

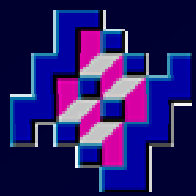


Science, Health and Development: Achievements and Challenges in One Hundred Years of PAHO

Advances in Nutrition Research: Challenges and Achievements

Juan Rivera Dommarco
National Institute of Public Health
Mexico

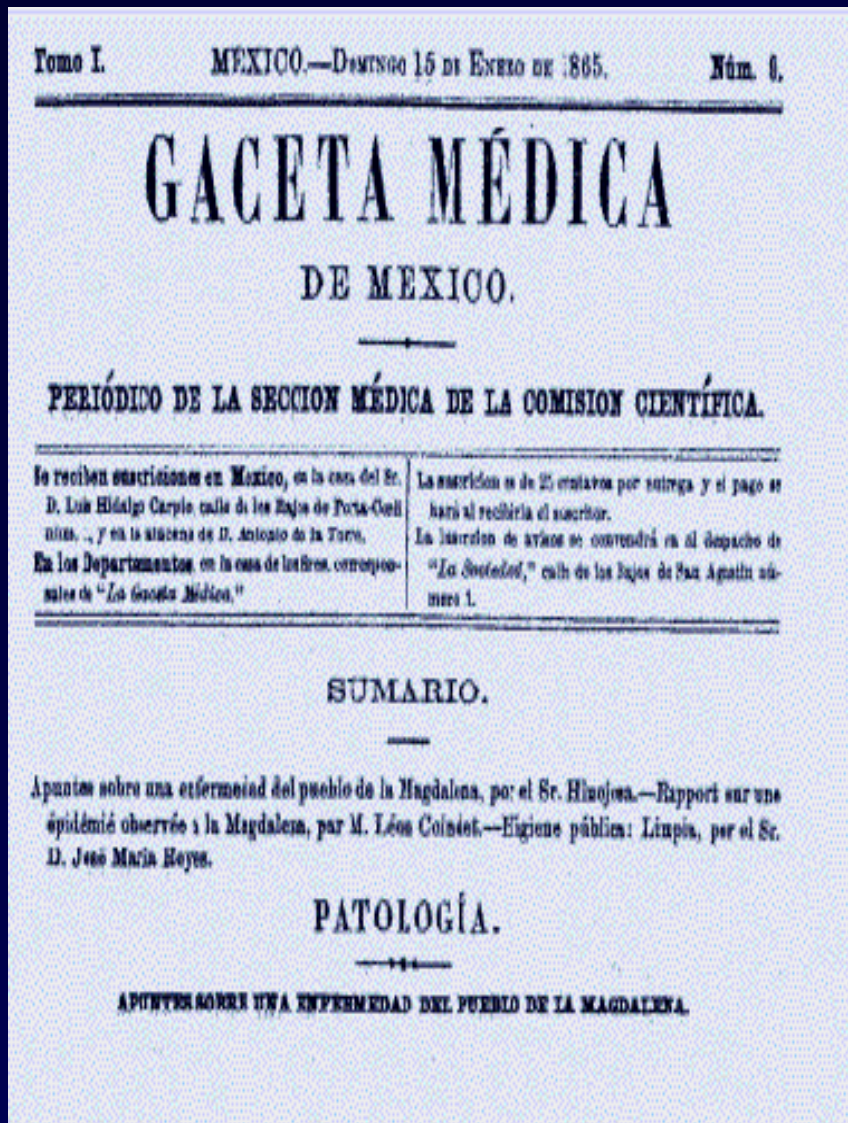
Reynaldo Martorell
Emory University
USA



Introduction

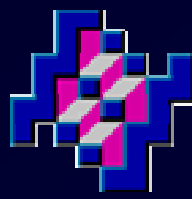
- Focus on achievements and challenges of research with application to Public Nutrition
- Brief overview of advances during the 100 years of PAHO
- Emphasis in achievements in LAC
- Impossible to be comprehensive, given time available
- Emphasis on landmarks in knowledge, concepts and paradigms in Maternal and Child Nutrition and the Nutritional Transition

Descriptions of apparently unrelated syndromes: the search for definitions and terminology (1865-1910)



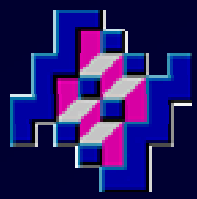
•Several publications in LA describing “syndromes” that we recognize now as severe undernutrition

- Hinojosa, México (1865) “an illness” (Kwashiorkor)
- Cámara Vales (1896) and Domínguez Peón (1889), México “a syndrome” (Pellagra)
- Cecilio S. López (1892), Argentina (Rickets)
- F. Destéfano (1903), Argentina, (Beriberi)
- Patrón Correa (1908), México (“culebrilla”=severe undernutrition)



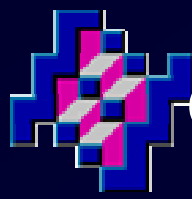
Identification and definition of clinical undernutrition (1930-1946)

- F. Gómez and co-workers
 - Identified the various “syndromes” as varieties and different degrees of severity of a unique pathological entity: “Desnutrición” (undernutrition)
 - Proposed classification of severity for clinical undernutrition
 - Equated “undernutrition” to the syndrome described in Africa by C. Williams, called Kwashiorkor in 1935
 - Showed higher mortality rates in third degree undernutrition
- Meneghelo, Scrogie, et. al. in Chile (1930-40)
 - “Síndrome pluricarencial de la infancia” (Multi-deficiency Syndrome during Infancy), better term than PEM



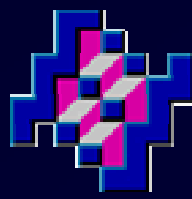
Clinical and metabolic studies of clinically severe undernutrition and rehabilitation (1930-1960's)

- High prevalences of clinically severe undernutrition
- Emphasis on clinical research
 - Fisiopathology, metabolic changes, rehabilitation schemes, reduction of fatality rates
- Mexico, Chile, Guatemala and Jamaica poles of clinical Research
 - Gómez, Cravioto, Ramos-Galván, Frenk (Mexico)
 - Waterlow, Rutishauser, Garrow, Alleyne (Jamaica)
 - Meneghelo, Scrogie et al; Monckeberg et al (Chile)
 - Behar (Guatemala)
- Little interest in mild to moderate undernutrition



Creation of a new paradigm: the studies of Goldberger about Pellagra in the USA (1914-1921)

- Pellagra recognized in USA in 1907
- 1912: 25,000 cases in previous 5 years
- Etiology unknown
 - Prevailing views: Infection or intoxication
- 1914: Goldberger starts studies. Through observation, epidemiologic reasoning and experimental studies demonstrated:
 - Not an infectious disease
 - Prevented with a diet rich in animal foods and legumes
 - Existence of a factor P-P (no protein, possibly tryptophan)
 - Proved in 1937 that nicotinic acid was factor P-P
- New paradigm:
 - from the presence of an etiologic factor (germ, toxin)
 - to the lack of an essential nutrient



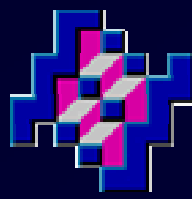
Synergism between nutrition and Infection

Interactions of nutrition and infection by N.S. Scrimshaw, C.E. Taylor and J.E. Gordon

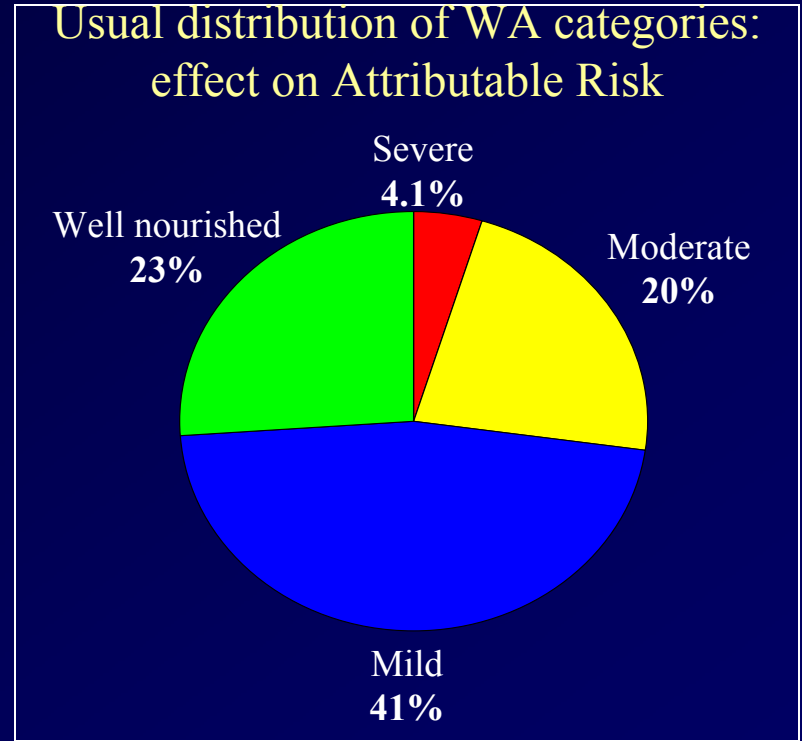
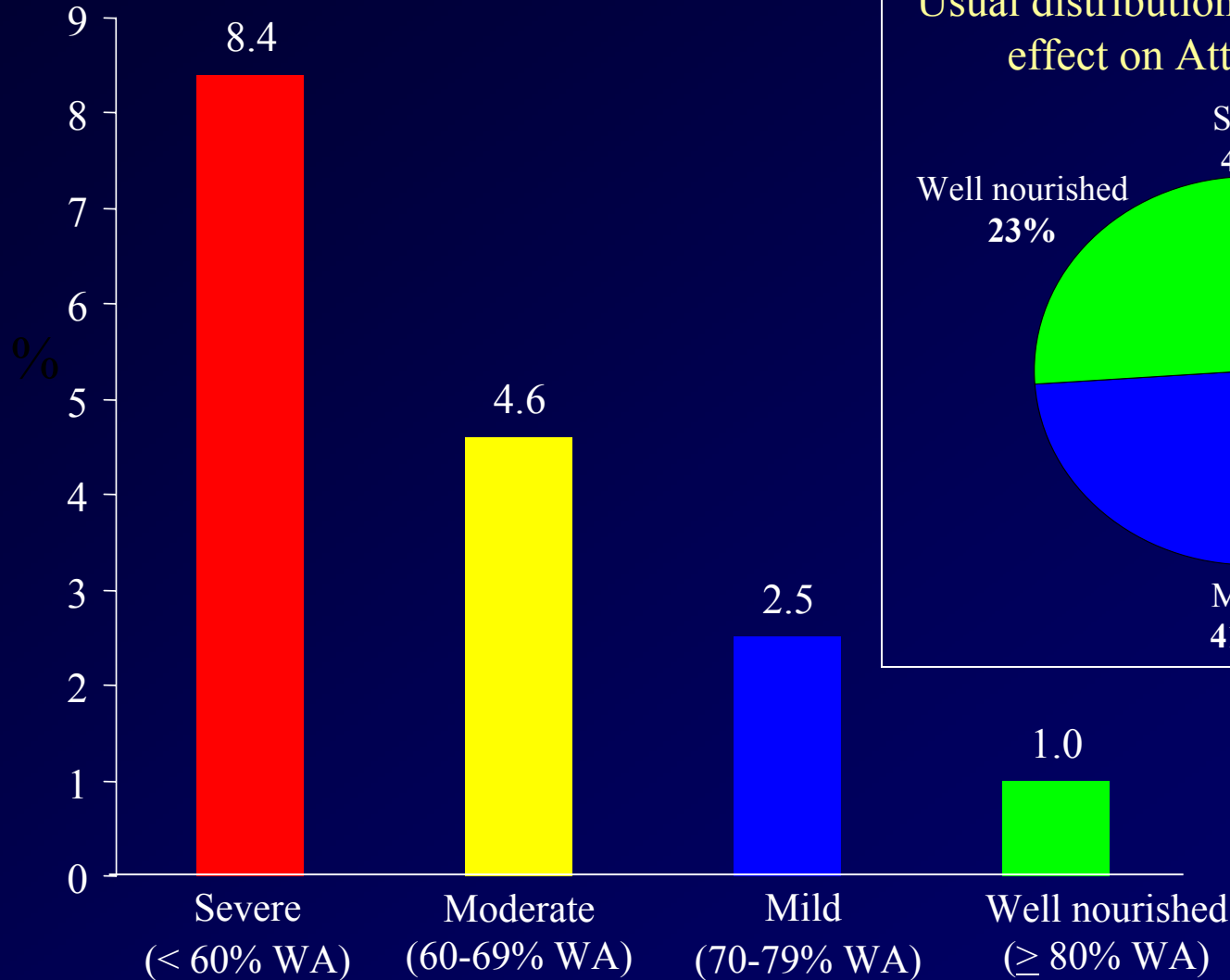
World Health Organization,
Monograph Series No. 57, 1968

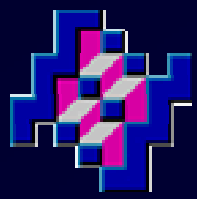
- **Infections are a cause of undernutrition**
- **Undernutrition increases the risk of morbidity and mortality for several infections**
- **importance of primary health care (PHC) for nutrition and of nutrition interventions for health**





Summary results of studies on RR of mortality in children < 5 y by categories of weight for age (Pelletier et al, 1993; 1995)

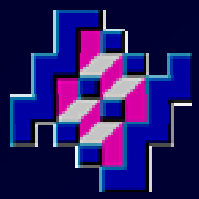




The debate about the nature of nutritional problems: protein deficiency or quantity of energy



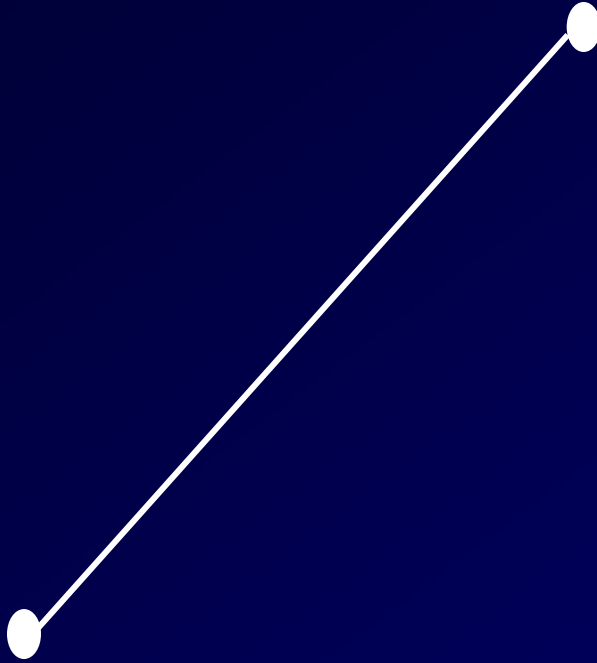
- Dramatic effects of severe protein deficiency: Kwashiorkor
- Prevailing view: severe protein deficiency affected brain growth and function (Monckeberg)
- Evidence of effects of severe undernutrition on mental development (Cravioto)
- Overemphasis on the role of protein
- One of results: High protein vegetable mixes for weaning (Incaparina)

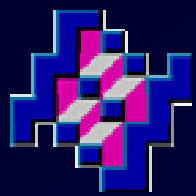


The nutrition pendulum

Proteins
(50s-60s)

Quality



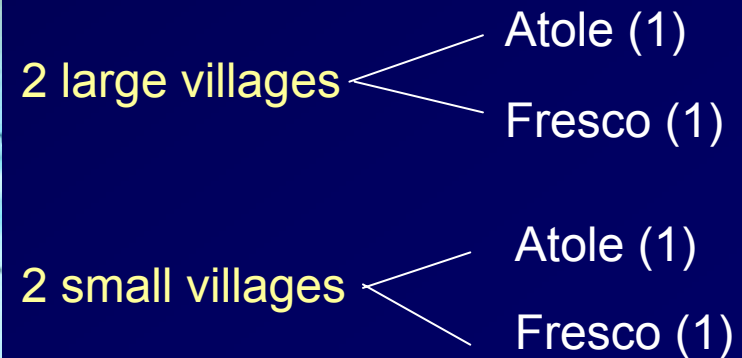


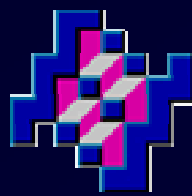
The INCAP Supplementation trial in Guatemala



Improving protein intake in pregnant women and children < 5 y will improve brain size, function and cognitive development

Experimental Design

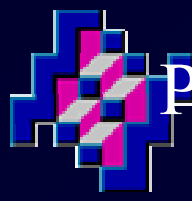




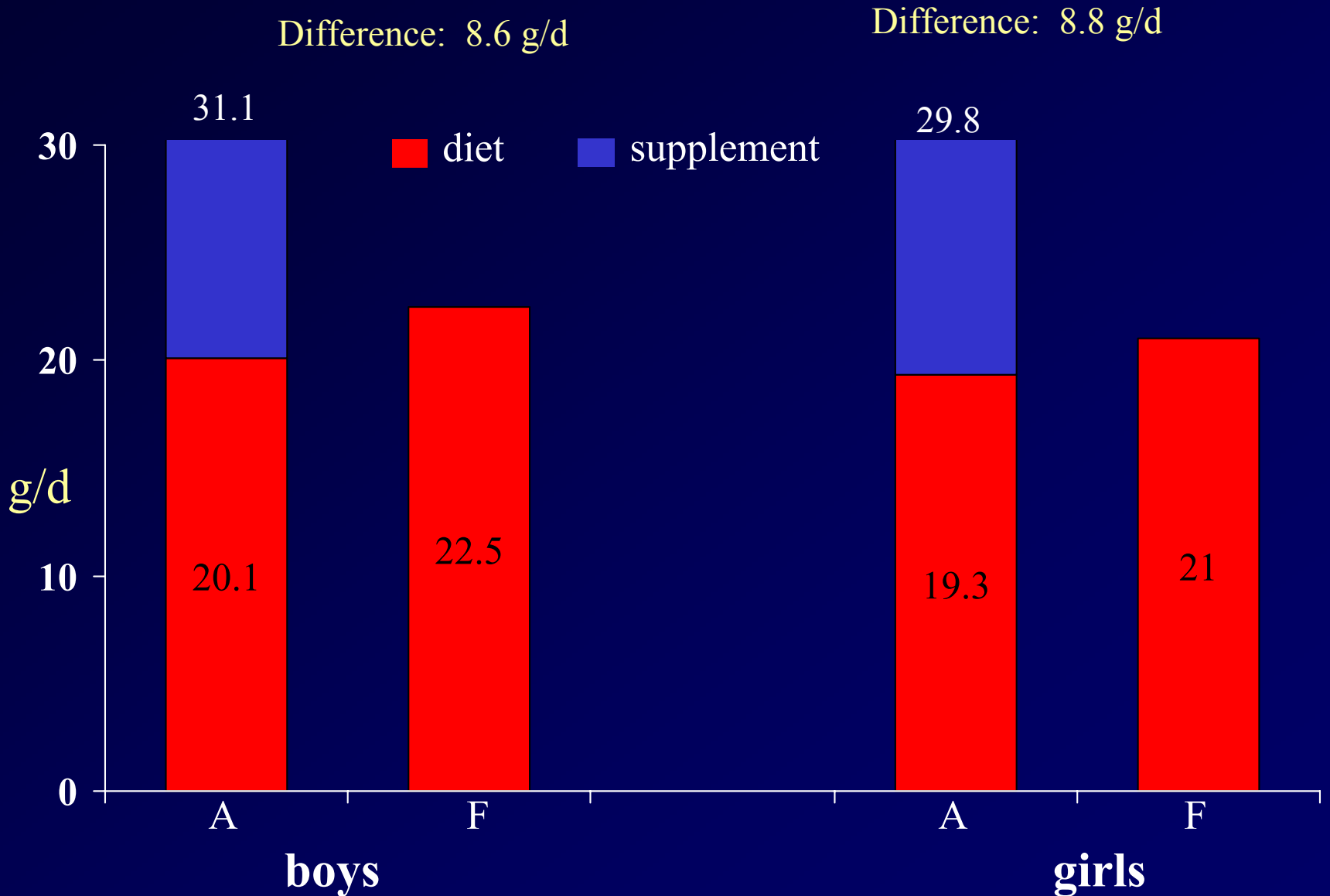
Formulation and energy and protein content per cup of the supplements (180 ml)

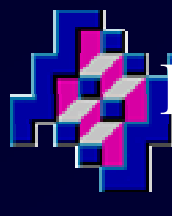
	Atole	Fresco
Ingredients(g/180 ml)		
Incaparina	13.5	-
Low fat milk	21.6	-
Sugar	9.0	13.3
Flavor	-	2.1
Nutrients ⁺		
Energy (kcal/180 ml)	163	59
Protein (g/180 ml)	11.5	0

+ Both supplements contained vitamins and minerals



Protein intake from the diet and the supplements between 15 and 36 months in Atole (A) and Fresco (F) villages

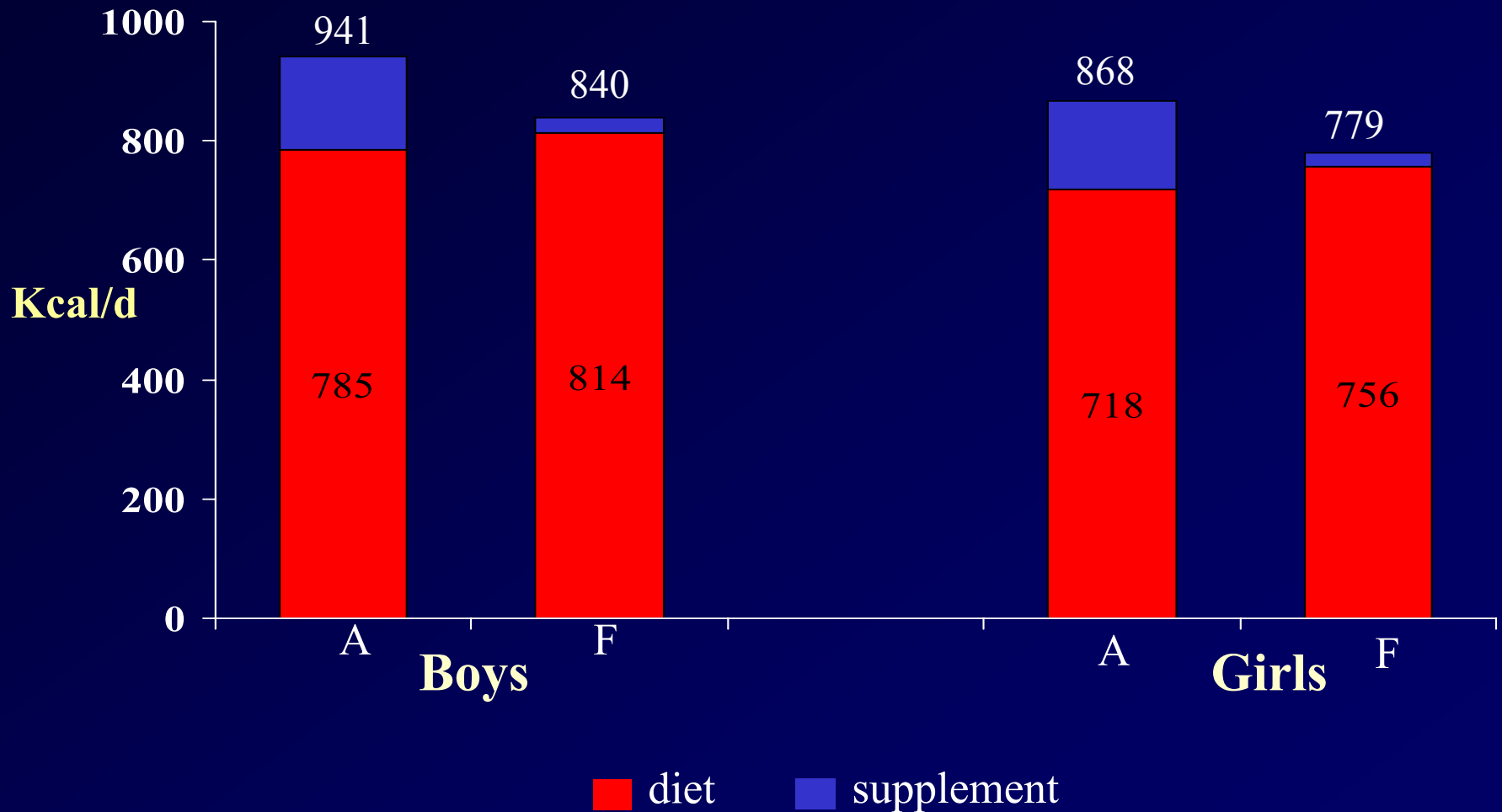


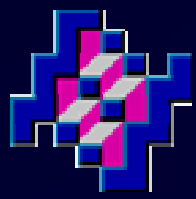


Energy intake from the diet and the supplements between 15 and 36 months in Atole (A) and Fresco (F) villages

Difference: 101 kcal/d

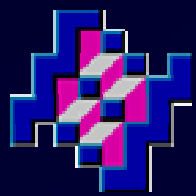
Difference: 89 kcal/d





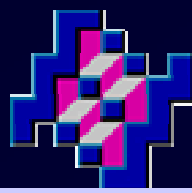
Effects on brain development and cognitive functioning

- Effects on brain size, development and function not substantiated
- Small effects on motor development
- Overall, effects during preschool years were of modest magnitude



Effects of supplementation on prenatal growth

- Larger birth weights in children consuming high amounts of energy, regardless of type of supplement
- Effects were not different in Atole and Fresco villages, suggesting no effects of protein
- Conclusion:
 - **Calories, not protein, the limiting factor**

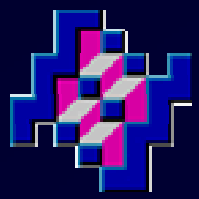


“The protein fiasco” (70s, 80s)

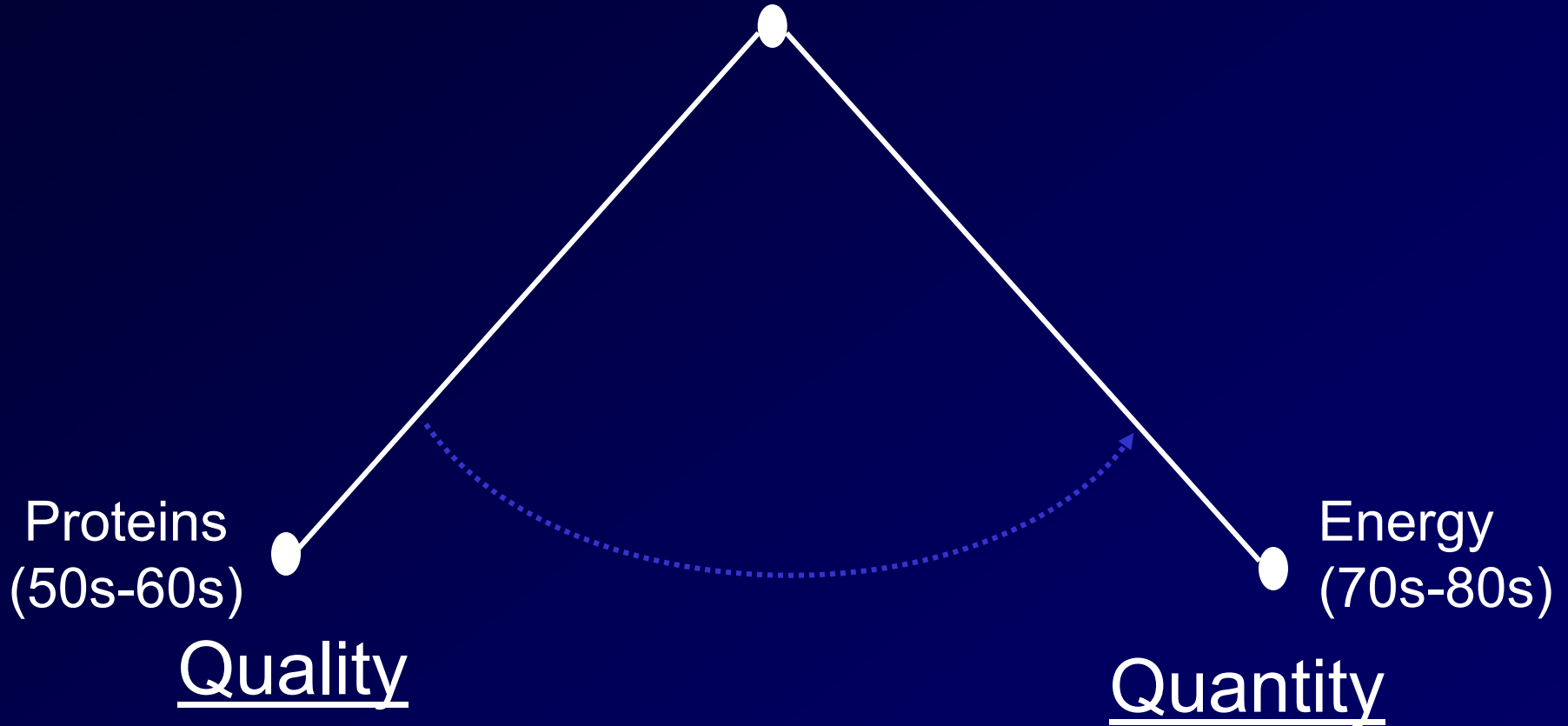


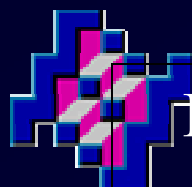
“Based on protein and energy requirements and intakes, the problem is basically of quantity and not of quality.”⁺

⁺Waterlow and Payne, “The Protein Gap,” Nature, 1975

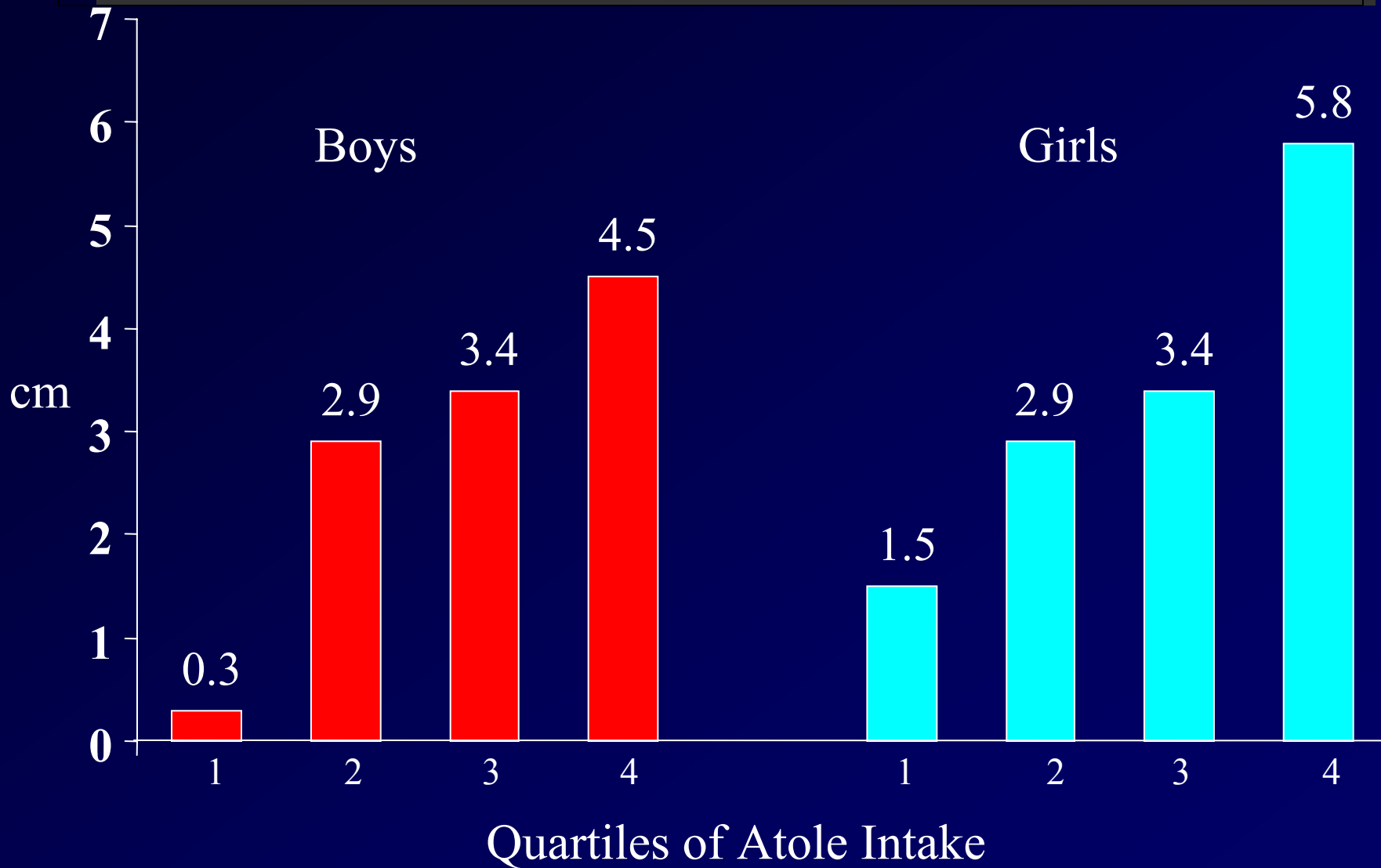


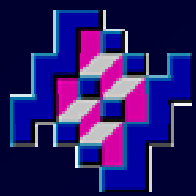
The nutrition pendulum



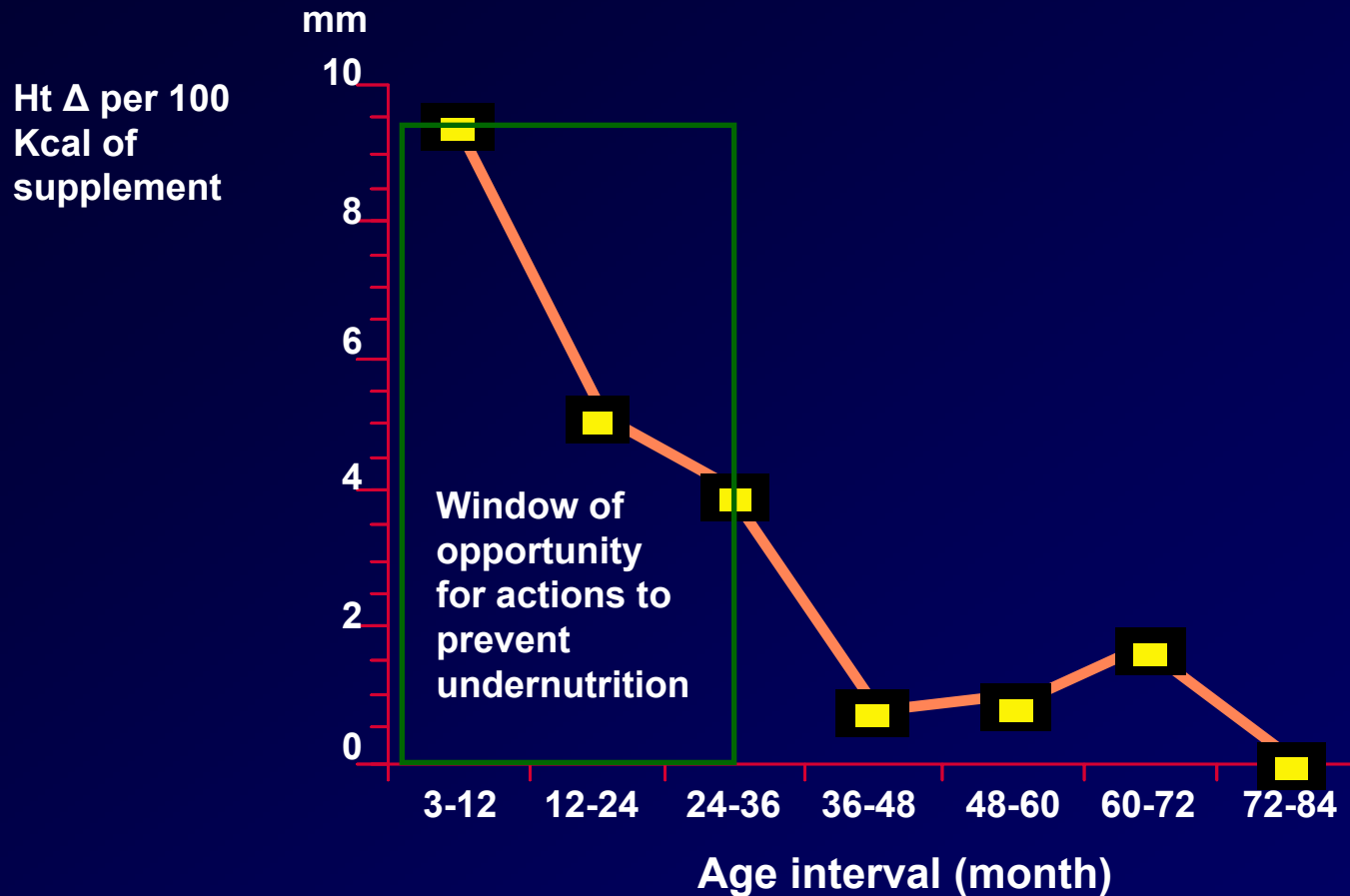


Difference in height at 3 y of age relative to height at 3 y of age at baseline according to Atole intake



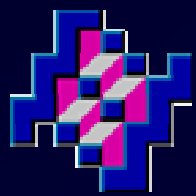


Targeting nutrition interventions to young children: the window of opportunity for prevention



*Adjusted for : initial weight, morbidity, SES, sex and dietary intake

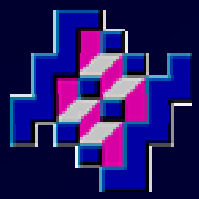
Source: Schroeder, Martorell, Rivera, et al , J. Nutr. 125: 1051S - 1059S, 1995



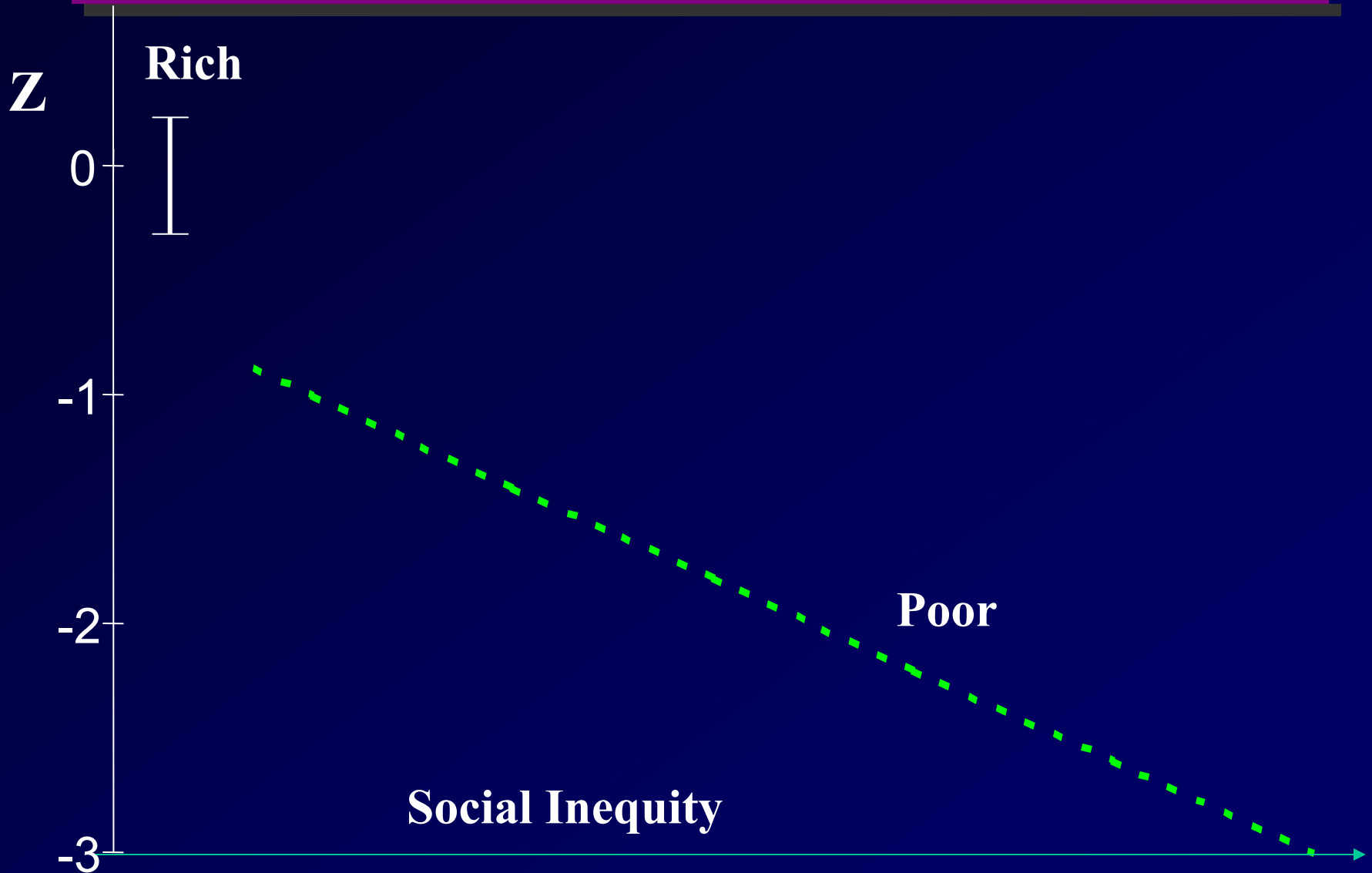
The debate about the significance of stunting in Latin American population, particularly in Indians

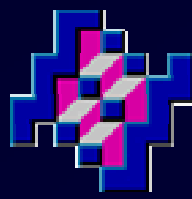
- Is growth potential low in Indian population in LA?
- What is the role of the environment?
- Small but healthy (Seckler, 1980, 1992)
 - Stunting is an adaptation without cost
 - Only severe PEM represent a Public health problem



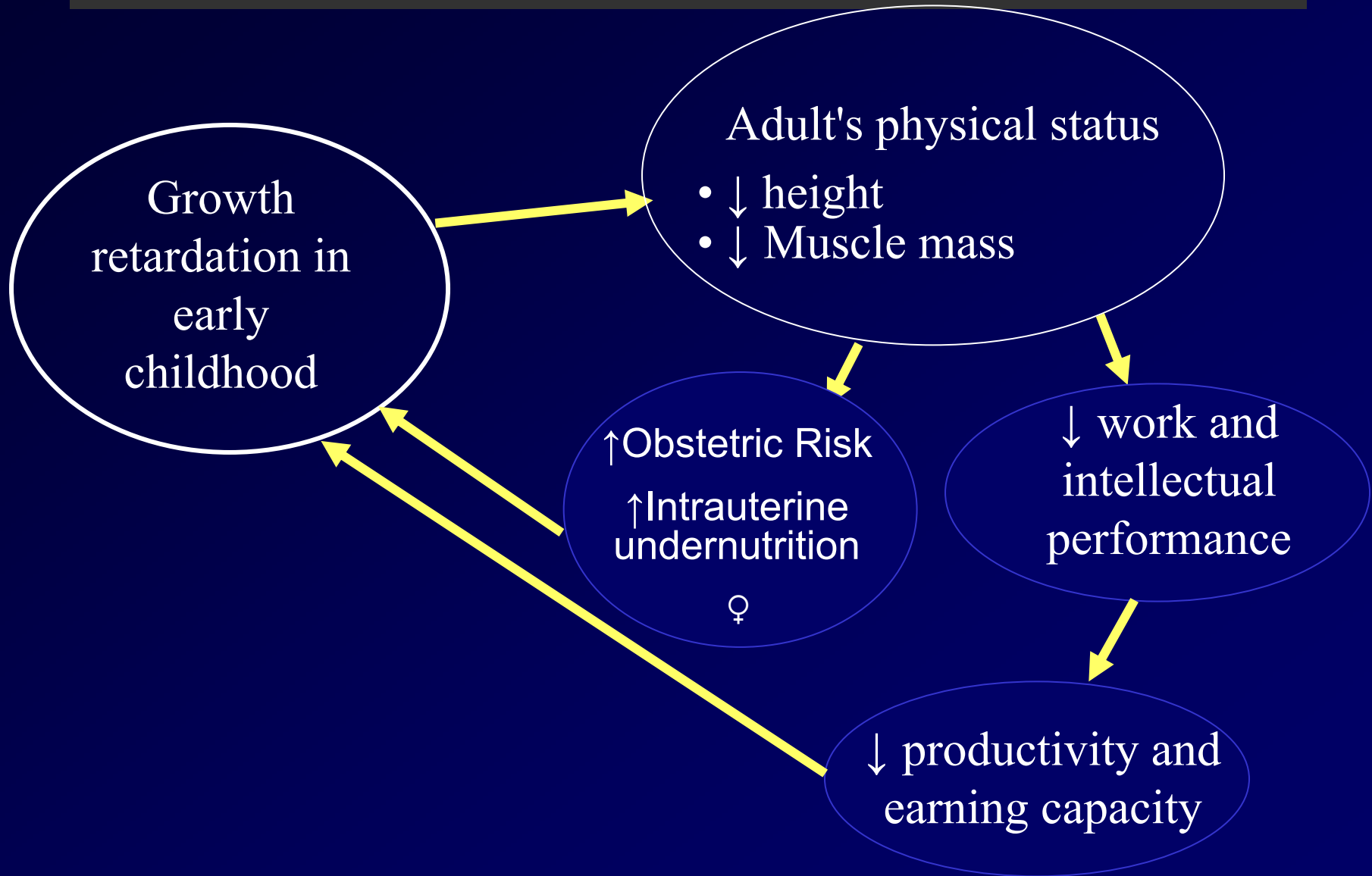


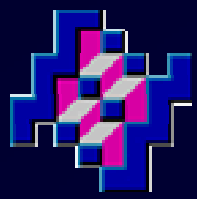
Height of children from LA, Asia and Africa according to social class



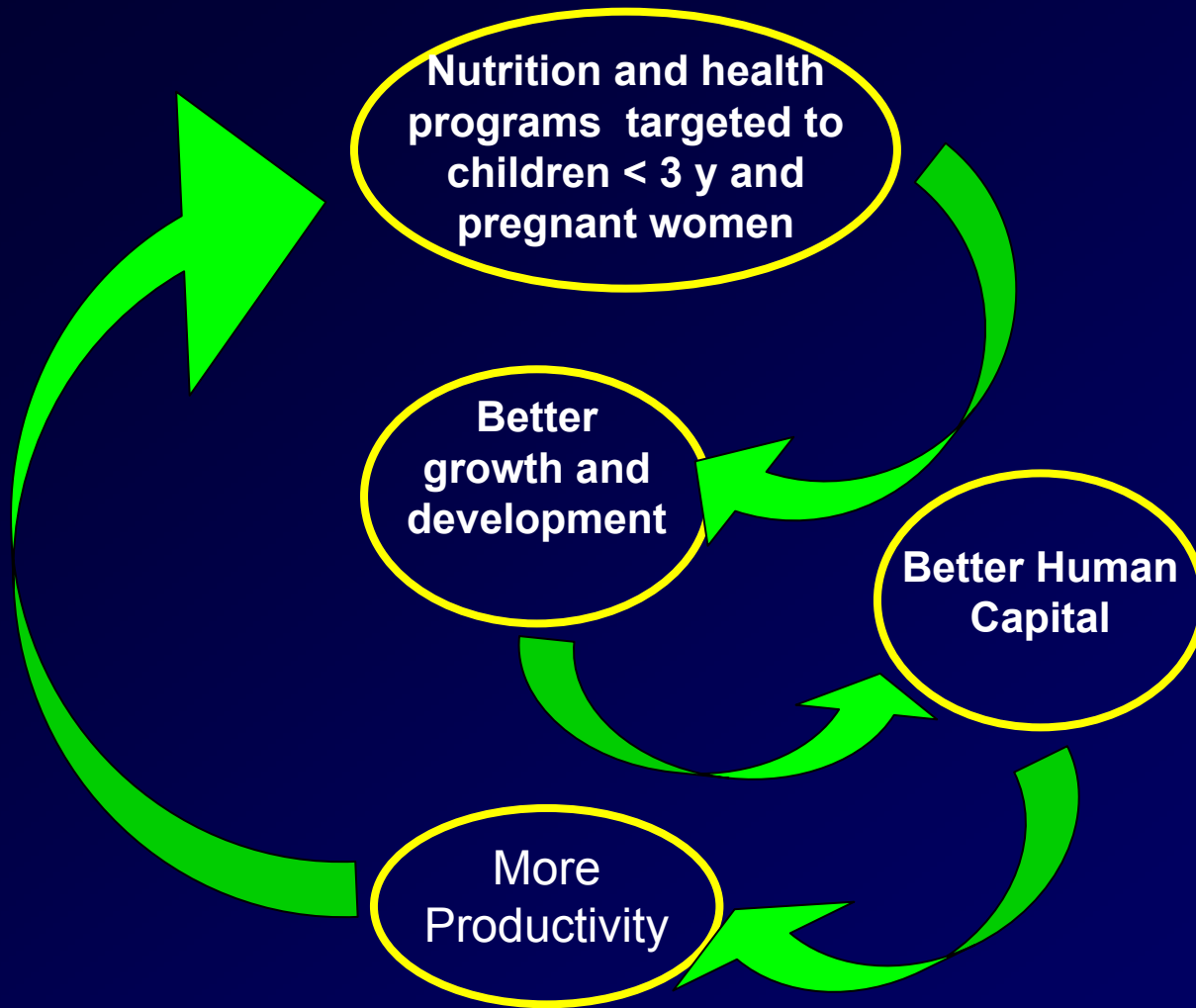


Long term consequences of growth retardation during early childhood

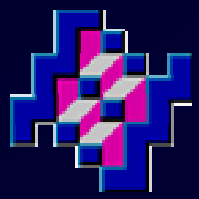




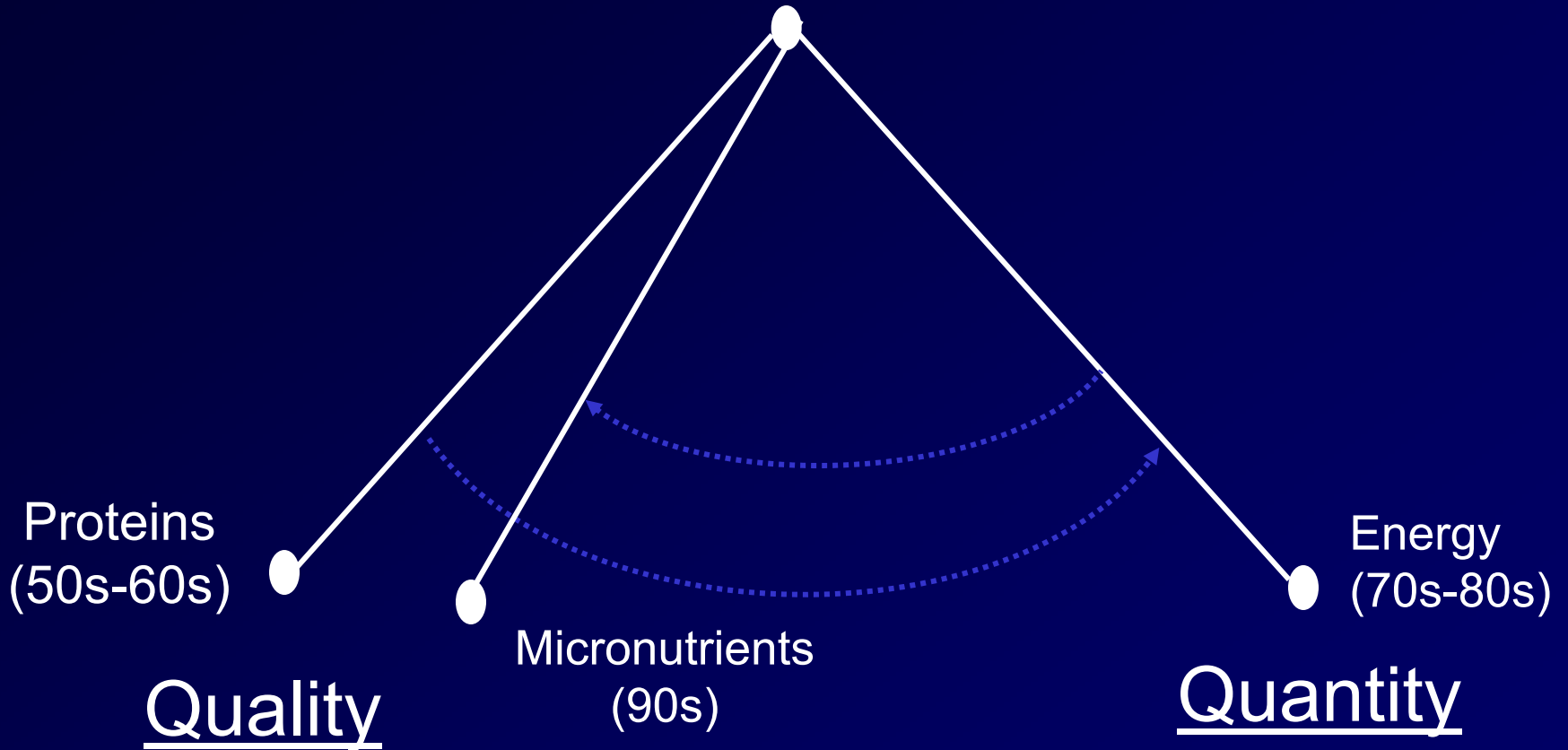
Early nutrition and human capital formation

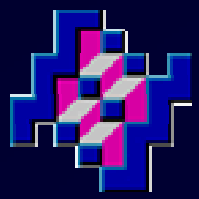


Nutrition interventions during pregnancy and the first years of life have positive effects on human capital formation and may increase productivity; therefore, may impact socioeconomic development



The nutrition pendulum



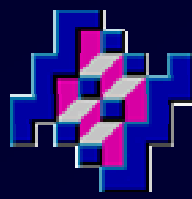


Meta-Analysis of randomized controlled clinical trials on Vitamin A supplementation and mortality in children⁺

# studies	=	8
# children	=	164,325
Average reduction	=	-23%
95% C.I.	=	-39% a -16%



⁺ Beaton y Martorell (coordinators), ACC/SCN, 1993



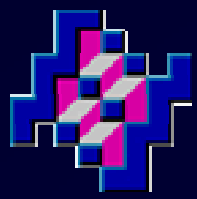
Zinc supplementation and growth in length: a meta-analysis of randomized clinical trials⁺

of studies = 33

Effect size = 0.350 D.E.

95% I.C. = 0.189 a 0.511

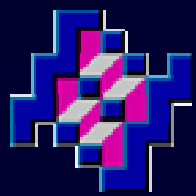




Zinc and morbidity in children: pooled analysis of randomized clinical trials



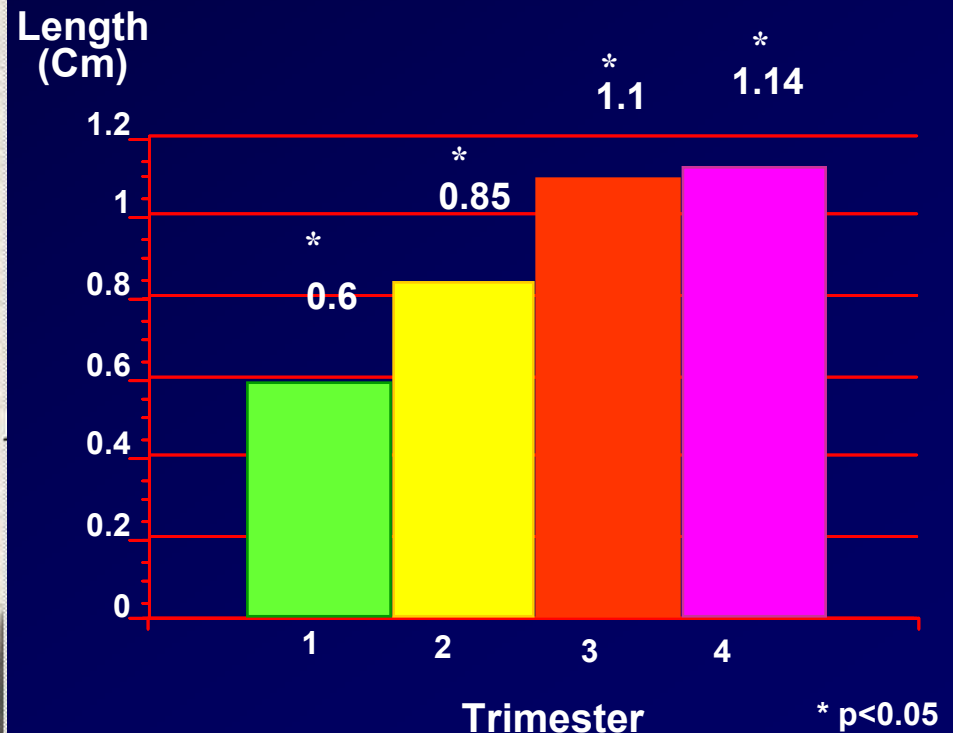
Reduction in incidence	95% I.C.
Diarrhea	
-18%	-28% a -7%
Pneumonia	
-41% ^b	-59% a -27%



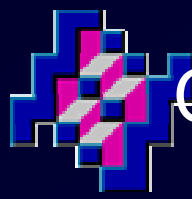
Effect of multiple micronutrient supplementation on growth



Growth in length of multiple micronutrient supplemented relative to control infants in a randomized trial in Mexico¹



¹ GEE. Adjusted for: initial length and age, sex, breastfeeding and SES



Characteristics of an adequate complementary feeding

Exclusive Breastfeeding for 6 mo

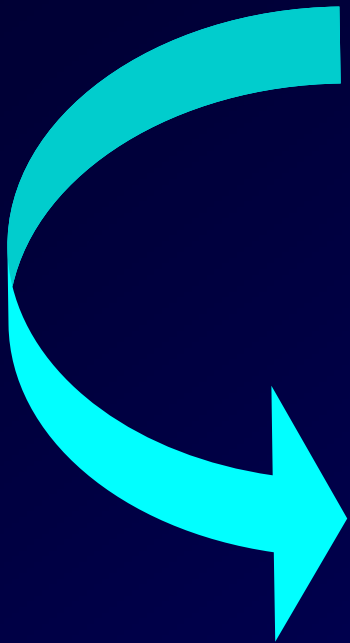
BF and Adequate Complementary 6-24 mo

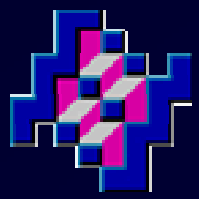
Children 6-24 months

- Low gastric capacity
- High nutrition requirements
- Frequent infections

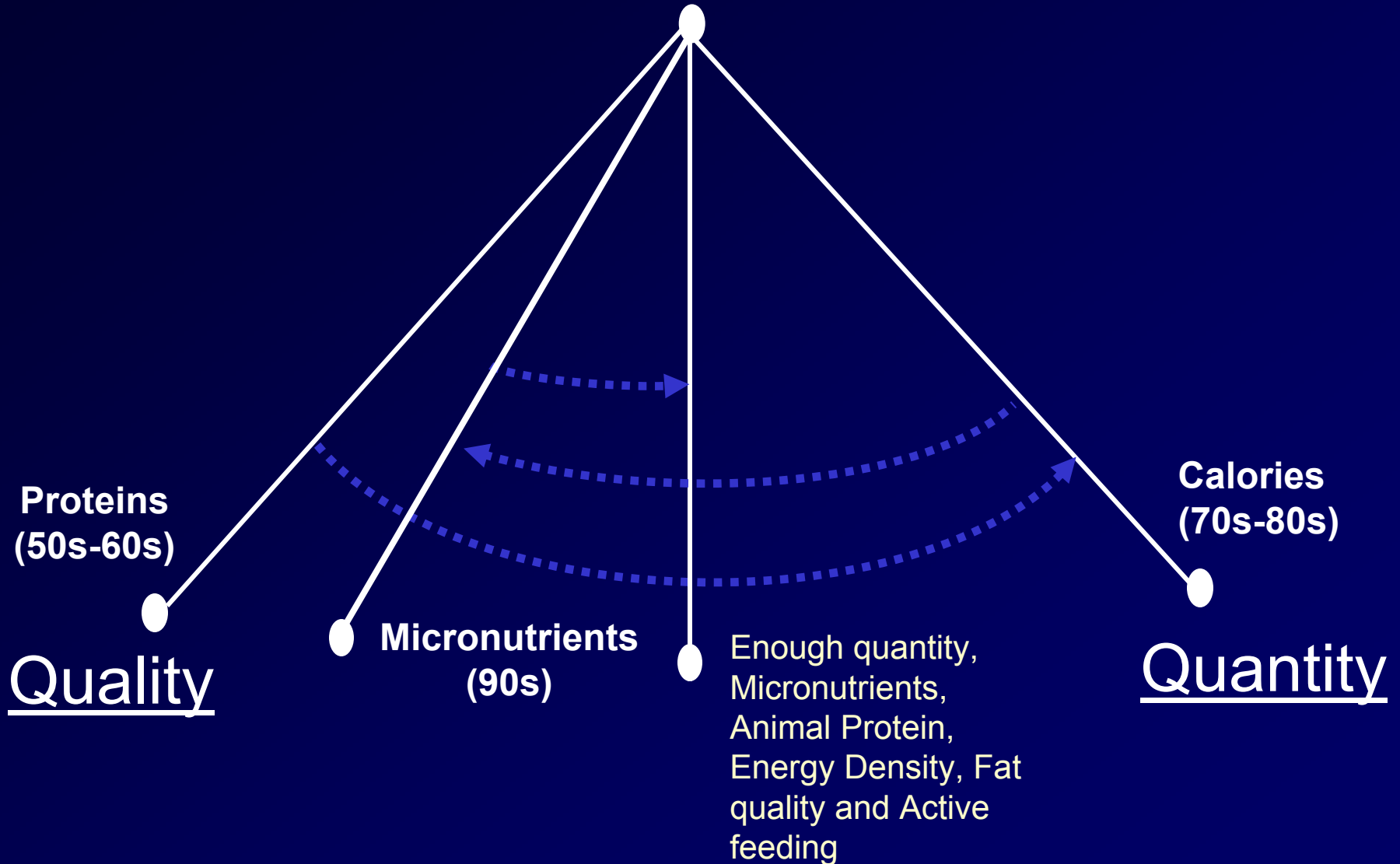
They need (relative to adults)

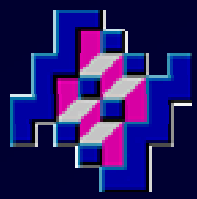
- High energy and high nutrient density
- High frequency of feeding 4 or more meals a day
- Active feeding (Maternal feeding behavior)





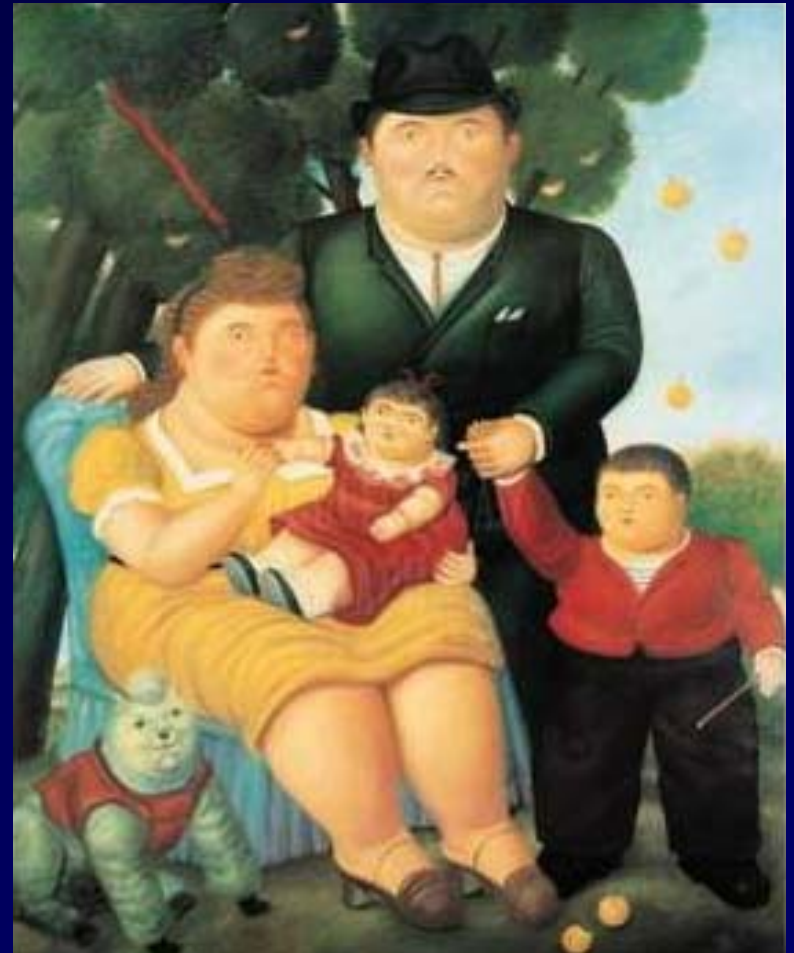
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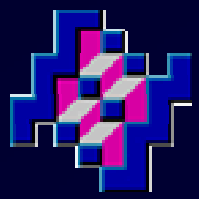




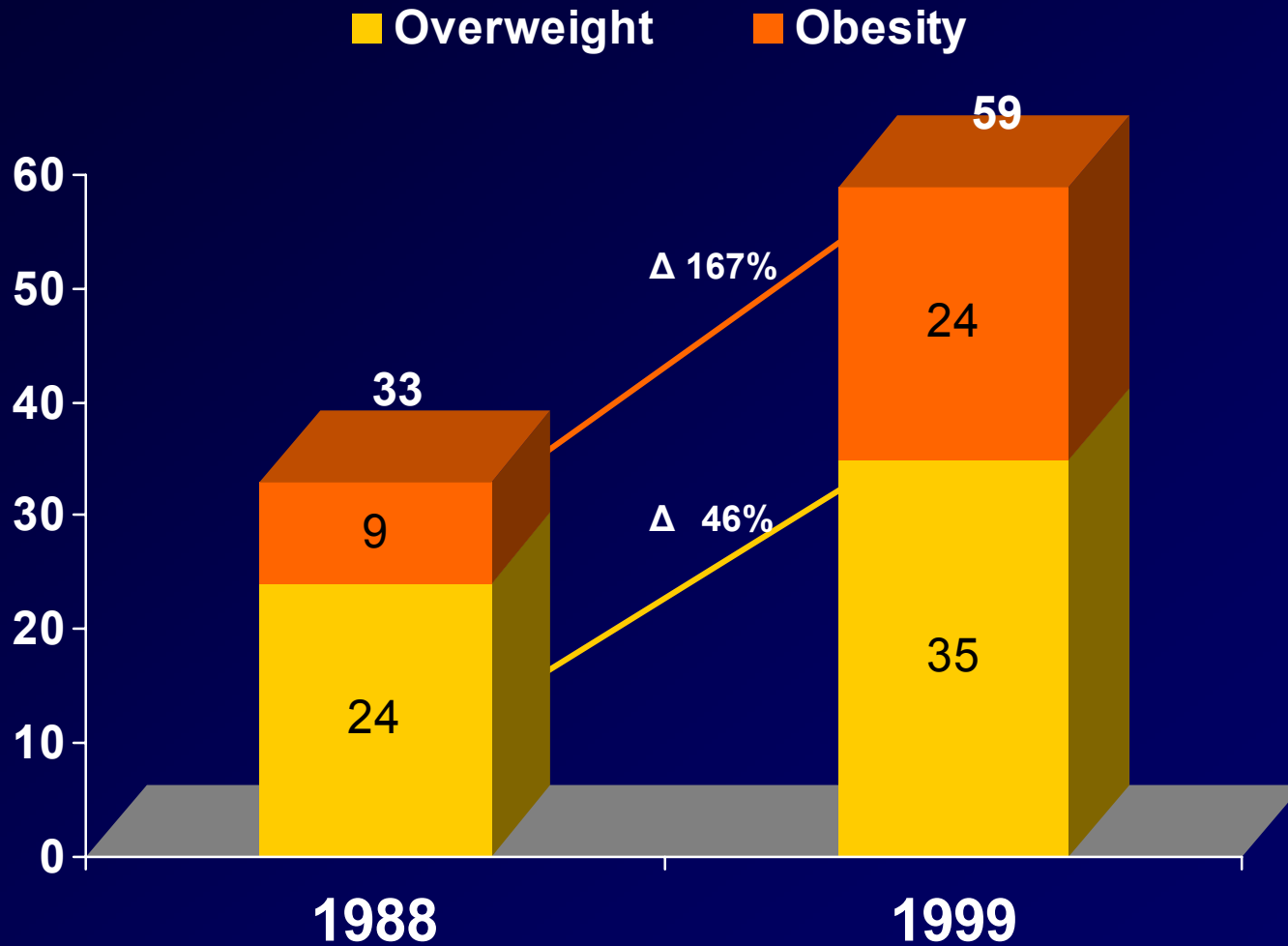
The nutritional transition in Latin America: Are we already late in fight against obesity?

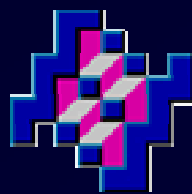
- Rapid increase of obesity and nutrition related chronic diseases (diabetes, hypertension, CVD)
- Obesity no longer a disease of the rich
- Dietary shifts to higher fat and refined carbohydrate intake



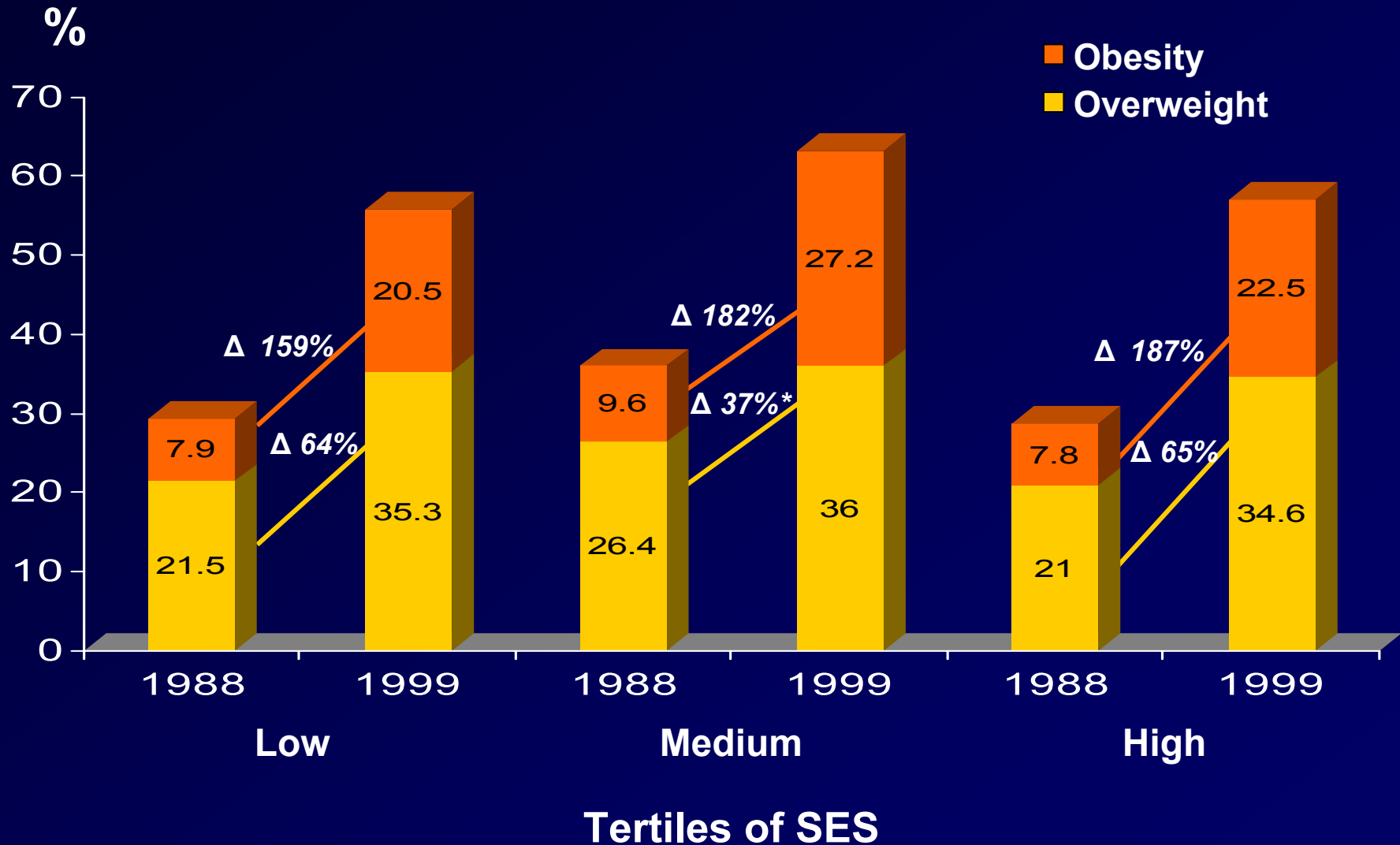


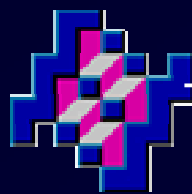
Prevalence of overweight and obesity in 1988 and 1999 in 18-49 y old Mexican women



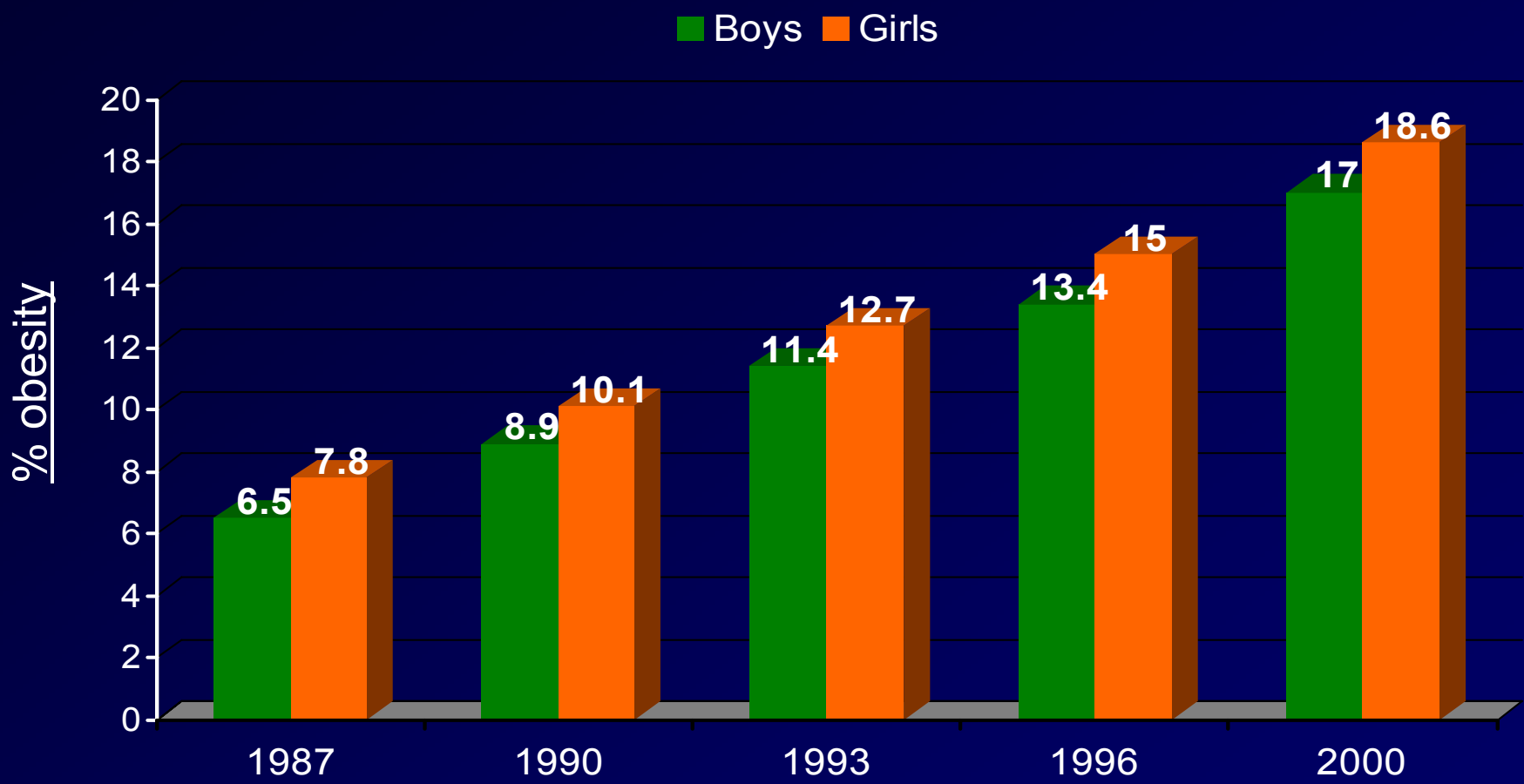


Changes in overweight and obesity from 1988 to 1999 in 18-49 y old Mexican women, by SES



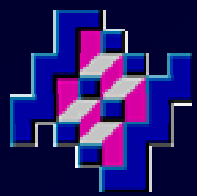


Trends in the prevalence of obesity in first grade school children in Chile (1987-2000)

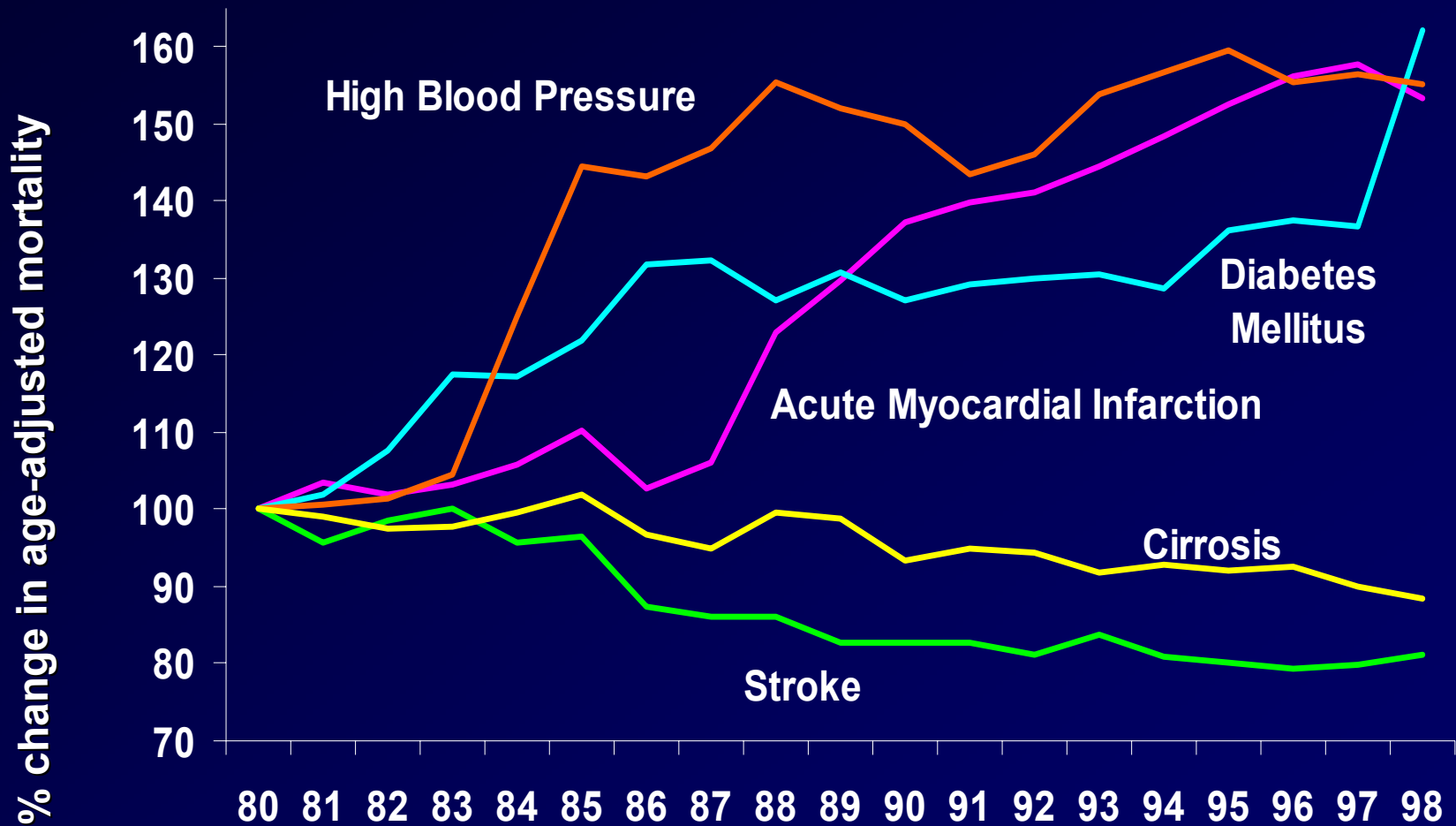


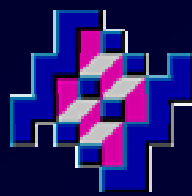
* Weight for age Z-score >2

Source: Albala, 2001

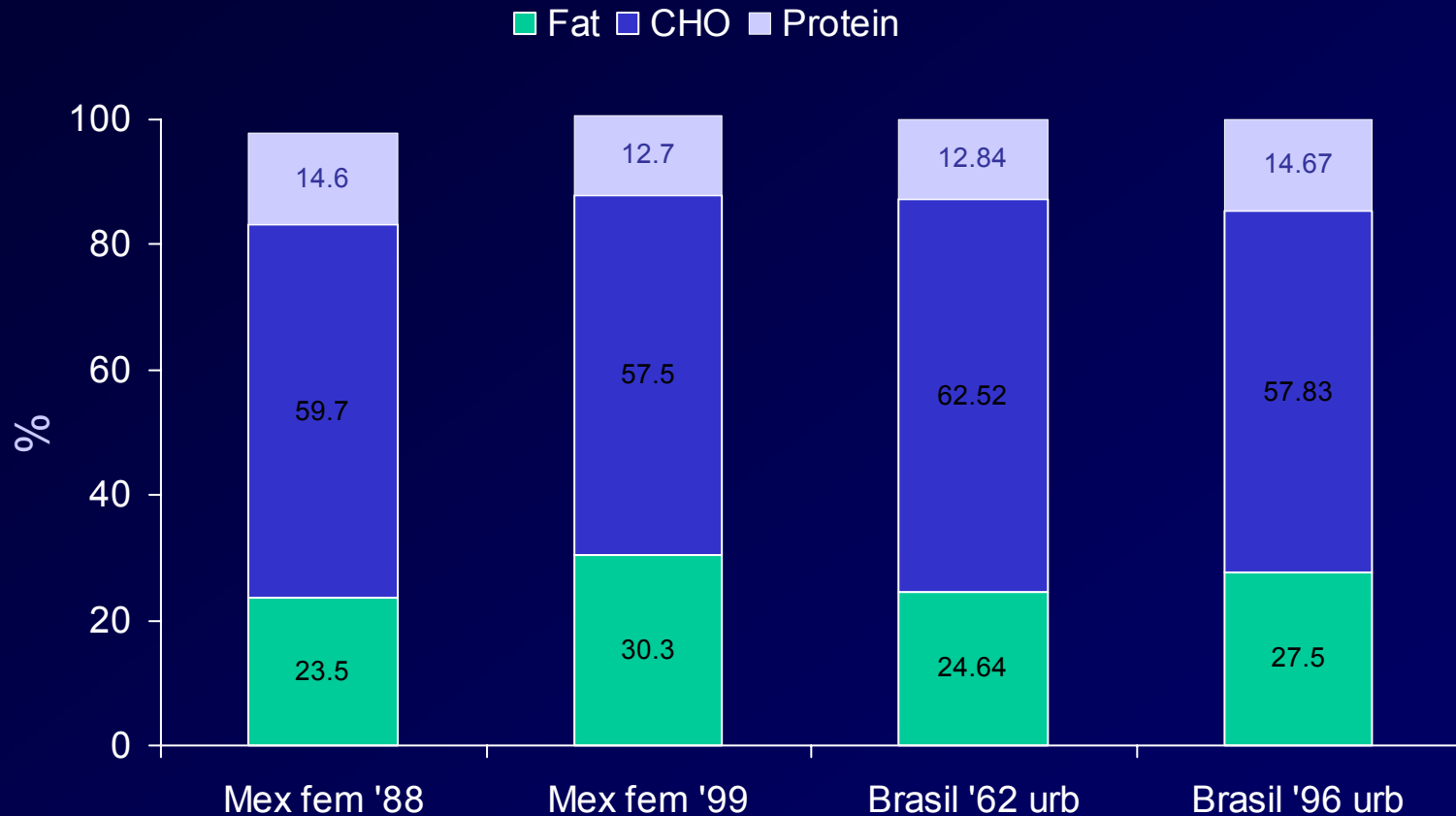


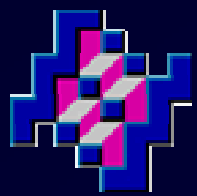
Relative change in age-adjusted mortality rates for nutrition-related NCCD in Mexico from 1980 to 1998





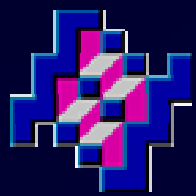
Trends in the dietary macronutrient intakes in two Latin American Countries





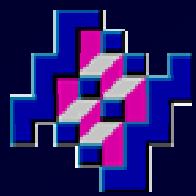
Hypothesis about fetal and early life origins of chronic diseases in the adult (Barker Hypothesis)

- Low birth weight newborns and those with retarded growth in infancy: ↑ risk of non communicable chronic diseases (NCCD)
- Genes are determinants of NCCD but expression of genes is modified by the nutritional status in early life
- If confirmed, new paradigm: Undernutrition and overnutrition (obesity) are not separate and opposite nutrition conditions; instead they are linked and are caused by an adverse nutritional environment in early life



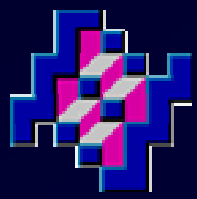
Summary of achievements

- Clinically severe undernutrition (CSU) identified, terminology standardized
- CSU studied, more efficient rehabilitation achieved, fatality rates reduced
- Pellagra identified as a nutrition deficiency rather than caused by a pathogen or toxin
- Synergism between nutrition and Infection: importance of PHC for nutrition and of nutrition for health
- Identified importance of targeting nutrition interventions in pregnancy and first 2 years



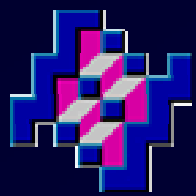
Summary of achievements

- Agreement on debate about the nature of nutritional problems in children:
 - Importance of macro- and micro- nutrients, quality, balance and maternal feeding behavior)
- Long term effects of early nutrition in human capital
- Micronutrients improve growth and reduce morbidity and mortality
- Recognition and description of the Nutritional transition



Nutrition Situation 100 years ago

- By turn of century:
 - ↑ mortality rates
 - ↑ prevalences of:
 - diarrhea
 - pneumonia
 - measles
 - clinically severe undernutrition
 - ↑ wasting and stunting,
 - goiter, other severe micronutrient deficiencies

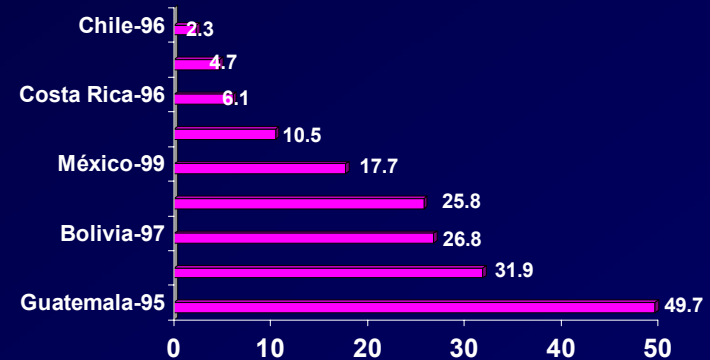


Nutrition situation today

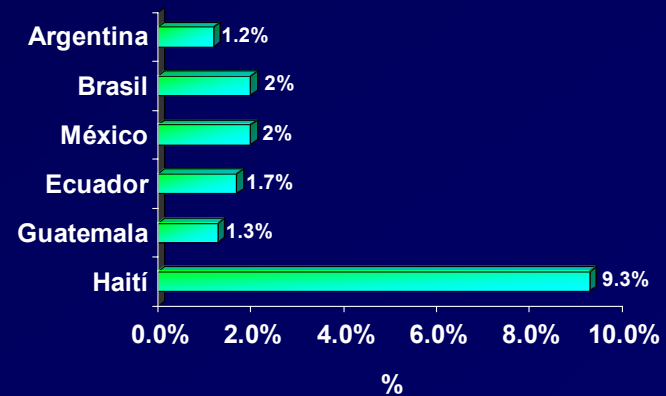
Today:

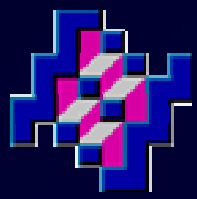
- ↓ IMR and morbidity due to diarrhea and pneumonia, ↓ measles
- Stunting but very little wasting
- Almost no goiter and clinical micronutrient deficiency

Prevalence of stunting in Latin America



Prevalence of wasting in Latin America



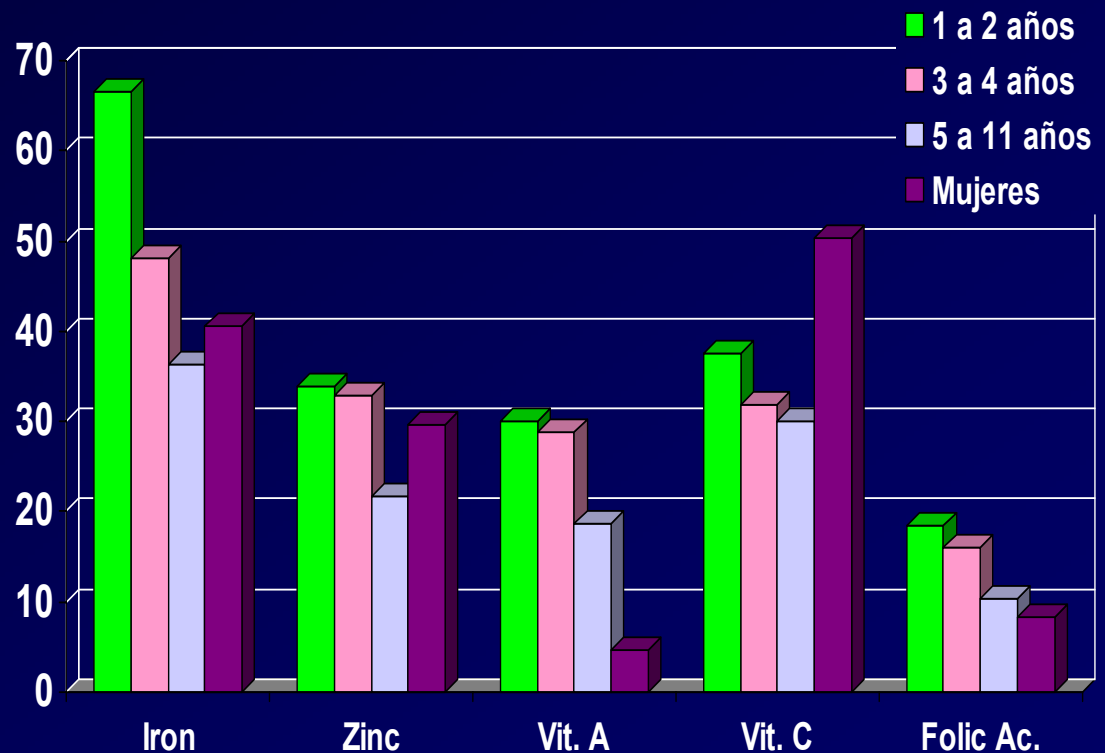


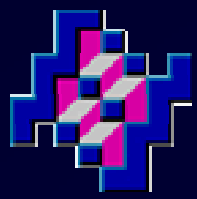
Nutrition situation today

Today:

- Anemia
- Micronutrient deficiencies
 - Iron
 - Zinc
 - Vitamin A
 - Folic acid
- Overweight, obesity and nutrition related chronic diseases

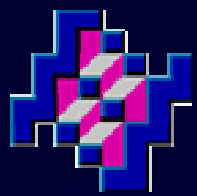
Prevalence of micronutrient deficiencies
in Mexico 1999





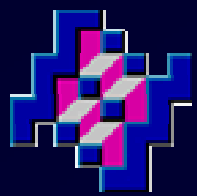
Challenges for nutrition research in LA

- **Micronutrient deficiencies**
 - Genetic modified plants to ↑micronutrients content and ↑bioavailability
 - Research on iron fortificants: ↑bioavailability for LA foods (↑phytic acid)
 - Enhancers of iron and zinc bioavailability in LA foods
 - Nutrient-nutrient competition for absorption (iron and zinc)
 - Animal tissue foods as sources of ↑bioavailable iron and zinc



Challenges for nutrition research in LA

- **Overnutrition and NCCD**
- Risk factors for nutrition related chronic diseases
 - Diet
 - Total Fat, Quality of fat, Refined Carbohydrates (glycemic index of foods), Total energy
 - BMI, body composition and Physical Activity
- Diet and Cancer
- Antioxidants in the diet and health risks
- Phytochemicals that promote health
- Is it possible to have genetic biomarkers for targeting interventions?



Challenges for nutrition research in LA

- **Other topics**
- **Assessment of nutritional status**
 - Less invasive methods for micronutrient deficiencies (micro-methods)
 - Biomarkers of deficiencies with inaccurate indicators (zinc)
- **Importance of fat quality in infant nutrition**
- **New dietary methods for current dietary habits and patterns**
- **Social sciences research to incorporate nutrition knowledge into policy and programs**
- **Social sciences research on food behaviors and physical activity (determinants, barriers, motivation factors)**