

Diet, Obesity and Genes (DiOGenes)

-
a European randomized-controlled
dietary family-level intervention

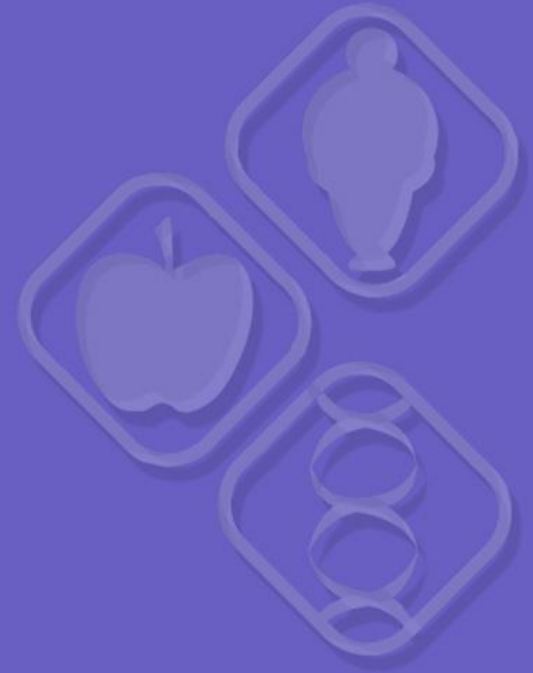
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Lecturer in Public Health Nutrition
BRU Seminar series, 25th September 2013



Outline

- Study objectives
- Partners
- Methods
- Main results



The DiOGenes (Diet, Obesity and Genes) study



What is the diet that will be most effective in preventing weight regain following weight loss?

DiOGenes: core objectives

Targeting the obesity problem through:

new findings linking :

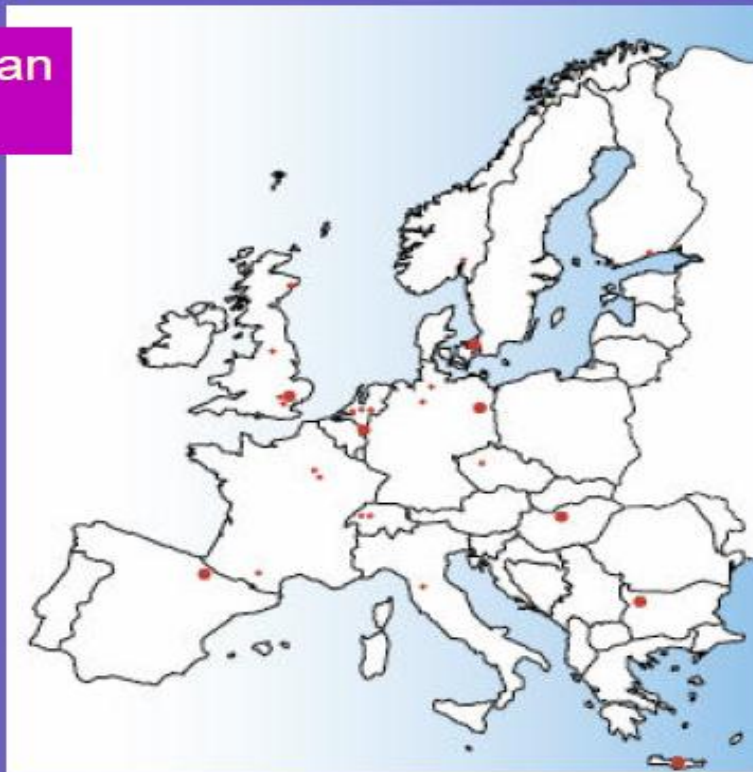
- Dietary factors (GI, protein)
- Genetic factors
- Behavioural factors
- The physiology of satiety and satiation

leading to applications for consumer benefit as:

- Innovative consumer food products or clinical foods
- New diagnostic tests for professional or consumer use
- Improved dietary advice from health professionals, media, industry.

DiOGenes: the partners

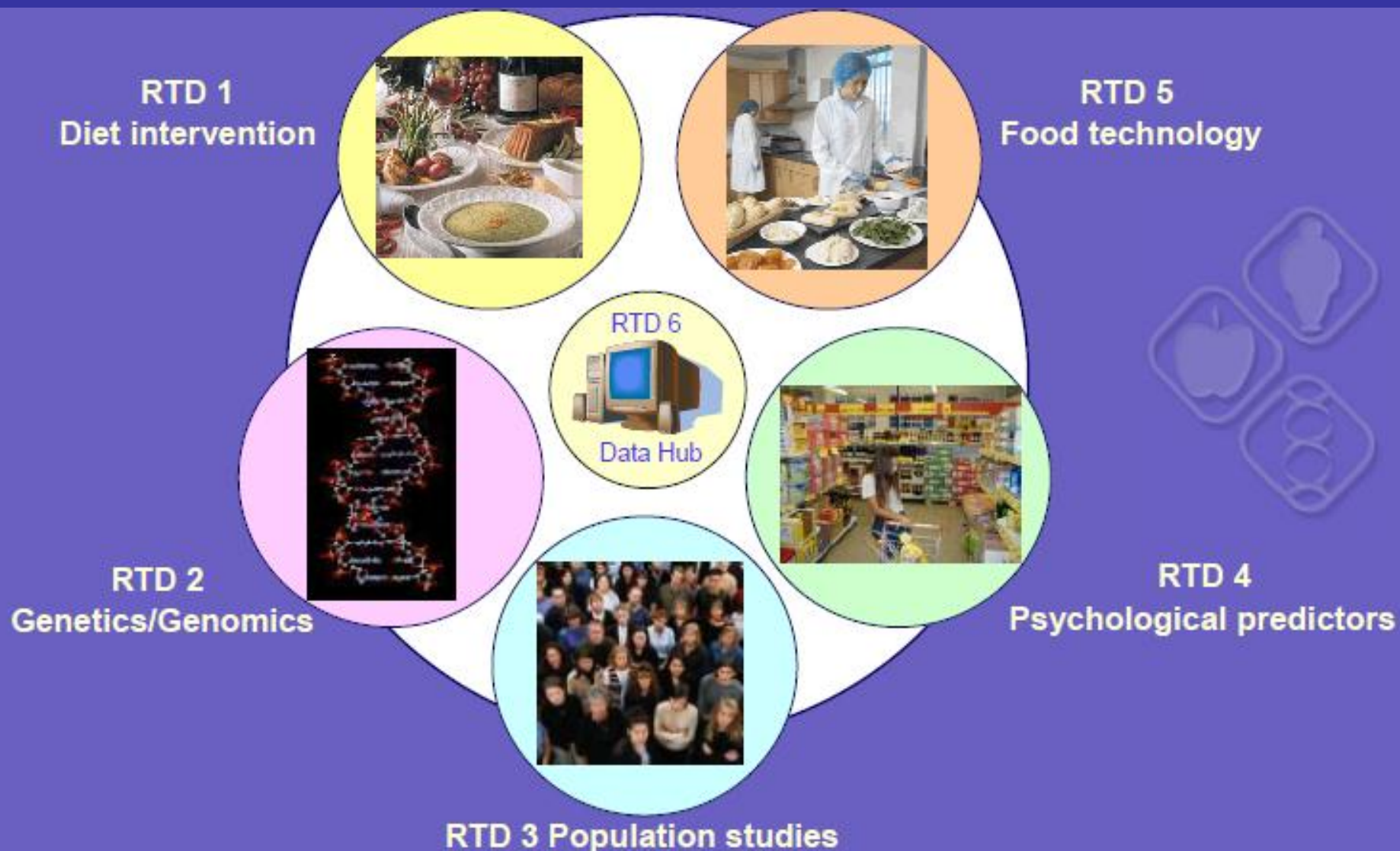
A truly European
project



- 5 year project (2005-2010)
 - € 20.1 million total budget (€ 14.5 million from EU)
- 14 EU countries: 25 research institutes, 3 food industries, 5 SMEs**



DiOGenes: the research lines



RTD 3 Population studies

www.diogenes-eu.org

DiOGenes: Inclusion criteria

Families with:

- 1 adult $30 \leq \text{BMI} < 45$ and 1 adult $\text{BMI} > 28$
- + minimum 1 child aged 5-18y iso-BMI > 25 living at home

Changed to:

- Minimum 1 adult with $27 \leq \text{BMI} < 45$
- + minimum 1 child aged 5-18y (regardless of BMI) living at home and agrees to examination
- Adults aged 18-65y
- In general good health

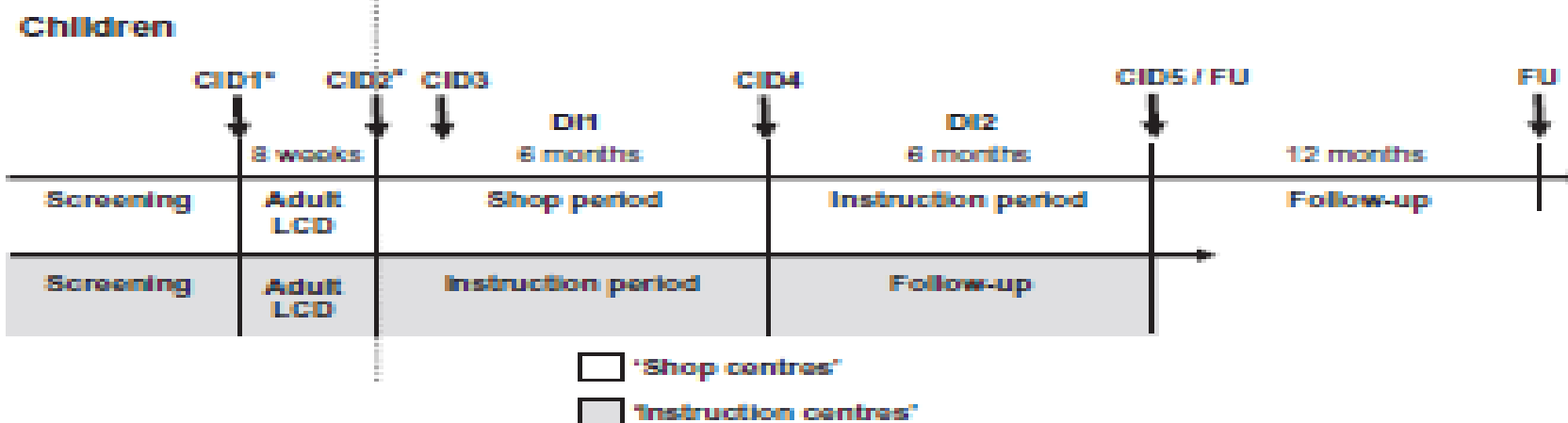
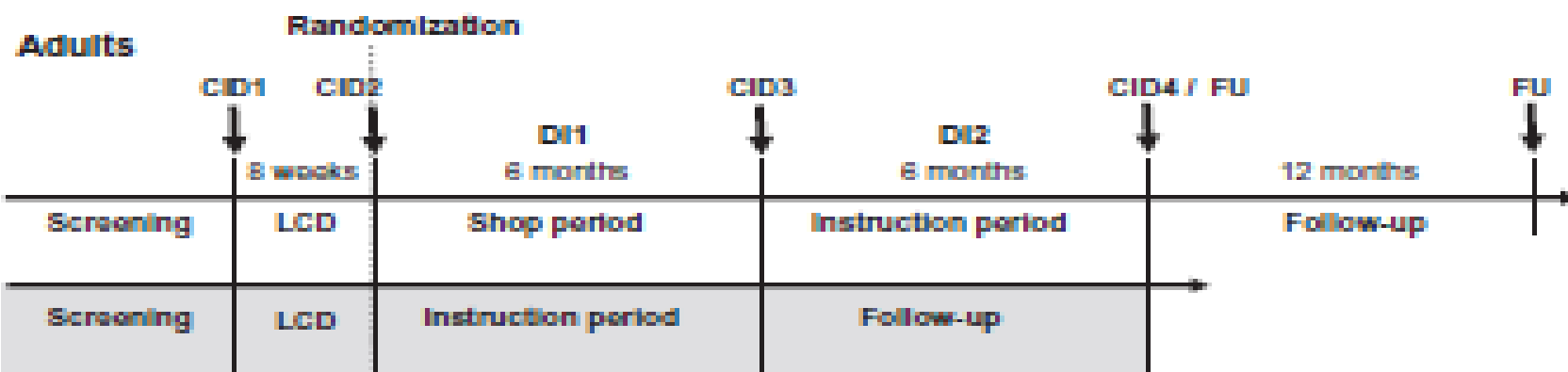


RTD1: Dietary intervention

- Initial 8-week weight loss phase with low-calorie (LCD) diet
- Randomization
- 6-12 month follow-up intervention in randomized families
 - Screening of ~ 900 adults + 350-1050 children
- 6-month supermarket weight maintenance + 6-month instruction weight maintenance in two centres
- 6-month instruction weight maintenance in six centres

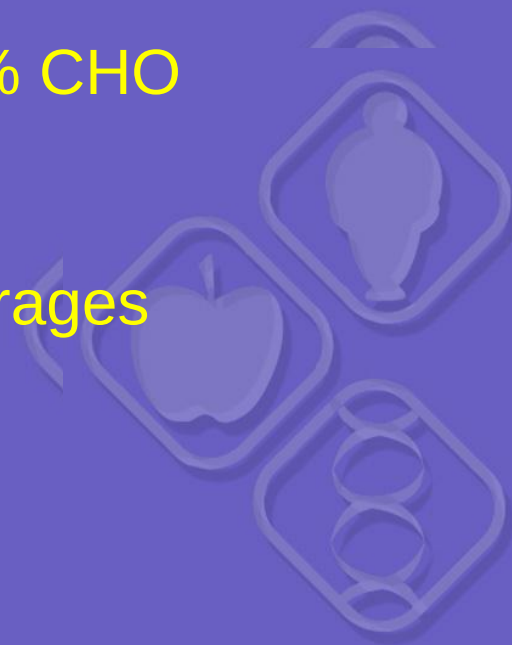


DiOGenes: experimental design



DiOGenes: LCD period

- Meal replacement powder products (800 kcal/ day)
 - 15-20% fat, 35-40% protein and 45-50% CHO
- + 400 g of specific vegetables per day
- Seasonings, sweeteners, non-calorie beverages
- Total of 800-1000 kcal/ day



Aim of LCD period:

Loss of $\geq 8\%$ of initial body weight → Randomization

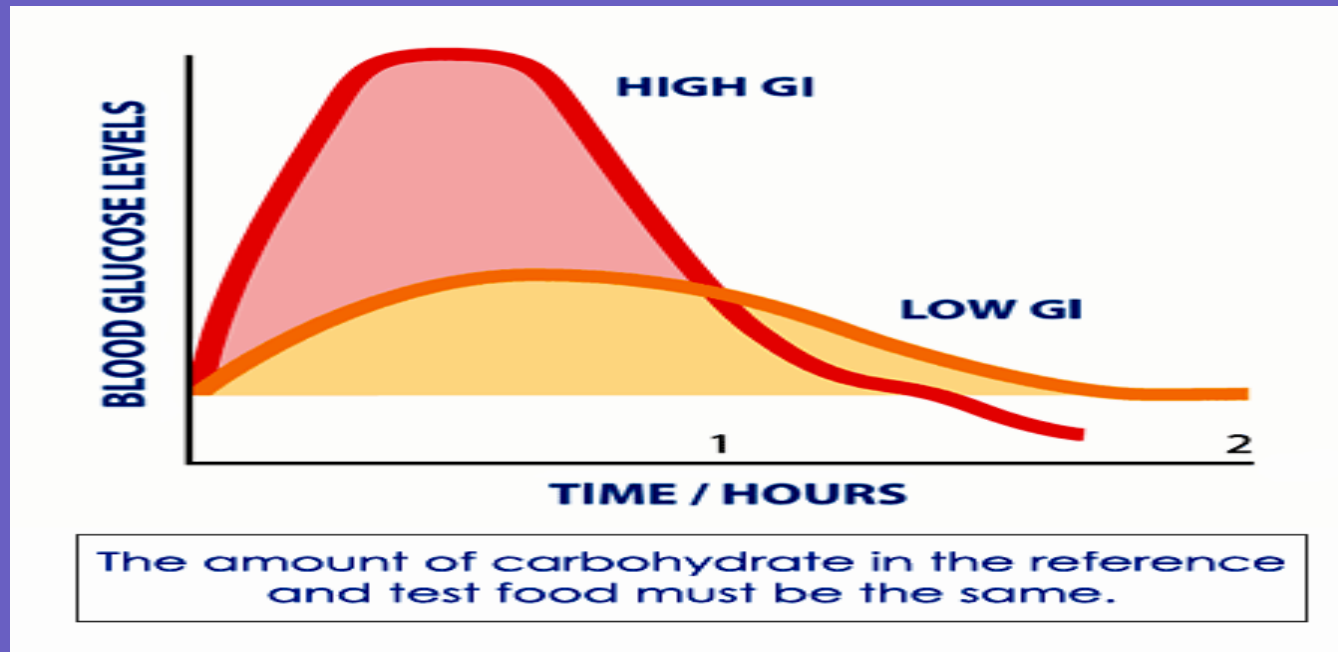
Dietary factors of interest

- Glycemic index (GI)
- Protein



Glycemic response to carbohydrates

- A food with a high GI causes a rapid rise in blood glucose
- A food with a low GI brings about a slower increase in blood glucose



Brand-Miller et al, Am J Clin Nutr, 2002; 76: 281S-5S

What about protein?

- Highest satiety than carbohydrates or fat¹
- Increase in energy expenditure and promotion of fat oxidation¹
- Promotion of weight loss and prevention of weight re-gain²
- Preservation of lean body mass during weight loss¹

¹ Paddon-Jones et al, Am J Clin Nutr. 2008; 87: 1558S-61S

² Due et al, Int J Obes Relat Metabol Disord. 2004; 28: 1283-90

High-protein diets in children

- High-protein (19-23%) vs. normal-protein (15%) diet did not improve body weight or body composition in obese children^{1, 2}
- High-protein vs. high-carbohydrate meals increased satiety in normal-weight children³

¹ Gately et al, Obesity. 2007; 15: 1527-1534

² Rolland-Cachera et al, Int J Obes. 2004; 28: 514-519

³ Araya et al, Int J Food Sci Nutr. 2000; 51: 119-124

Glycemic index in children's diets

- LGI vs. low-fat (25-30%) diet → decrease in body weight and BMI in obese children¹
- GI positively associated with body fat in adolescent boys²
- LGI vs. HGI meals → decrease in energy intake^{3, 4} and hunger⁴ in children and adolescents

¹ Spieth et al, Arch Pediatr Adolesc Med. 2000; 154: 947-951

² Nielsen et al, Br J Nutr. 2005; 94: 992-997

³ Ludwig et al, Pediatrics. 1999; 103: e26

⁴ Warren et al, Pediatrics. 2003; 112: e414

DiOGenes - Dietary composition

1. Low GI + low protein (10-15%)
2. High GI + low protein
3. Low GI + high protein (23-28%)
4. High GI + high protein
5. Control group

25-30% fat



Target:

- 12% difference in protein between LP and HP groups
- 15 points difference in GI between LGI and HGI groups
- *Ad libitum* diets: Changes in satiety → change in body weight

- Group 1: Low protein/ low GI diet



DiOGenes: Dietary composition

- Group 2: Low protein/ high GI diet



DiOGenes: Dietary composition

- Group 3: High protein/ low GI diet



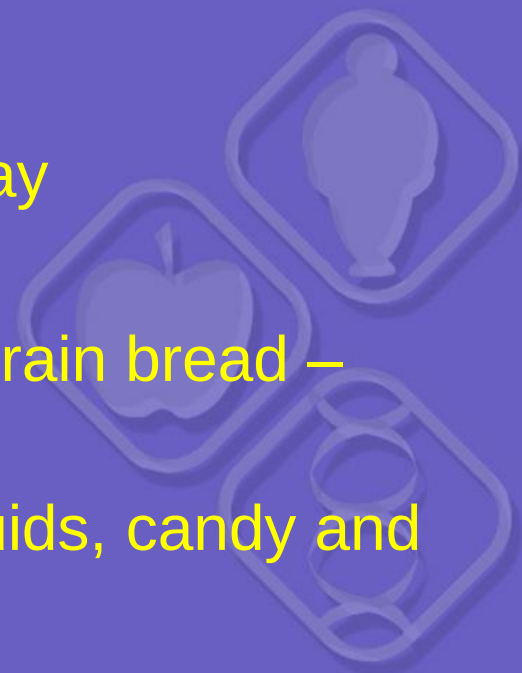
DiOGenes: Dietary composition

- Group 4: High protein/ high GI diet



Dietary composition in control group

- A healthy diet following these "national/ global" recommendations:
- Eating ~ 600 grams fruit & vegetables a day
- Eating fish – several times a week
- Eating potatoes, rice or pasta and whole grain bread – every day
- Limiting sugar intake – especially from liquids, candy and cakes
- Eating less fat – especially from dairy and meat
- Eating varied – and keeping the weight stable



The food industry as a partner in DiOGenes







La pasta No.1 in Italia



KELLOGG EUROPE TRADING LIMITED



PASTALIFE



Good Food, Good Life



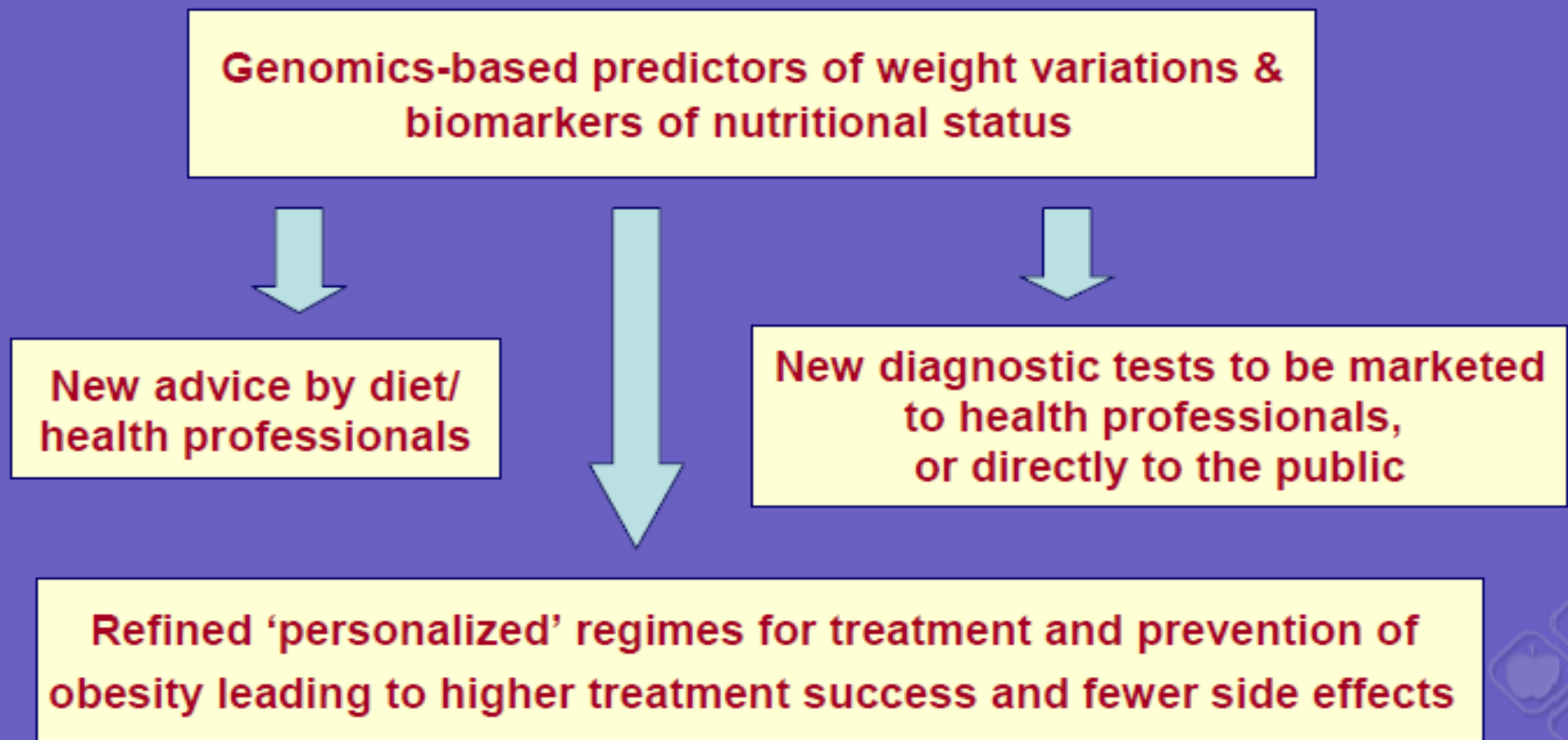
www.diogenes-eu.org



RTD2: Genetics/ genomics

- Identification of gene-nutrient interactions associated with changes in body weight

Results



RTD3: Population studies

- Obesity, genes and diet at the population level (large-scale cohort studies and genetic twin studies)

Results

Epidemiological identification of key dietary factors influencing development of obesity, and risk of co-morbidities, across Europe



Influence on national dietary policy, including diet & health R&D policy, at government and public health level.



RTD4: Psychological predictors of weight gain

Results

A new set of psycho/behavioural tools to identify predictors of weight (re)-gain



Use of the tools (as free downloads), and reference databases, by R&D organisations (companies, institutes) and health professionals

A multi-lingual, software-based, obesity risk and behavioural advice screening tool (ORBAST)



A software-based tool for use by health professionals to tailor obesity-avoidance advice to individual consumers

RTD5: Food technology

Results



Identification of novel food ingredient systems, which induce satiety/satiation while remaining in the preferred sensory range



Innovative products from manufacturers of consumer foods and/or clinical foods

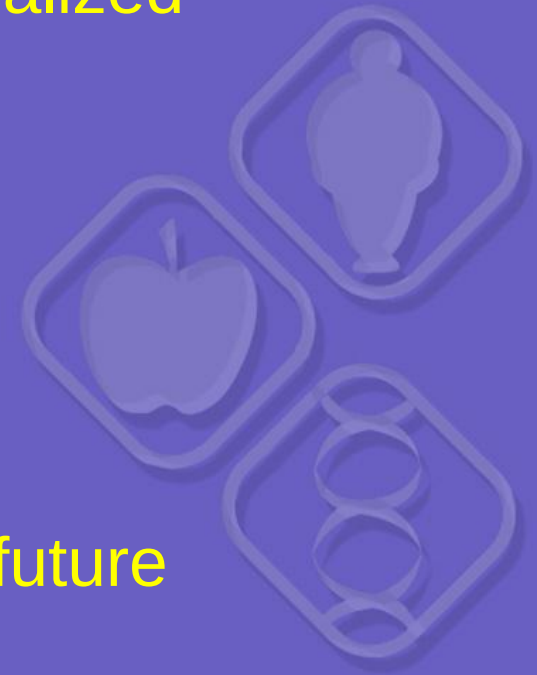


Laboratory analyses partners



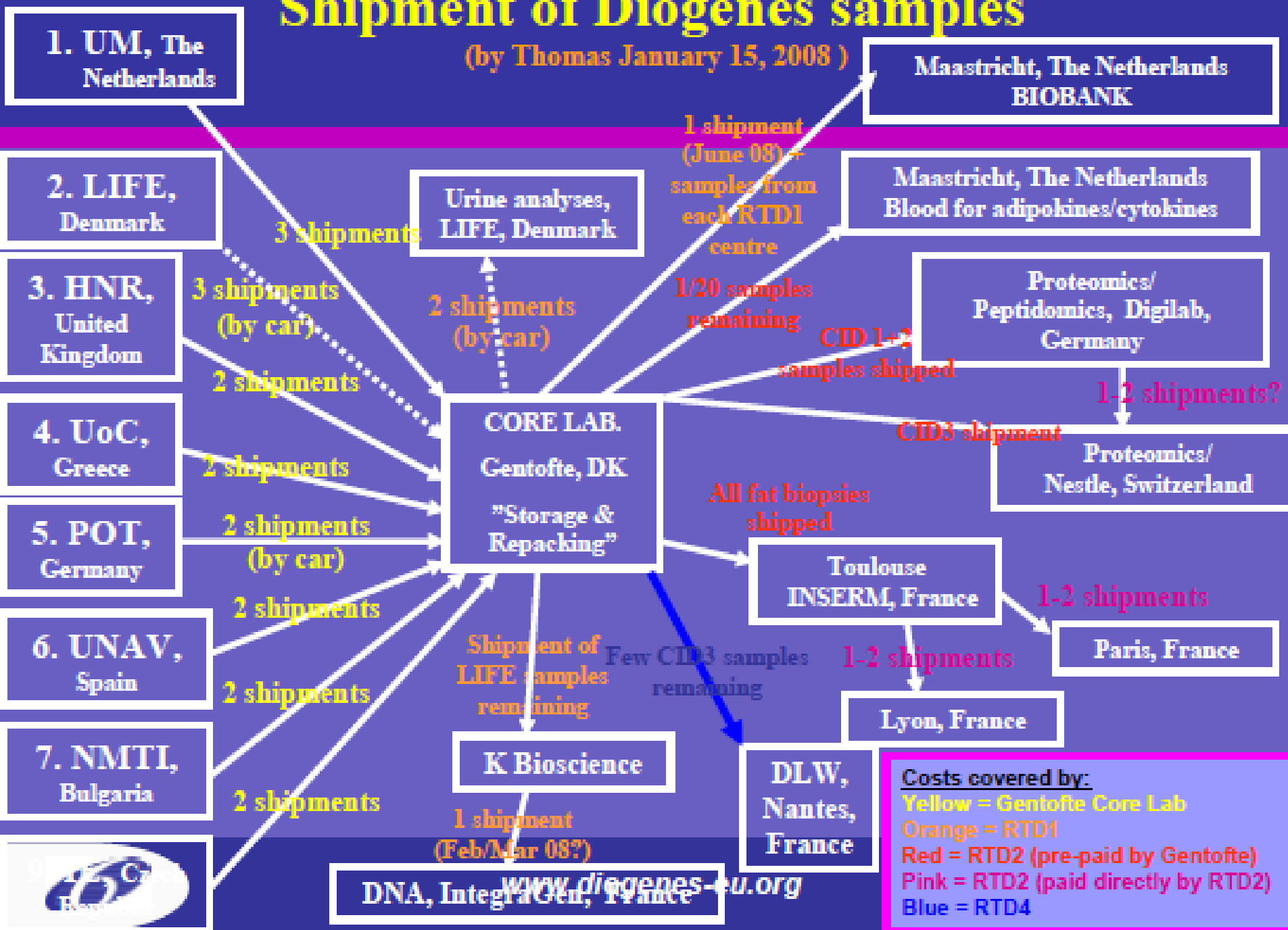
Shipment and analysis of clinical samples - partnered laboratories

- One main laboratory + 11 labs for specialized analyses
 - Blood samples
 - Urine and 24-hour urine samples
 - Fat biopsies
- Spare samples stored in a Biobank for future analyses

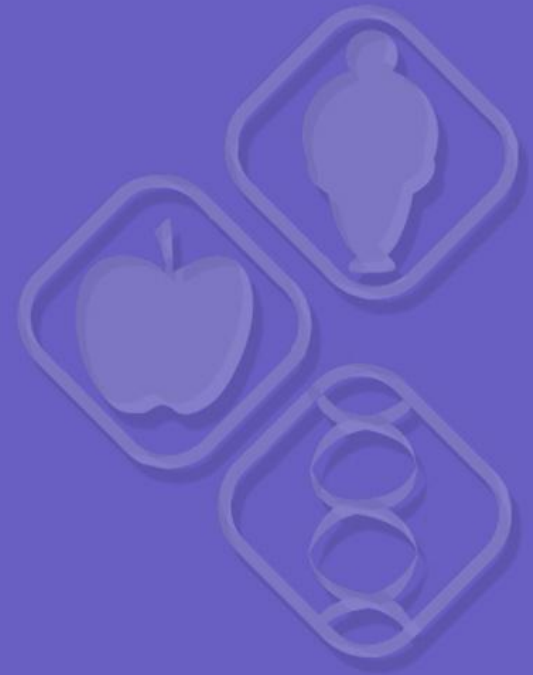


Shipment of Diogenes samples

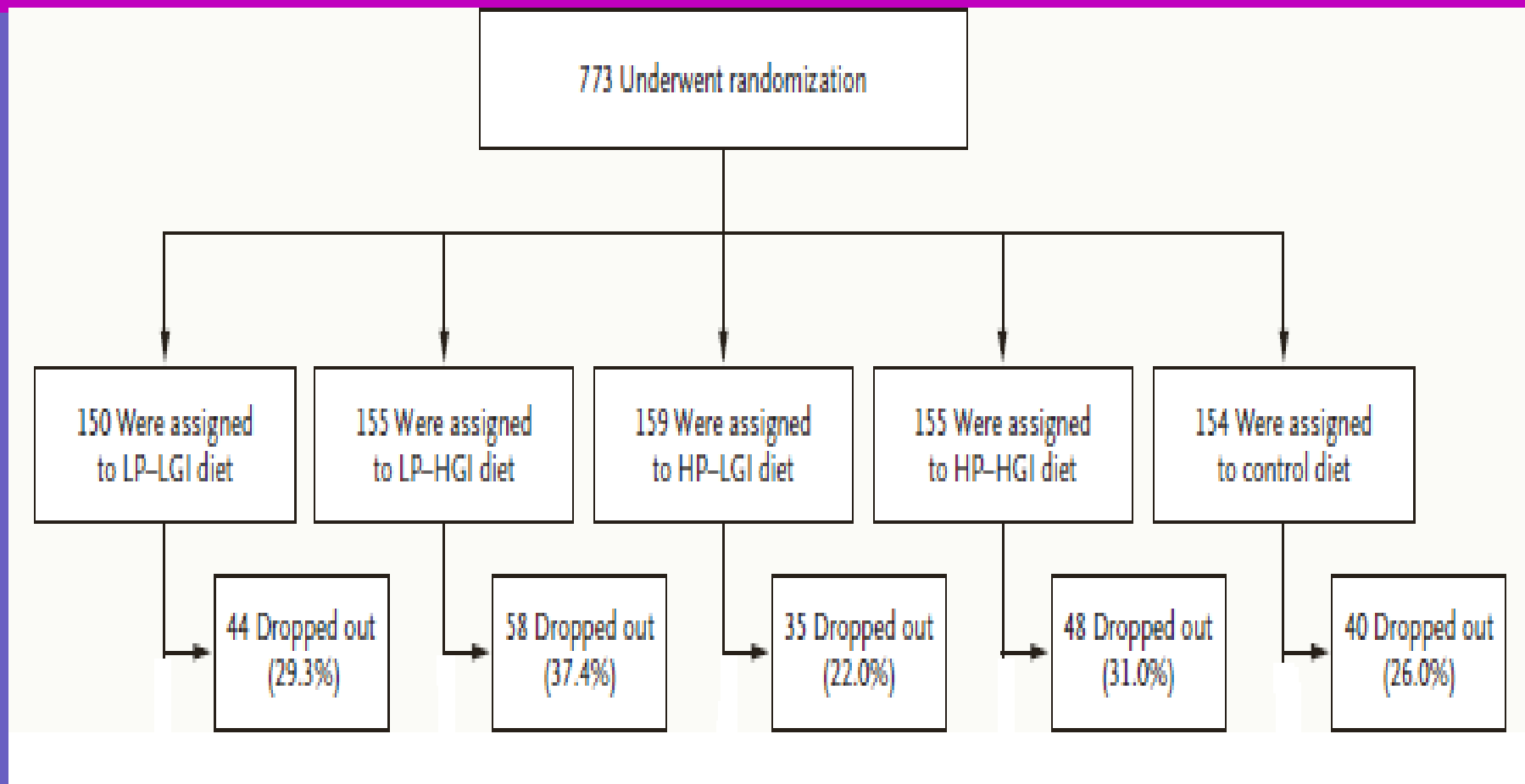
(by Thomas January 15, 2008)



Main Results



Adult data: drop-out



Larsen et al, N Engl J Med, 2010; 363: 2102-2113

Adult data: Dietary intake

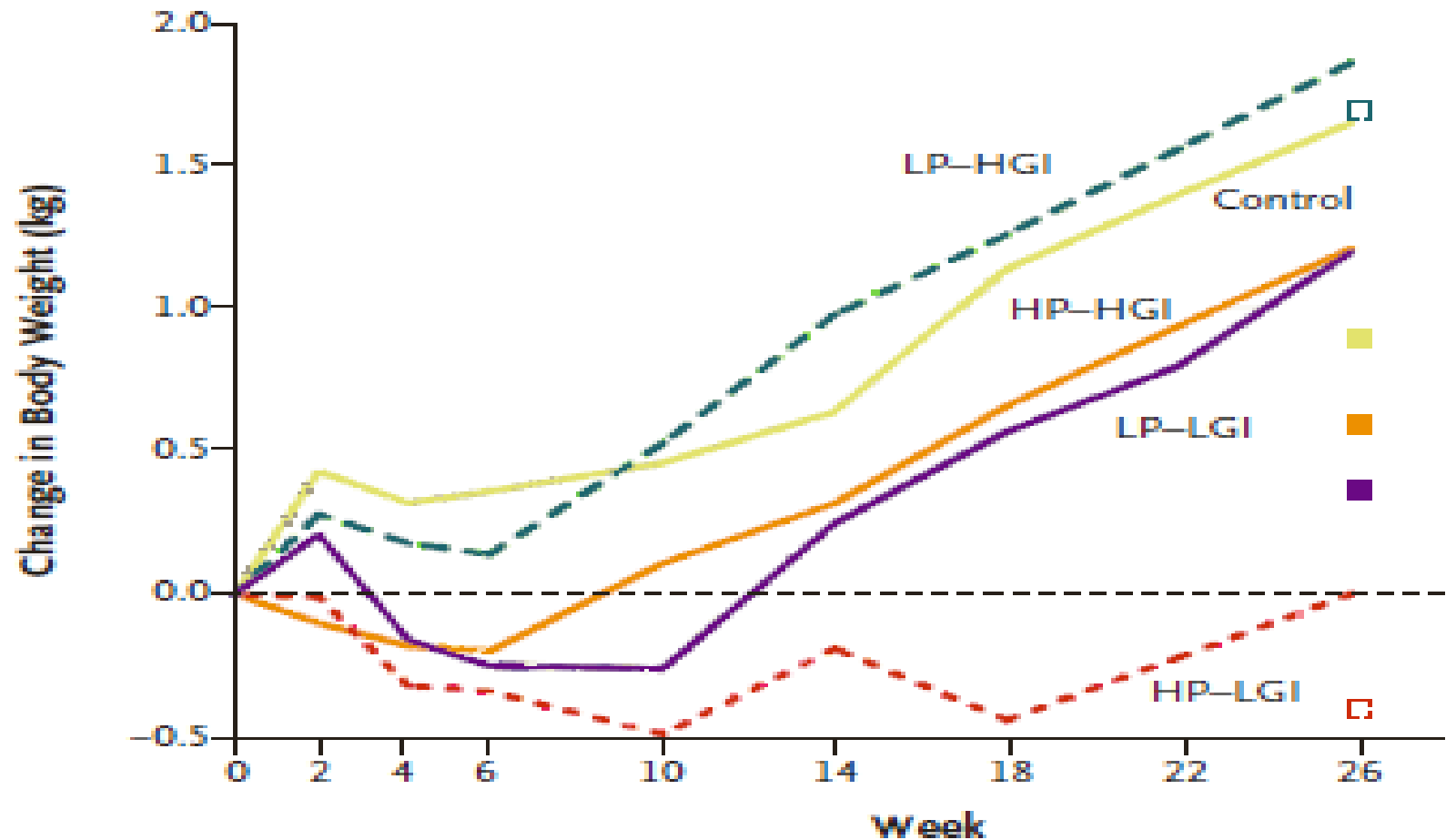
- GI: 5 units difference between LGI and HGI groups ($P < 0.001$, target: 15 units)
- Protein: 5.4% difference between LP and HP groups ($P < 0.001$, target: 12%)

Dietary fat target achieved in all groups



Larsen et al, N Engl J Med, 2010; 363: 2102-2113

Adult data: body weight changes



Larsen et al, N Engl J Med, 2010; 363: 2102-2113

Results in children

- 800 children randomised
- Results based on 465 children who attended all clinical examinations



Papadaki et al, Pediatrics, 2010; 126: e1143-52

Children data: Dietary intake

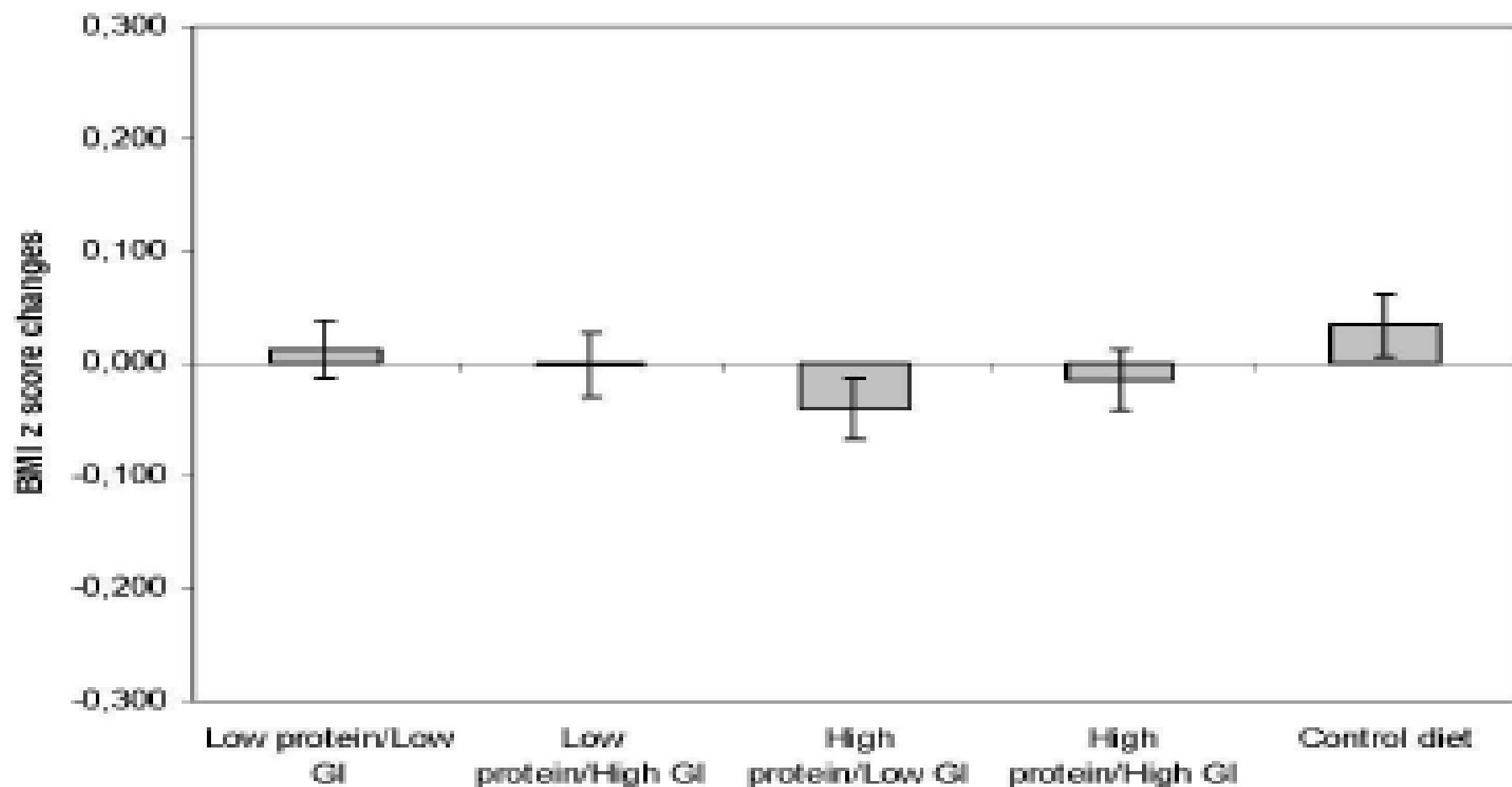
- GI: 2.3 units difference between LGI and HGI groups ($P=0.013$, target: 15 units)
- Protein: 4.9% difference between LP and HP groups ($P<0.001$, target: 12%)

Dietary fat target achieved in all groups

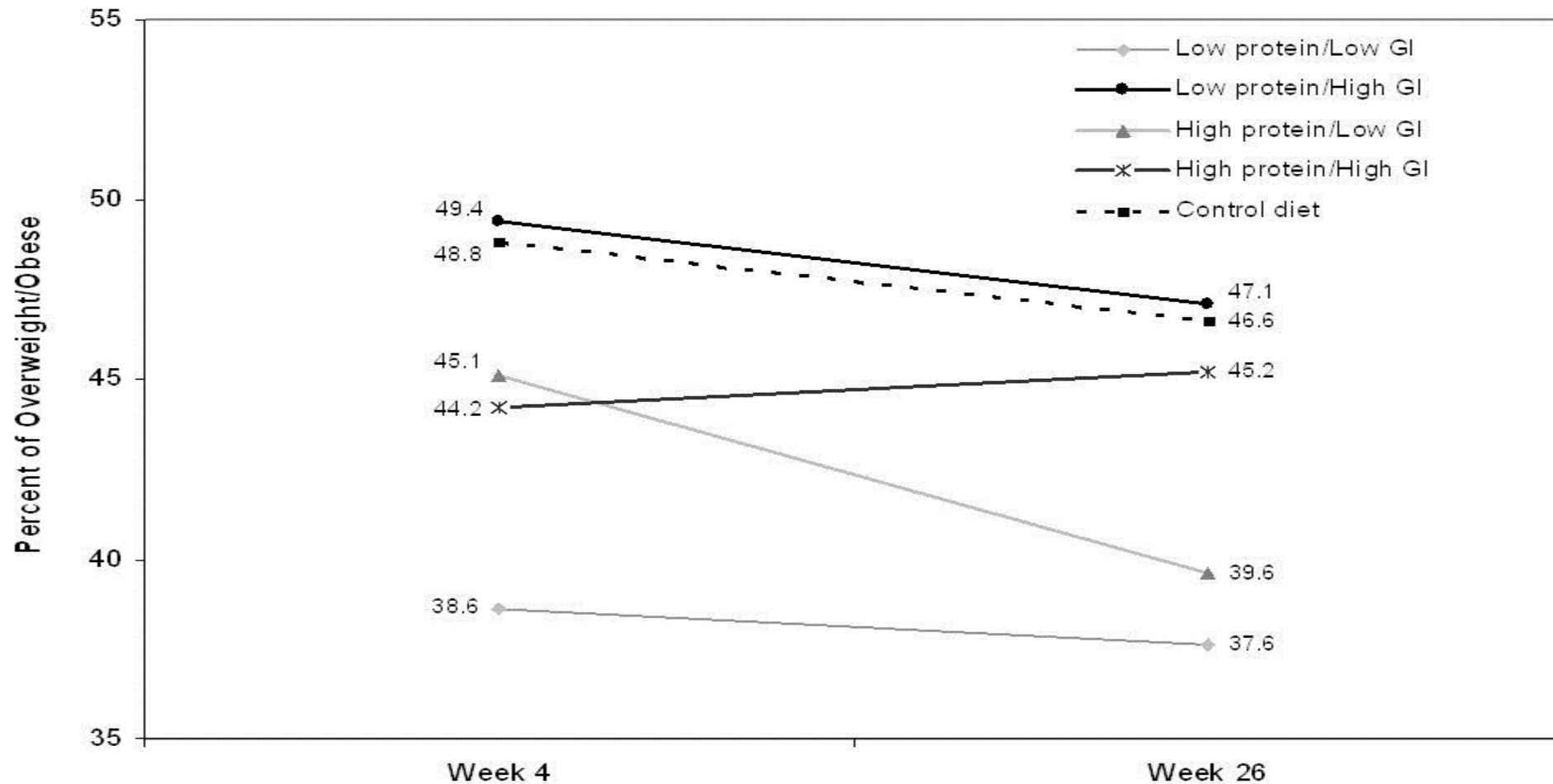


Papadaki et al, Pediatrics, 2010; 126: e1143-52

Children data: BMI z score changes



Children data: Proportion of overweight/ obese children

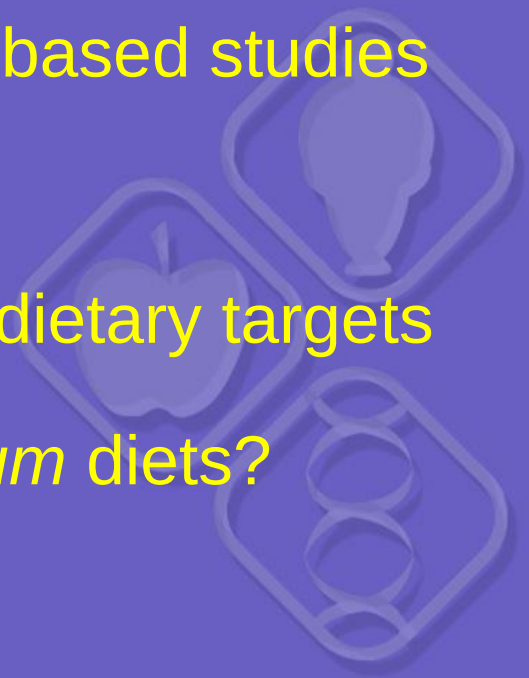


Children data: % body fat

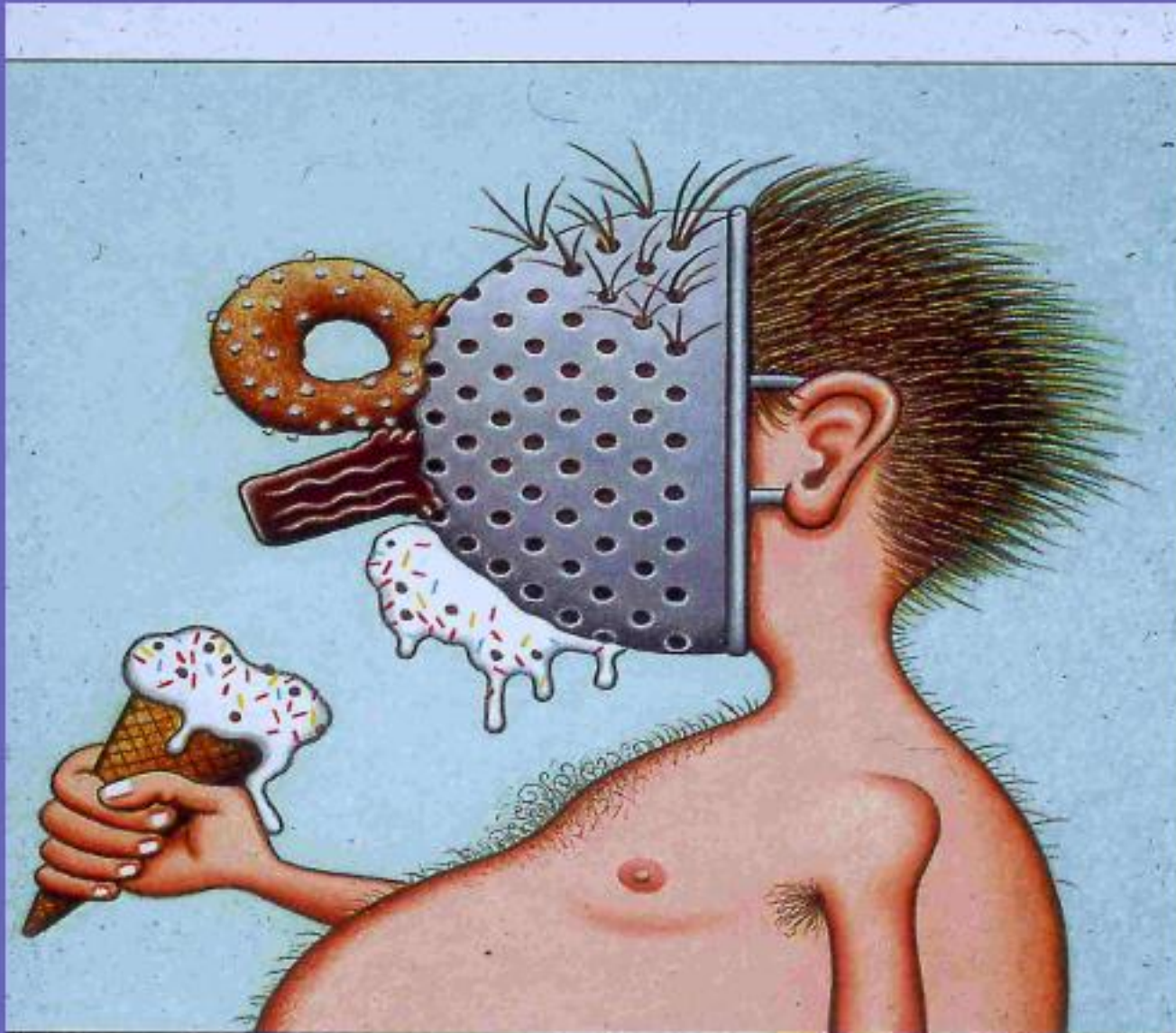
Measurement	N	Diet	N	1 st examination (baseline)	Week 4	Δ -change (week 4 - baseline)	Week 26 (post- intervention)	Δ -change (week 26 - baseline)	Δ -change (week 26 - week4)
				Mean (SE)	Mean (SE)		Mean (SE)		
FM (kg)	295	Low protein/Low GI	57	15.2 (1.1)			14.7 (1.1)	-0.53	
		Low protein/High GI	55	14.9 (1.2)			15.2 (1.1)	0.12	
		High protein/Low GI	68	16.6 (1.1)			16.3 (0.9)	0.12	
		High protein/High GI	56	17.1 (1.1)			16.3 (1.1)	-0.44	
		Healthy diet	59	16.5 (1.1)			16.6 (1.0)	-0.25	
		<i>P</i> -value						.531	
Fat %	262	Low protein/Low GI	60	25.2 (1.2)			24.4 (1.3)	-0.84	
		Low protein/High GI	41	26.7 (1.5)			28.2 (1.5)	1.53	
		High protein/Low GI	57	28.2 (1.3)			28.9 (1.3)	0.73	
		High protein/High GI	56	28.9 (1.3)			29.4 (1.3)	0.44	
		Healthy diet	42	28.4 (1.4)			27.8 (1.4)	-0.63	
		<i>P</i> -value						.040	

Considerations for future interventions

- High attrition rates of children in family-based studies (~42% of randomised children)
- Lack of achievement of protein and GI dietary targets
- Focus on further weight loss or *ad libitum* diets?



Weight management is not easy



The all-you-can-eat-through-a-colander diet