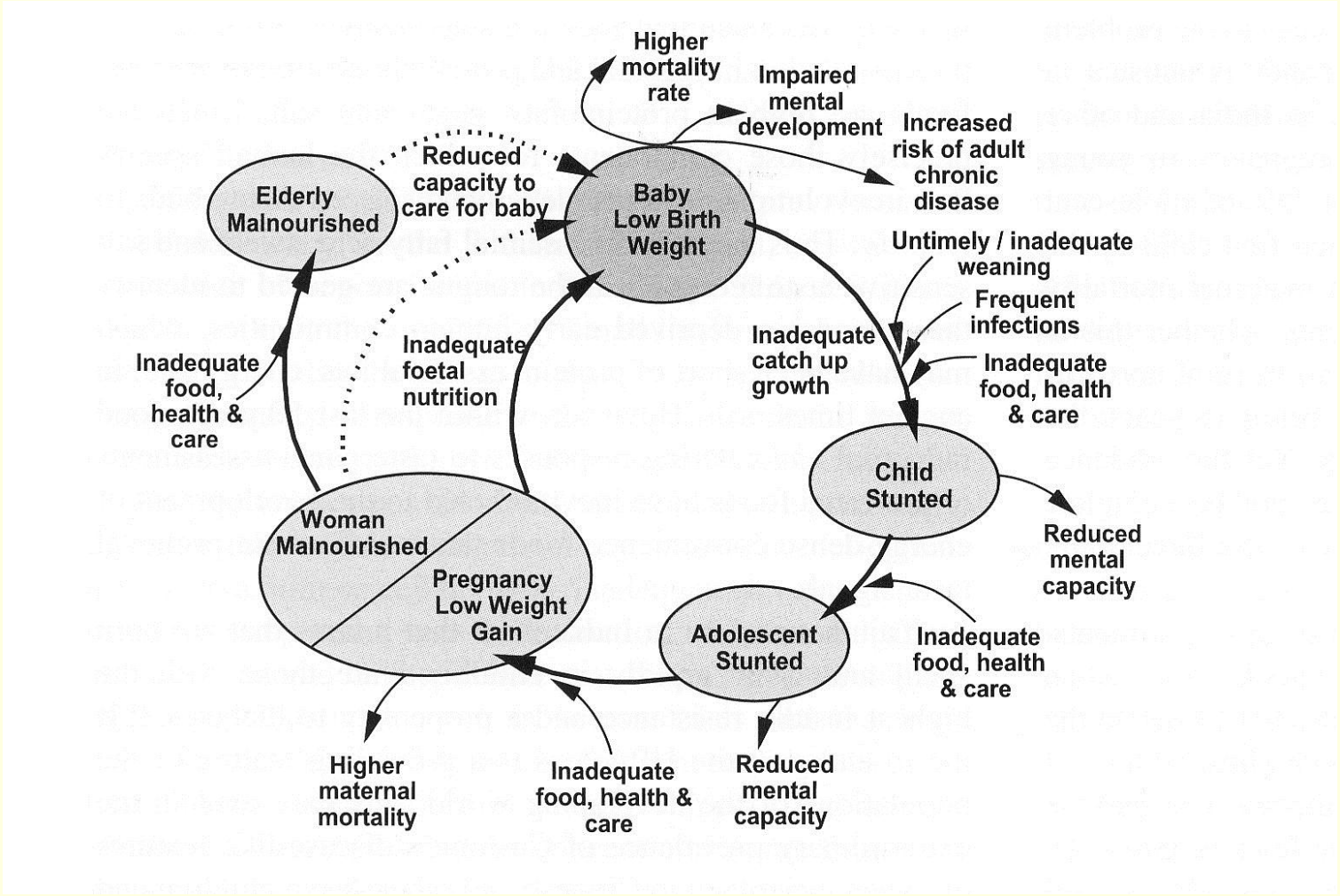
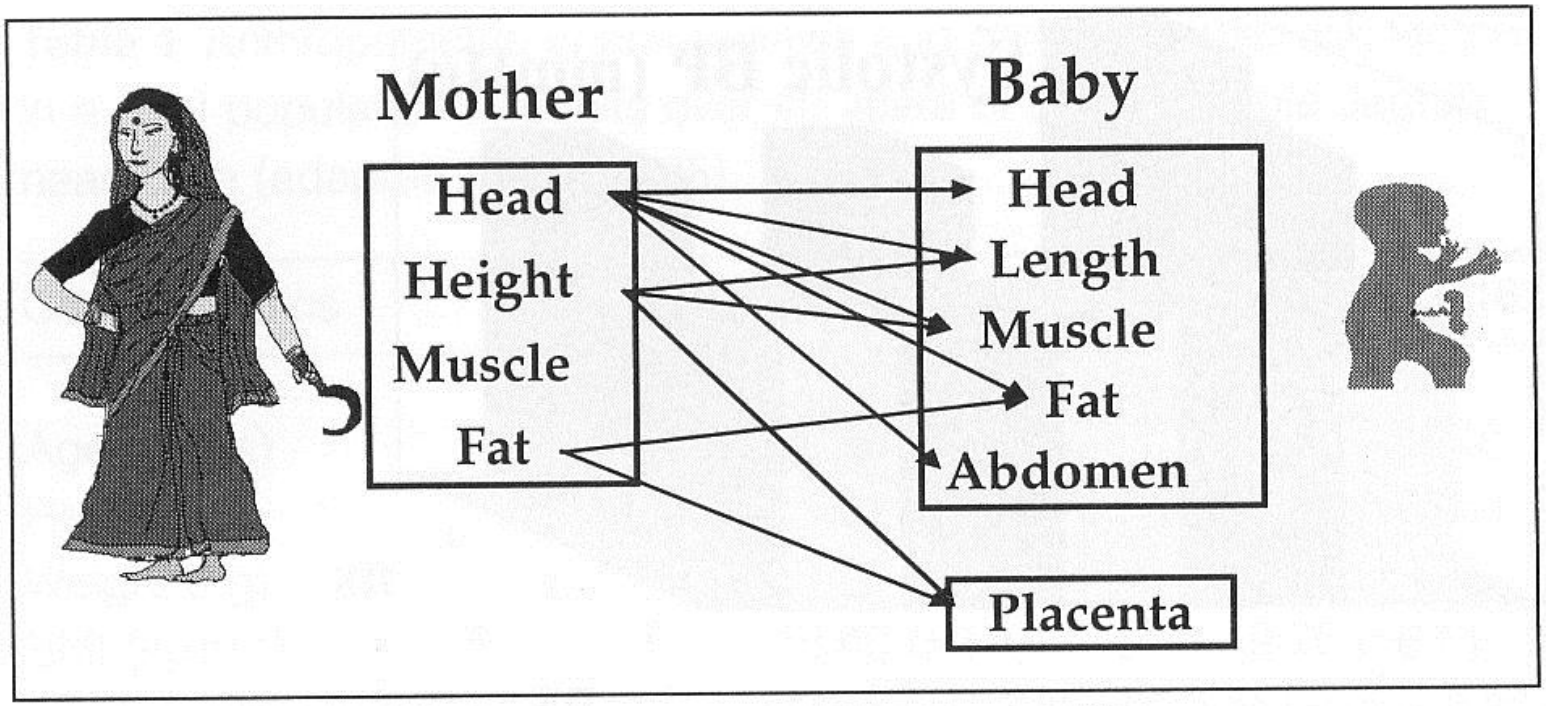
# Transition from Inter-generational Malnutrition to Abdominal Adiposity and Diabetes

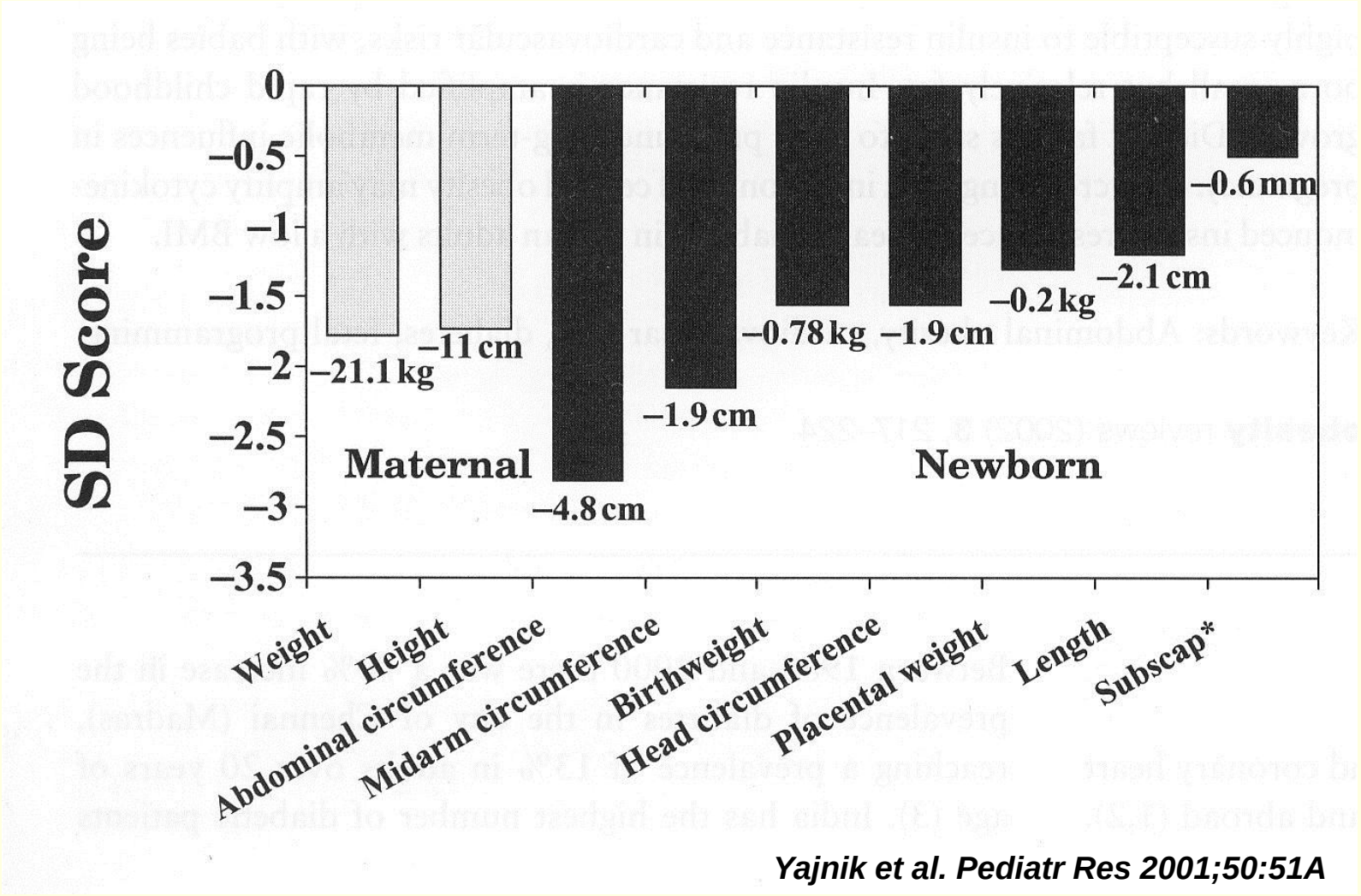



*James. Asia Pac J Clin Nutr 2002;11(Suppl):S516-23*

# Pre-pregnancy Mother and Newborn Baby

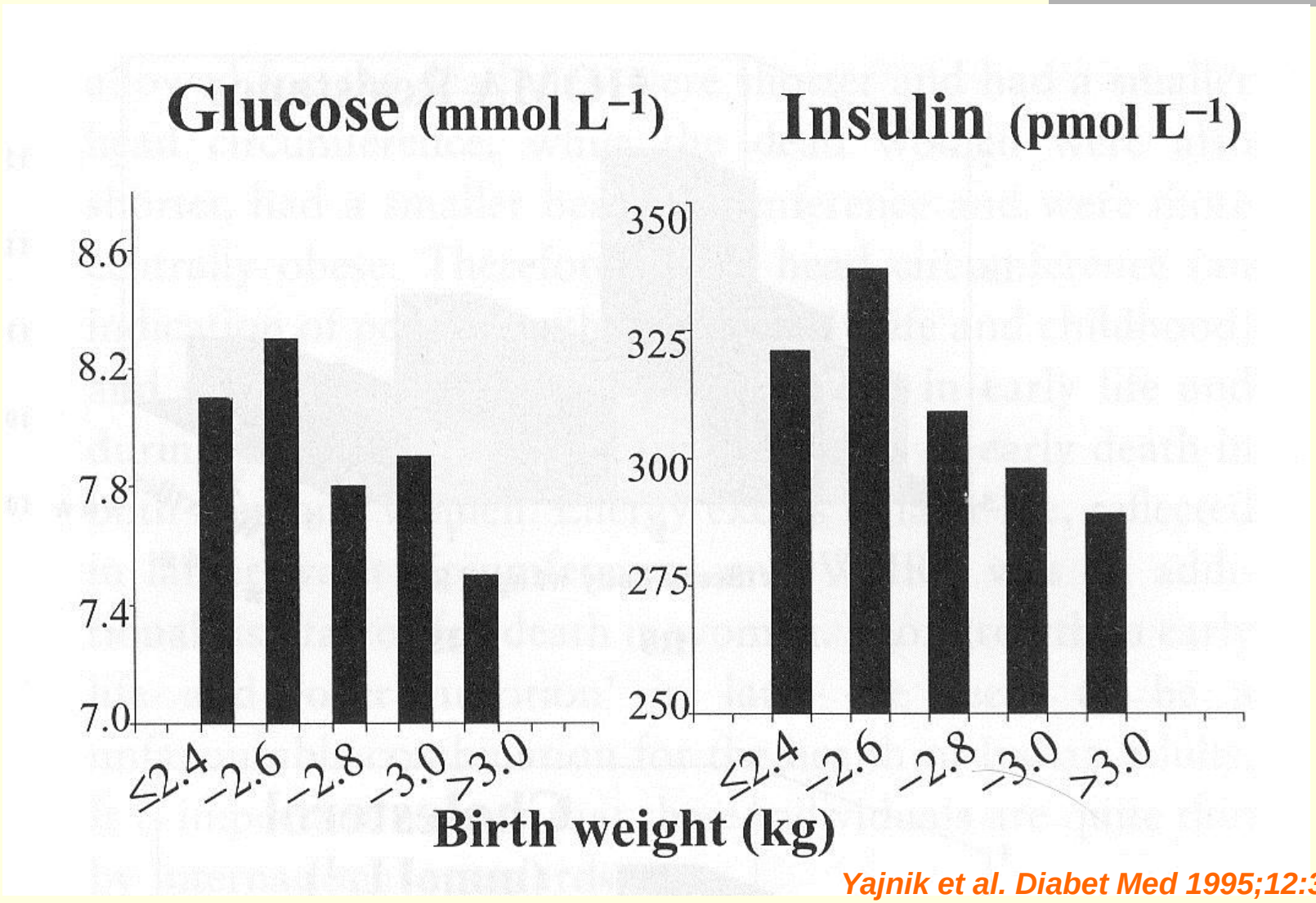


# Indian Thrifty Phenotype at Birth




*Yajnik et al. Pediatr Res 2001;50:51A*

# Glucose and Insulin Response in Childhood in Relation to Birth Weight




*Yajnik et al. Diabet Med 1995;12:330-6*

# Differences between undernourished and well nourished children

| | Severely stunted N=15 | Stunted N=88 | Non-stunted N= 278 |
|---|---|---|---|
| Hemoglobin (g/L) | 12.34 ± 1.03 | 12.63 ± 1.19 | 12.87 ± 1.02* |
| Serum Ferritin | 27.40 ± 15.58 | 28.80 ± 28.30 | 27.60 ± 18.64 |
| Transferrin Receptor | 5.05 ± 3.2 | 4.89 ± 1.66 | 4.49 ± 1.05* |
| **Coding** | **25.80 ± 10.44** | **25.68 ± 8.58** | **28.05 ± 7.91*** |
| **Reading comprehension** | **3.93 ± 2.96** | **5.85 ± 4.33** | **7.68 ± 5.65**** |

| | Severely underweight N=5 | Underweight N=113 | Not underweight N=263 |
|---|---|---|---|
| Hemoglobin | 11.54 ± 1.22 | 12.61 ± 1.14 | 12.90 ± 1.01** |
| Transferrin Receptor | 18.00 ± 17.64 | 26.34 ± 14.53 | 28.70 ± 23.29 |
| **Visual Attention** | **-7.60 ± 12.97** | **2.31 ± 9.31** | **4.99 ± 7.26**** |
| **Coding** | **25.00 ± 7.48** | **25.13 ± 8.34** | **28.44 ± 8.00**** |
| **Design Fluency** | **5.80 ± 1.64** | **5.39 ± 2.39** | **6.08 ± 2.53*** |
| **Vocabulary** | **10.20 ± 2.77** | **10.94 ± 4.63** | **12.51 ± 5.21*** |
| **Reading comprehension** | **3.20 ± 1.30** | **5.96 ± 4.52** | **7.68 ± 5.65**** |

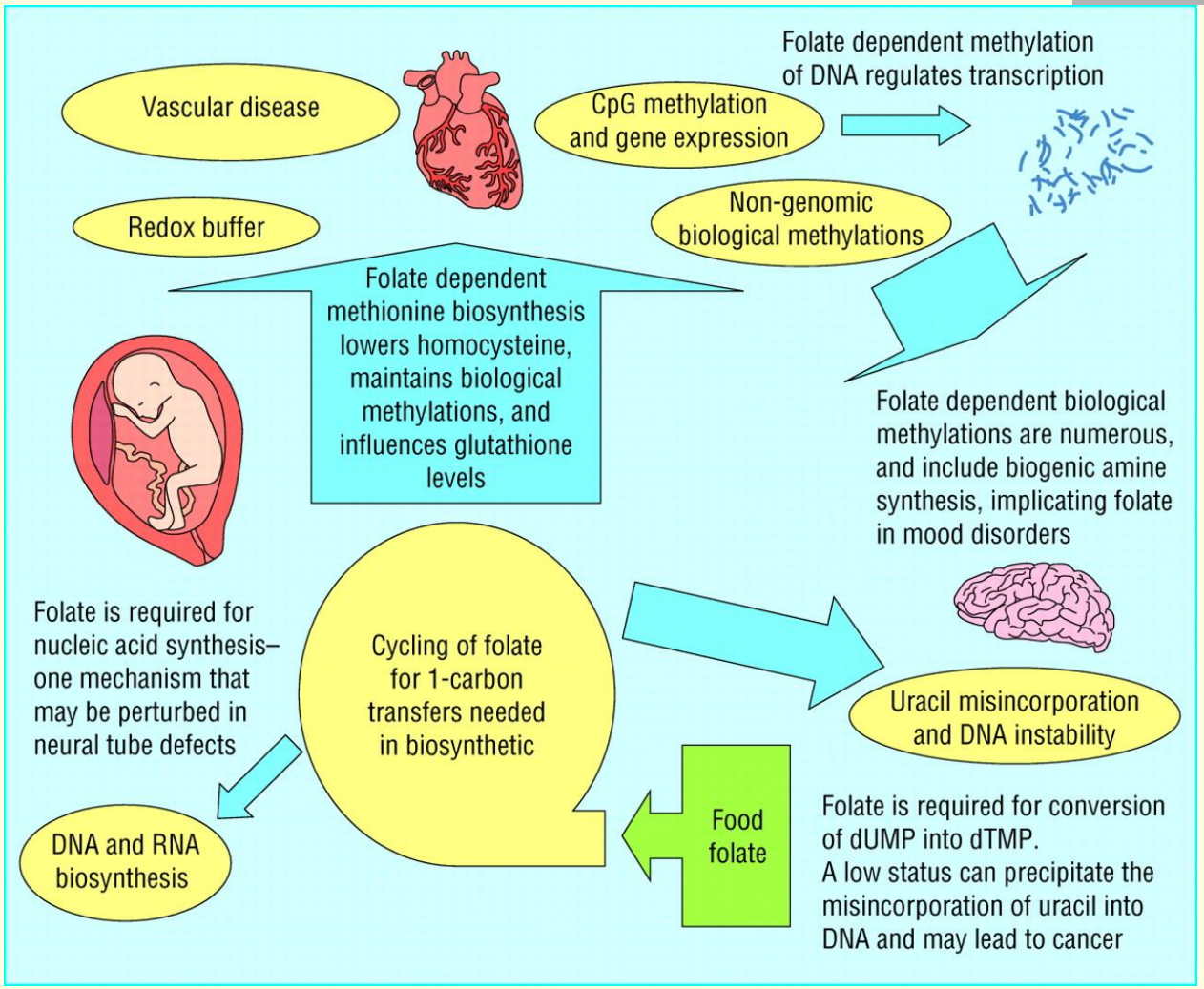
Severe stunting <-3 SD Ht/age; stunting -3;-2SD Ht/age non-stunted >-2 SD Ht/age. Differences assessed with ANOVA; *p< 0.05; **p < 0.01; ***p < 0.005

# Differences between iron-deficient and non-iron deficient children

| Australia | Iron deficient N=17 | Not iron deficient N= 141 |
|---|---|---|
| Visual Attention | 41.06 ± 11.34 | 33.31 ± 11.04** |
| RAVLT | 8.29 ± 2.39 | 9.47 ± 2.20* |
| Coding | 32.24 ± 8.63 | 37.64 ± 9.93* |
| Vocabulary | 18.41 ± 6.47 | 23.73 ± 6.21** |
| **Indonesia** | **Iron deficient N=86** | **Not iron deficient N=284** |
| **RAVLT** | **2.87 ± 1.63** | **3.35 ± 1.85*** |
| **RAVLT-B** | **4.08 ± 1.70** | **4.49 ± 1.71*** |
| **Vocabulary** | **11.07 ± 5.22** | **12.33 ± 5..00*** |
| **Reading comprehension** | **6.07 ± 4.15** | **7.54 ± 5.70*** |

Iron deficiency defined as serum ferritin < 15 ug/L. Differences assessed with ANOVA; *p< 0.05; **p < 0.01; ***p < 0.005

# Molecular mechanisms affected by dietary folate

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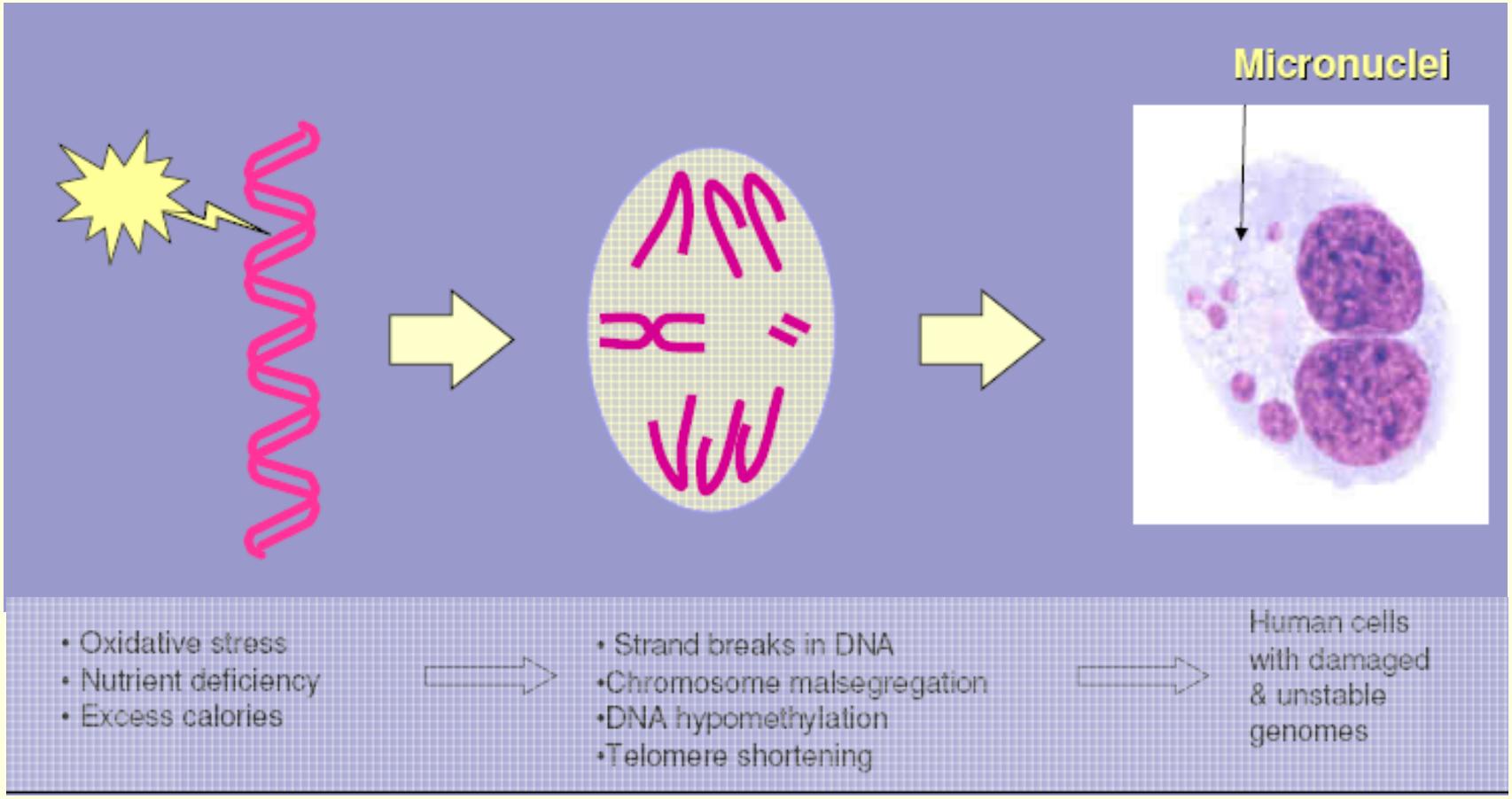
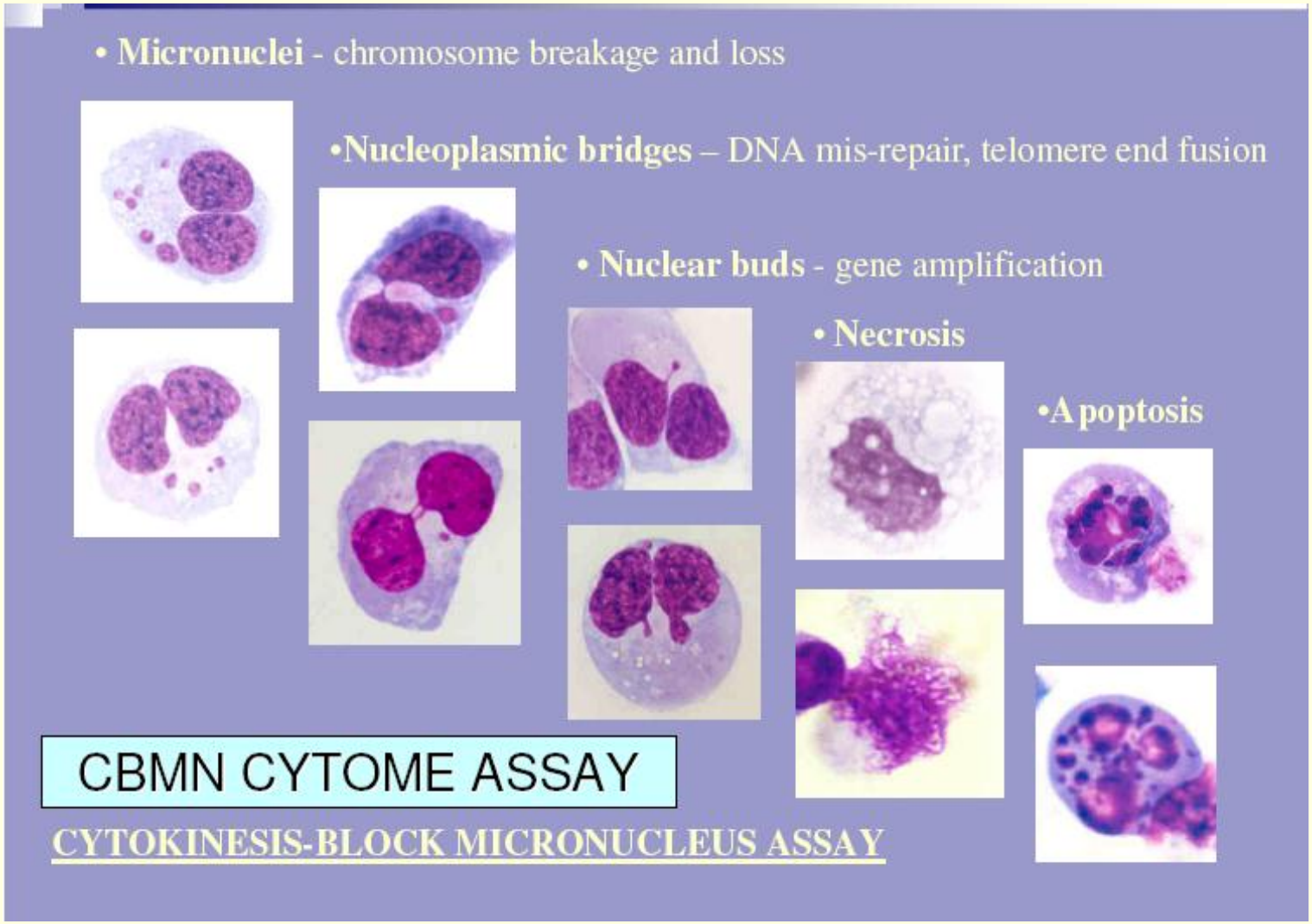
*Lucock, M. BMJ 2004;328:211-214*

# Genome damage

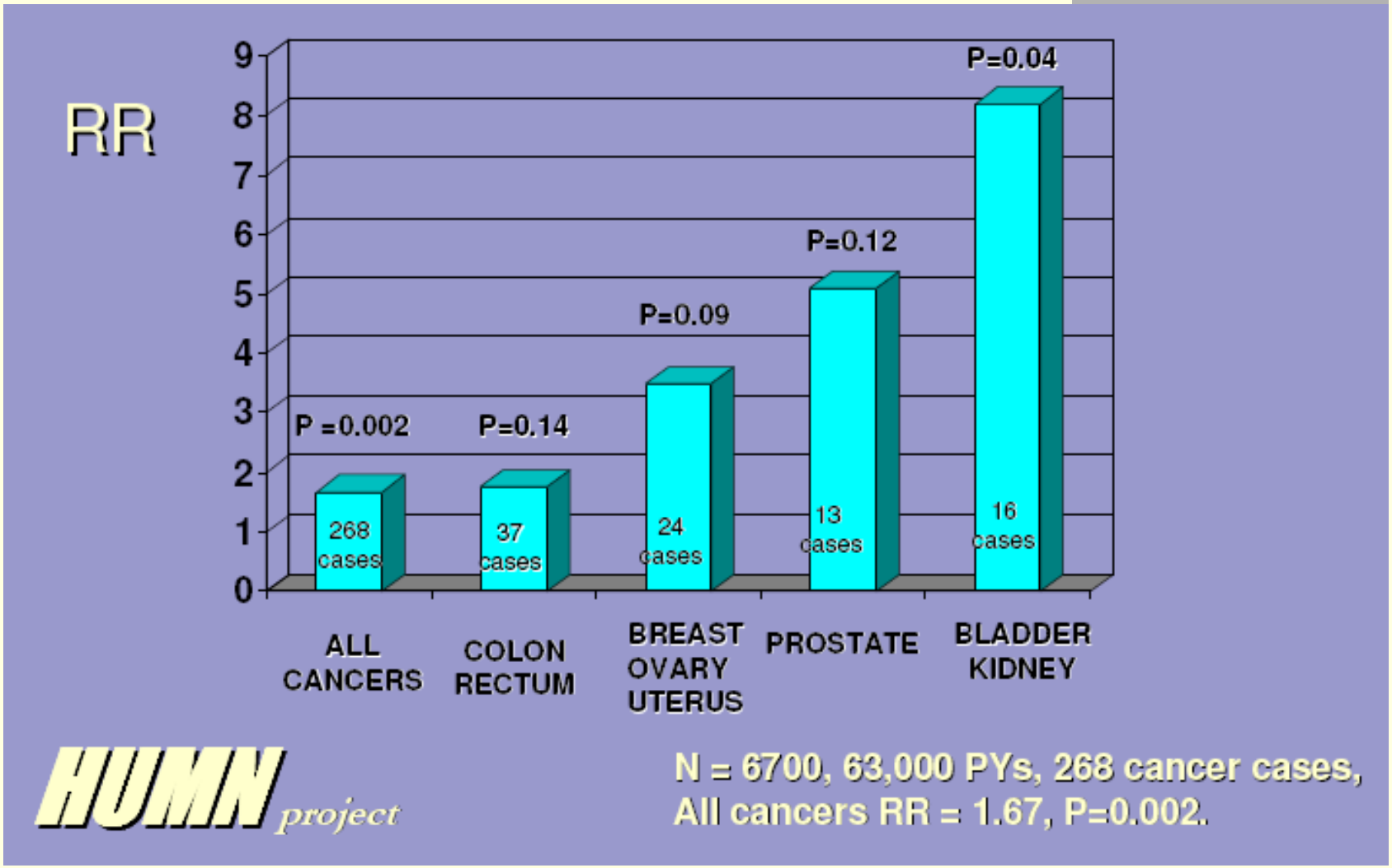



*Fenech, 2003*

# Cytokinesis-Block Micronucleus (CBMN) Cytome Assay



# Cancer risk by sites for medium/high relative to low tertile micronucleus frequency




*Bonassi et al. Carcinogenesis, 2006. In Fenech, 2010*

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Original Article

# Determinants of child malnutrition during the 1999 economic crisis in selected poor areas of Indonesia

Saptawati Bardosono MD PhD, Soemilah Sastroamidjojo MD and Widjaja Lukito MD PhD

*South East Asian Ministries of Education Organization Regional Center for Community Nutrition at the University of Indonesia, Jakarta, Indonesia*

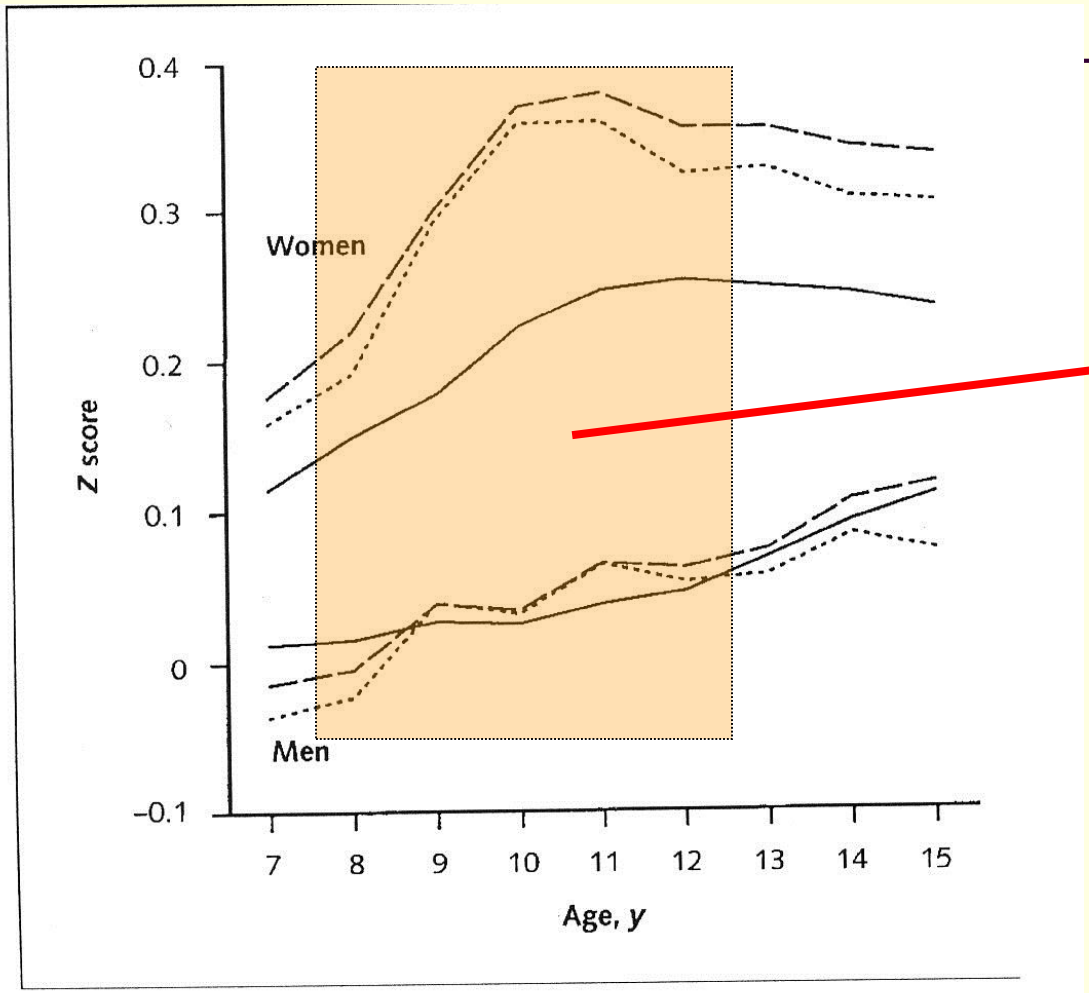
*Asia Pac J Clin Nutr 2007;16:512-26*

# Findings (3): determinants of wasting

| Urban Poor Jakarta | Banggai | Alor-Rote |
|---|---|---|
| Purchasing power | Possession of KMS card | Purchasing power |
| Maternal and child care | Infectious diseases | Mother's education |
| Infectious diseases | | Maternal and child care |

*Bardosono et al. Asia Pac J Clin Nutr 2007;16:512-26*

# Height, Weight and BMI during Childhood in 286 Men and 185 Women who later Developed Type 2 Diabetes




A *Z* score of 0 corresponds to the mean value in the whole cohort; a *Z* score of 1 corresponds to a value of 1 SD above the mean. Solid line indicates height; dashed line indicates weight; dotted line indicates body mass index.

**Catch-up fat phenomenon**

# Refeeding Study on Children with Marasmus or Marasmic-Kwashiorkor

**When children recovering from marasmus or marasmic-kwashiorkor had reached their expected weight-for-height, their bodies contained 25-37% of fat, with a mean value of 30%**

*Ashworth. Br J Nutr 1969;23:835-45*

# Semistarvation and Refeeding Study

**When body fat was 100% recovered, the recovery of muscle mass or fat-free-mass was less than 40%**

***Keys et al. 1950***

# Forgetting the evidence?

Forgetting the physiology of growth and development, eg bone lengthening processes??

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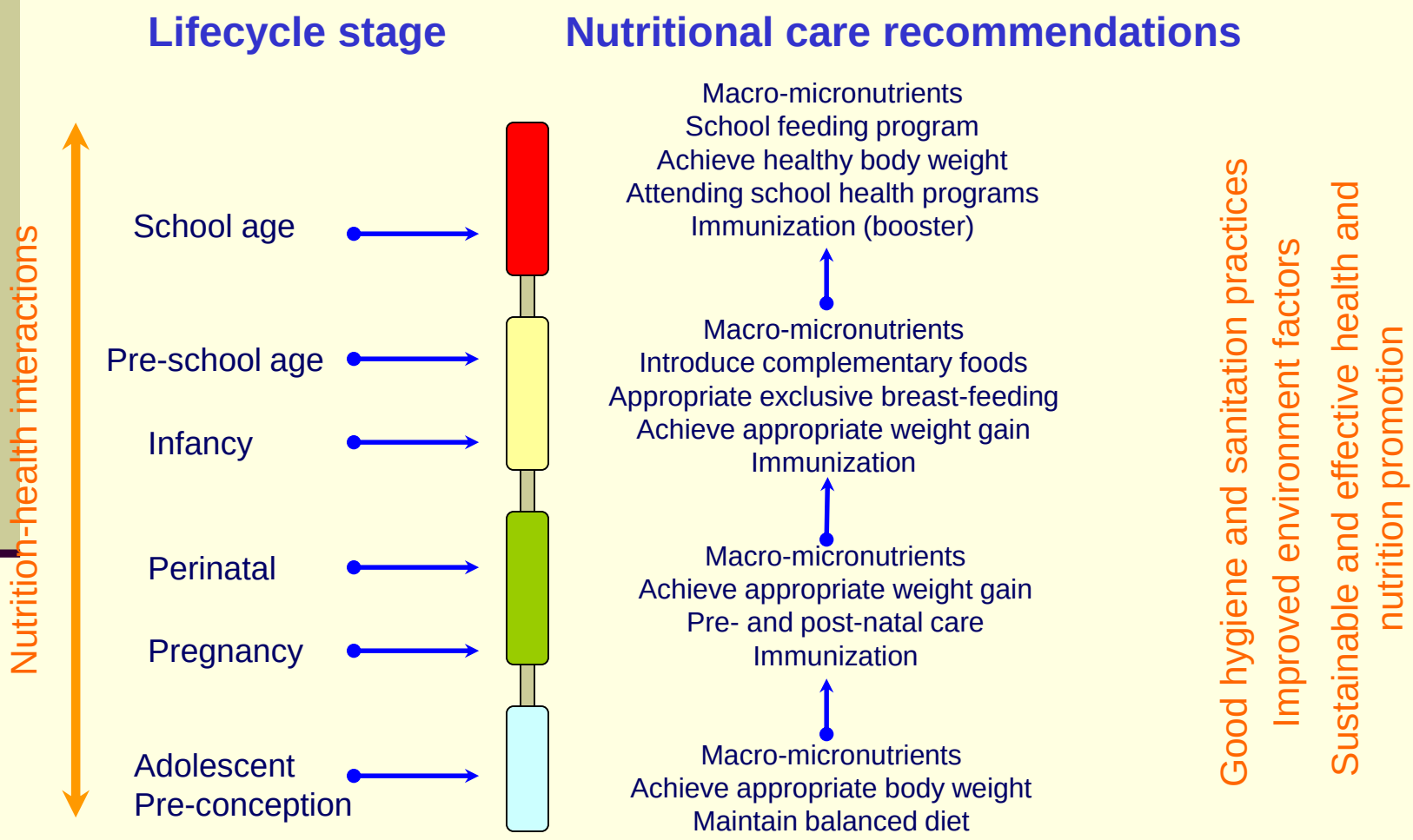
# Total Nutritional Care at Various Life-cycle Stages



# Potential strategies to be considered: Operational level

- Penyeragaman terminologi
- Mengembangkan dan meningkatkan perinatal surveillance
- Penguatan nutritional surveillance system, terintegrasi dengan surveillance of infectious diseases
- Pengembangan dan revitalisasi ‘therapeutic feeding centers’ di masyarakat, primary health care and RS
- Mengembangkan program nutritional promotion yang efektif
- Inter-sectoral solution in developing sustainable school feeding programs
- Eradikasi neglected infectious diseases, like helminthiasis, filariasis and others
- Control dan minimkan persisting infectious diseases, seperti malaria, tuberculosis

Thank You
Terima Kasih