# Strategies to Improve Compliance to Weight Management in Young Women


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**Research Supported by a Grant from Meat & Livestock Australia**


THE UNIVERSITY OF SYDNEY

Metabolism & Obesity Services

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# Weight Gain Greatest in Young Women

**Australian Longitudinal Study of Women's Health**
**Weight Gain (g/year) 1996-2003**

| Young Women (n=5770) | Mid-age Women (n=8942) | Older Women (n=6777) |
|---|---|---|
| **649** (95% CI: 620-678) | **492** (95% CI: 467-516) | **162** (95% CI: 185-140) |

Popkin 2010 – review 1990-2000

http://www.alswh.org.au/

# Weight Gain & Young Women

- Moving away from home
- Busy with work and/or study
- Eating out and alcohol
- Limited shopping/cooking skills
- Budget constraints
- Decline in physical activity
- Cohabitation (friends or partner)
- Marriage & pregnancy

Ball et al 2002

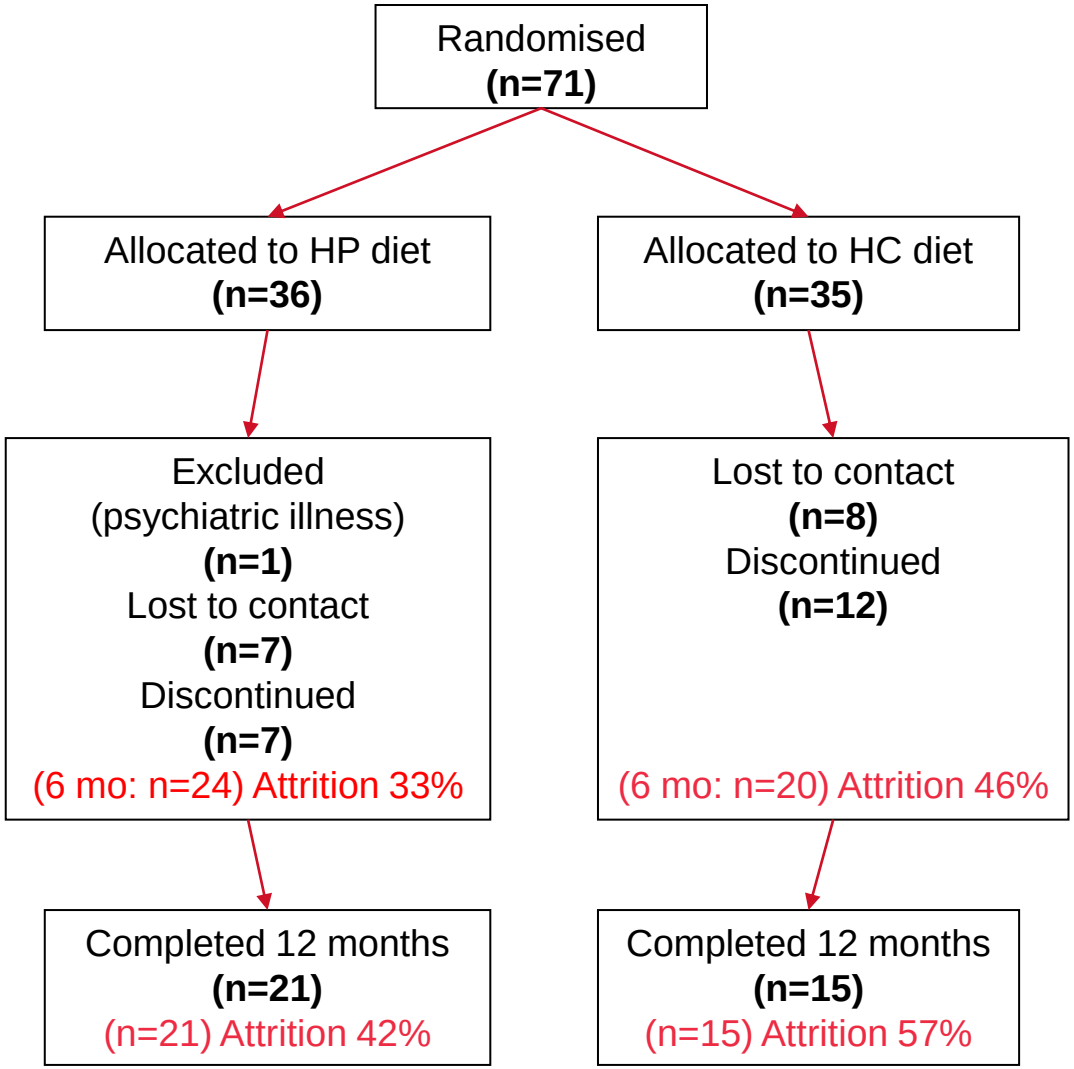
# Risks of Weight Gain in Young Women

- **Weight Tracks Upward**
  - Negative physical & mental health
- **Reproductive Health**
  - Infertility
  - Obstetric complications
  - Epigenetic effects for off spring
- **Family & Future Health**
  - Women decide family meals
  - Modelling health behaviour important
  - Vicious cycle for future generations

# Young Women & Weight Management

- **Limited research in young women & weight management**
- **Systematic review (Poobalan et al 2010)**
  - Studies in young women n=10
  - Overweight or obese young women n=6
  - Diet, exercise and behavior modification (n=1)
- **Studies report:**
  - Difficult to recruit younger participants
  - Higher rate of attrition
  - Limited evaluation of effectiveness
- **Weight Management**
  - Young women different to middle age
  - Less co-morbidity at this life stage
  - Need to find out what works metabolically & behavourally

# Weight Loss in Young Women Study

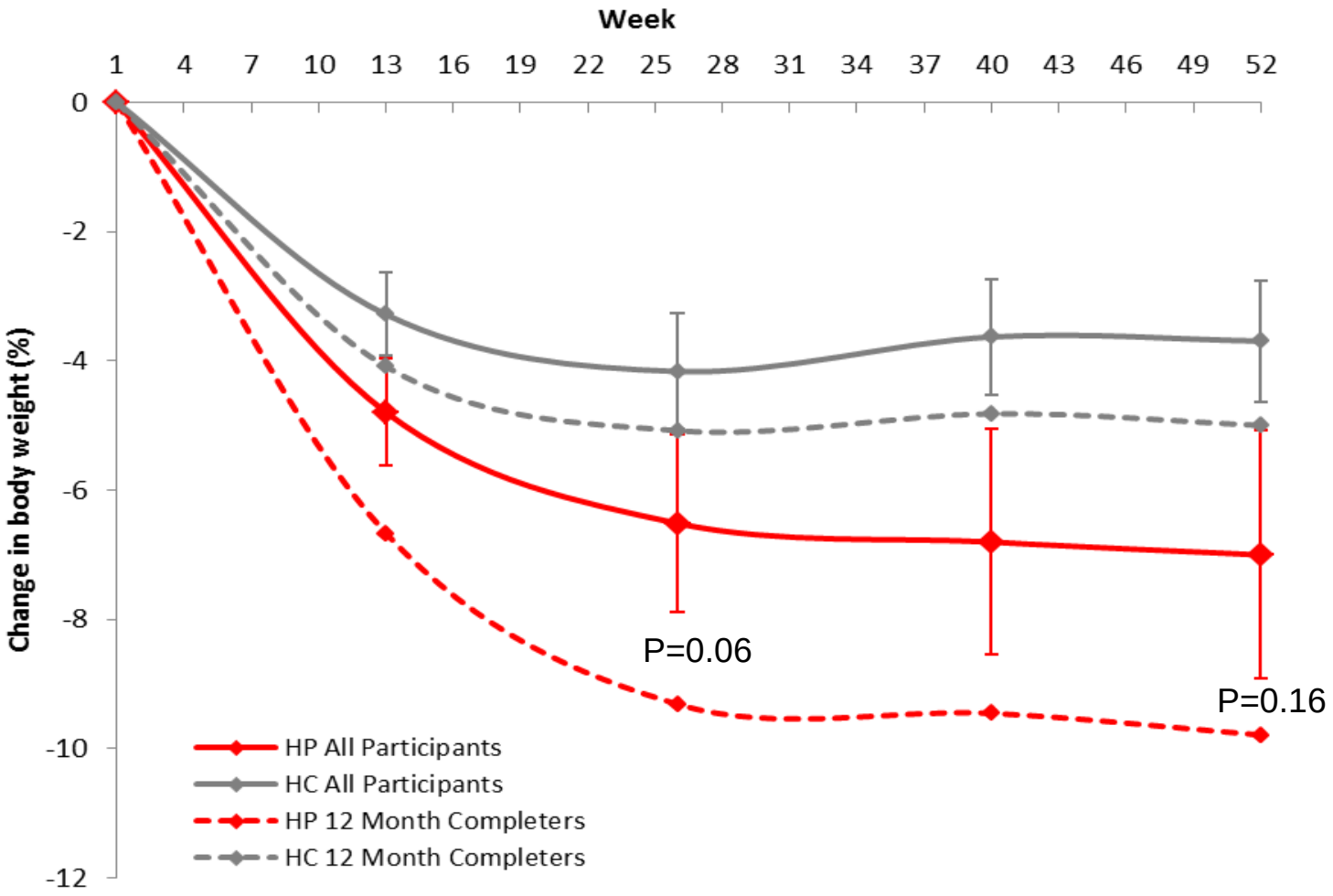


# Macronutrients Study Diets & Exercise

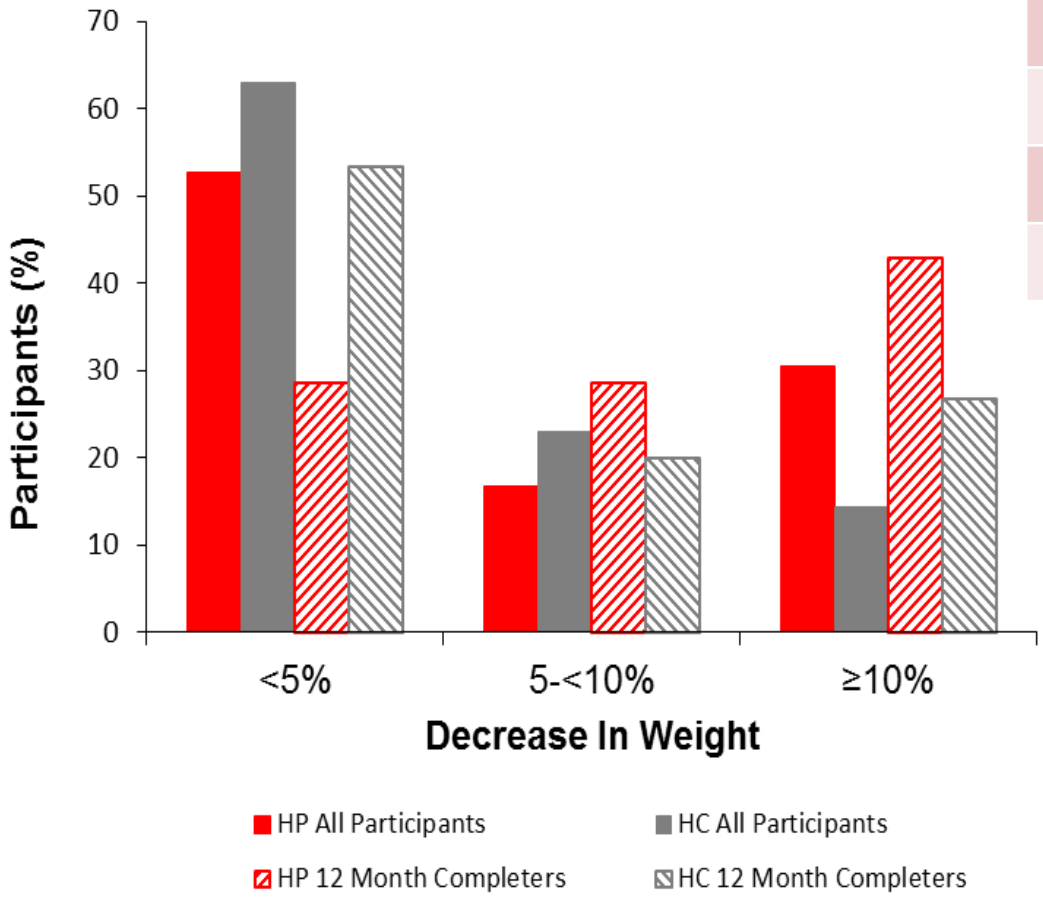
| Nutrient | HP Diet | HC Diet |
|---|---|---|
| Energy (kJ) | 5615 | 5602 |
| Protein (g) | 107 (32% of E) | 67 (20% of E) |
| Carbohydrate (g) | 138 (41% of E) | 191 (58% of E) |
| Sugars (g) | 73 | 83 |
| GI/GL | 46/61 | 52/93 |
| Dietary fibre (g) | 23 | 24 |
| Total fat (g) | 38 (25% of E) | 32 (21% of E) |
| Saturated fat (g) | 11 | 10 |
| Cholesterol (mg) | 298 | 87 |

30 min accumulated physical activity daily (activity diary)

# Weight Loss


Week
1
4
7
10
13
16
19
22
25
28
31
34
37
40
43
46
49
52
0
-2
-4
-6
-8
-10
-12
Change in body weight (%)
P=0.06
P=0.16
HP All Participants
HC All Participants
HP 12 Month Completers
HC 12 Month Completers

# Participants Losing > 5 & 10% Initial Weight

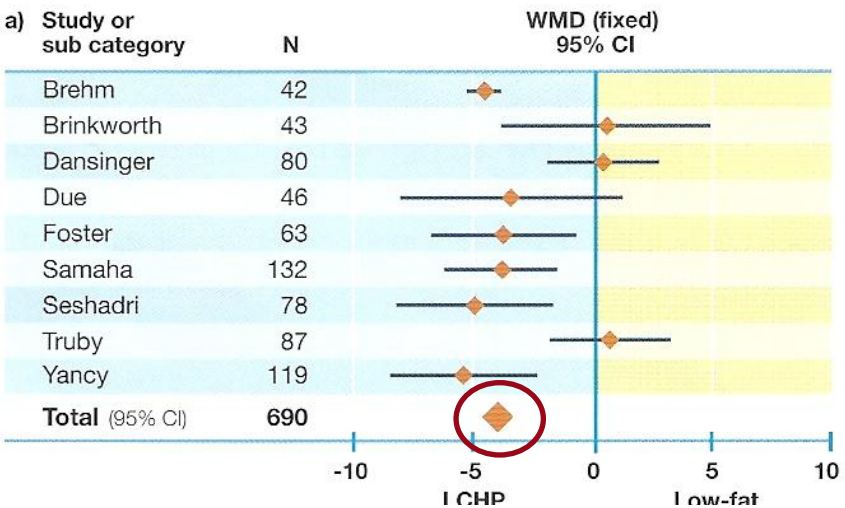


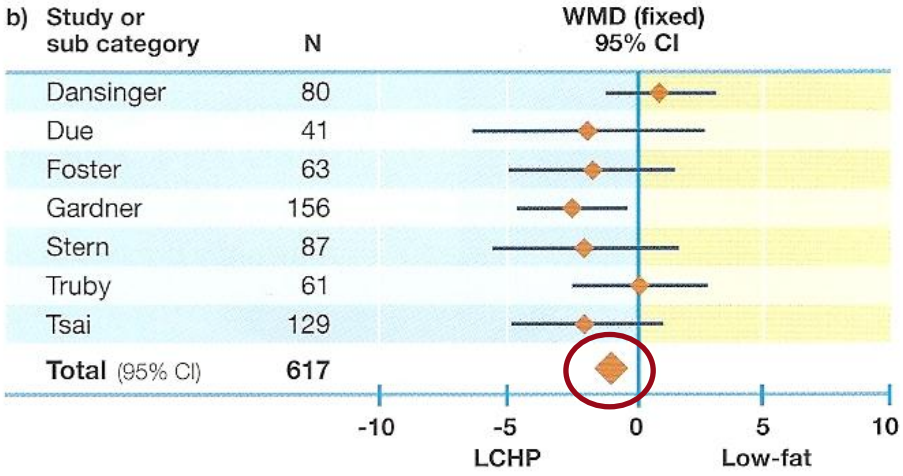

| Participants | <5% | ≥ 5% | ≥ 10% |
|---|---|---|---|
| HP (All Participants) | 53.0 | 47.0 | 30.6 |
| HC (All Participants) | 62.8 | 37.2 | 14.3 |
| HP (12 mo completers) | 28.6 | 71.4 | 42.9 |
| HC (12 mo completers) | 53.5 | 46.5 | 26.7 |

Participant proportions losing ≥ 10% initial weight trend to be higher for HP at 6 months (p=0.053)

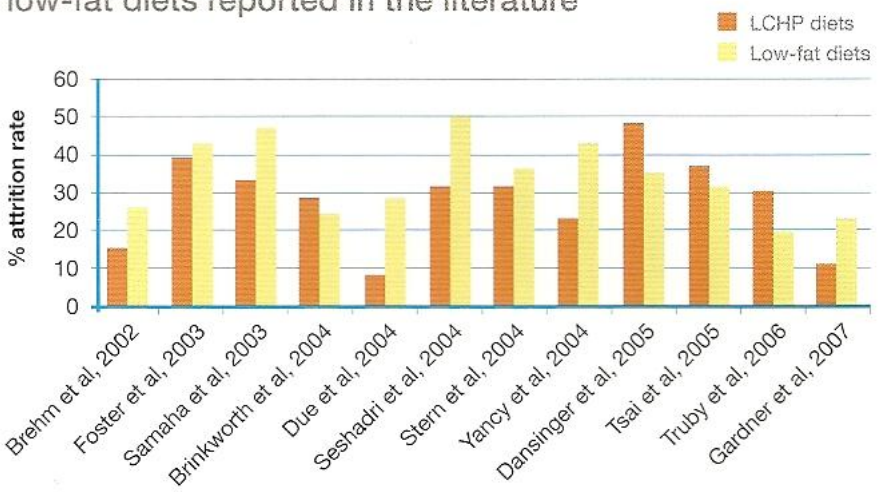
# Systematic Review of Higher Protein Diets

Effect size at 6 (a) and 12 (b) months




Percentage attrition rate in low-carbohydrate and low-fat diets reported in the literature




n=13 studies (2000-2001)

**LCHP vs LFHC**

~ -4 kg at 6 months

~ -1 kg at 12 months

**Better at 6 months**

**As effective at 12 months**

Hession et al 2009

# Diogenes Study

- Multicentre clinical trial
- 772 European families (one healthy child 5-17 y)
- 938 adults; 827 children
- Adults 18-65 y; BMI 27-45 $kgm^{-2}$;
- Adults 800-1000 kcal/d for 8 weeks
- VLED (Modifast) + low energy vegetables if desired
- Participants needed to lose 8% initial weight over 8 weeks
- Those losing > 8% initial weight randomised to next phase
- Children did not do VLED – just randomised diet of parents
- Mean loss ~11 kg (n=773 completed) over 8 weeks

# Diogenes Study

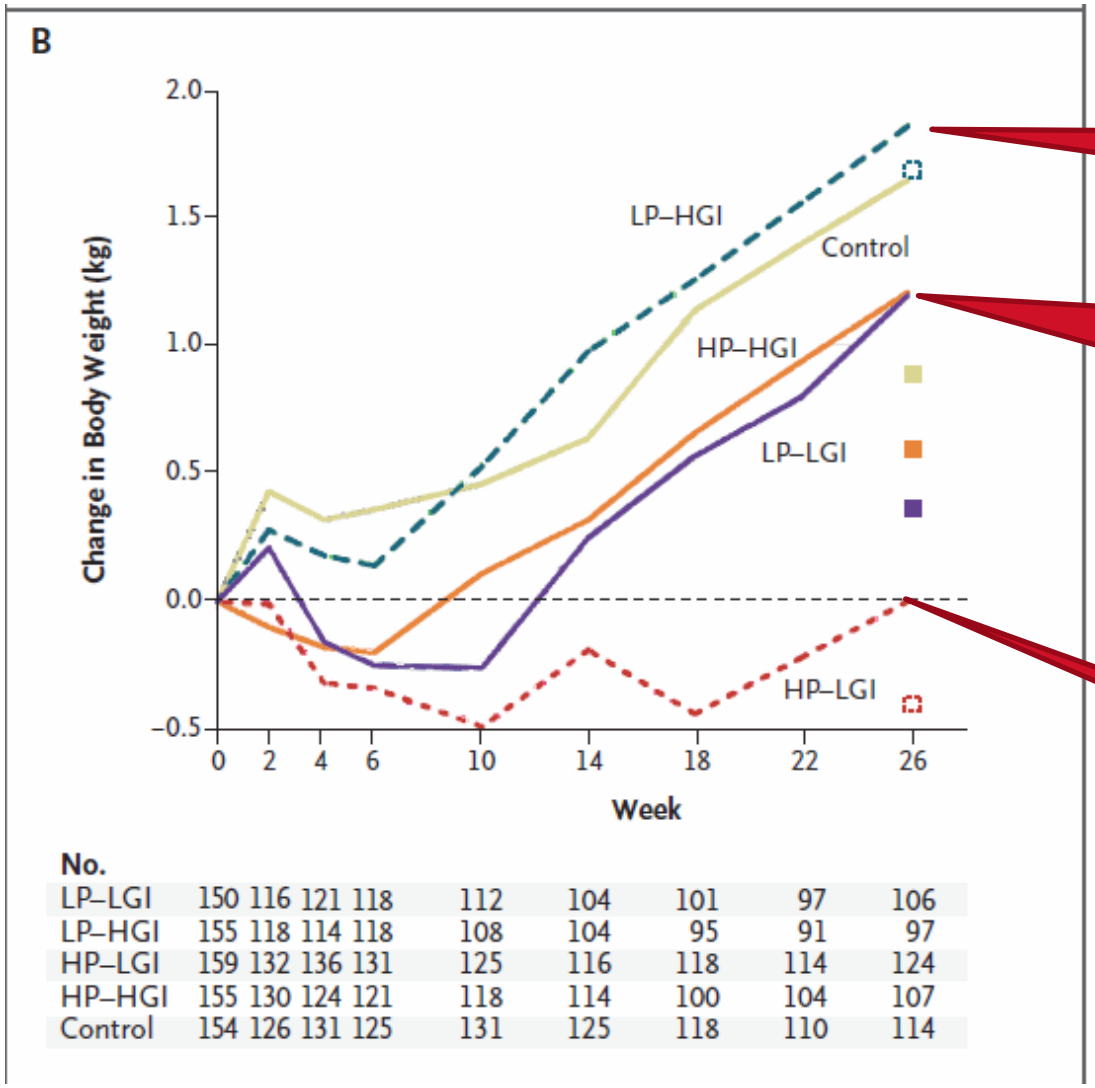
Random assignment one of 5 diets (all <30% fat):

- Low Protein (13% of energy); High GI
- Low Protein (13% of energy); Low GI
- High Protein (25% of energy); High GI
- High Protein (25% of energy); Low GI
- Control: < 30% fat, diet guidelines, no macronutrient/GI plan
- Diets *ad libitum (not energy restricted)*
  - Instructed to maintain weight loss
  - Additional loss permitted
- n=548 completed 6 mo; 29% attrition

5.4% E in P
4.7 GI Points

**Target**
12% E difference in protein
15 GI points difference in GI
Weighed Food Diary
24 h Urine Collection

# Diogenes Weight Maintenance




| No. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| LP–LGI | 150 | 116 | 121 | 118 | 112 | 104 | 101 | 97 | 106 |
| LP–HGI | 155 | 118 | 114 | 118 | 108 | 104 | 95 | 91 | 97 |
| HP–LGI | 159 | 132 | 136 | 131 | 125 | 116 | 118 | 114 | 124 |
| HP–HGI | 155 | 130 | 124 | 121 | 118 | 114 | 100 | 104 | 107 |
| Control | 154 | 126 | 131 | 125 | 131 | 125 | 118 | 110 | 114 |

**LP-HGI & Control Most Weight Regain**

**HP or LGI alone moderate benefit 0.93 kg less gain in HP & 0.95 kg less in low GI**

**HP-LGI best**

Larsen et al 2010

# Diogenes - Children

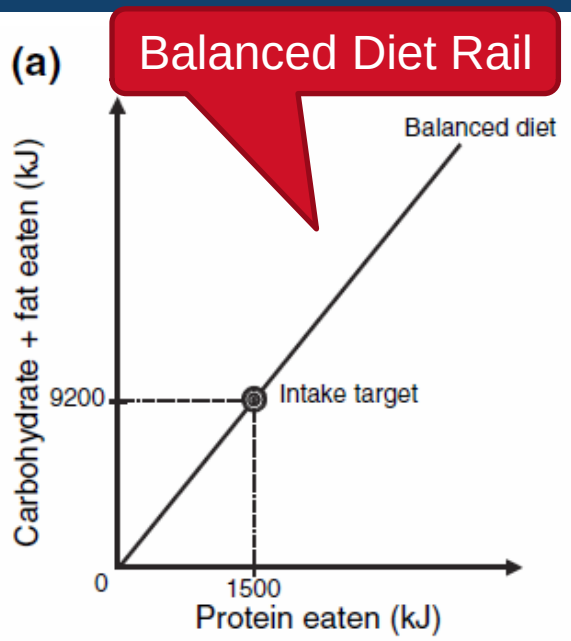
**Proportion (%) of Children Overweight/Obese Pre and Post Diogenes**

| Diet | Pre-Diogenes | Post-Diogenes |
|---|---|---|
| Low Protein/Low GI | 36.9 | 36.6 |
| Low Protein/High GI | 44.7 | 45.2 |
| High Protein/Low GI | 46.2 | 39.6 |
| High Protein/High GI | 47.4 | 45.2 |
| Control Diet | 48.8 | 47.7 |

Papadaki et al 2010

# Protein Leverage & Obesity

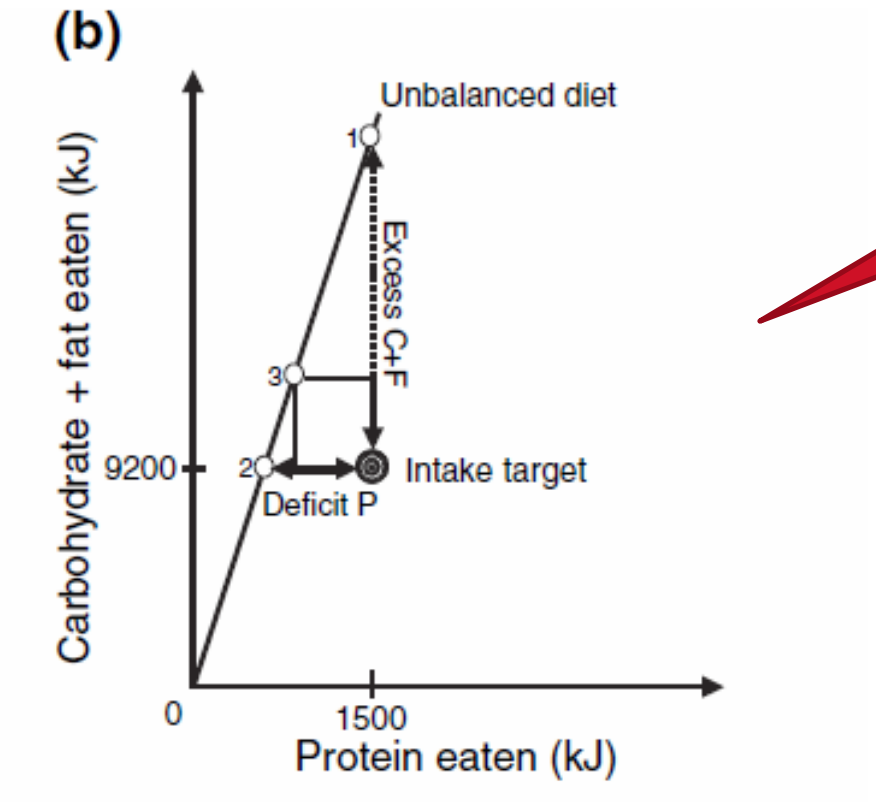
- **Role of protein in human obesity**
  - Largely ignored until recently
- **Energy from protein in human diets**
  - Remained static
  - Protein not linked with obesity epidemic
- **Protein leverage hypothesis**
  - Evidence in animals and insects
  - Emerging evidence in humans
- **Protein & weight regulation**
  - Small proportion of diet energy
  - Tight regulation
  - Eating behaviour & appetite




**Balanced diet for 45 year old moderately active male**
**BMI 23.5 kgm$^{-2}$**
**Energy requirement 10,700 kJ/d**
**14% protein or 1,500 kJ protein**
**Remainder 9,200 kJ CHO & fat**

Simpson & Raubenheimer 2005

# Protein Leverage Hypothesis




Excess CHO/Fat consumed to meet Protein target

**Unbalanced diet rail, higher proportion CHO/Fat.**

**Range of possible diet rails to meet protein target**

# Protein Leverage Hypothesis

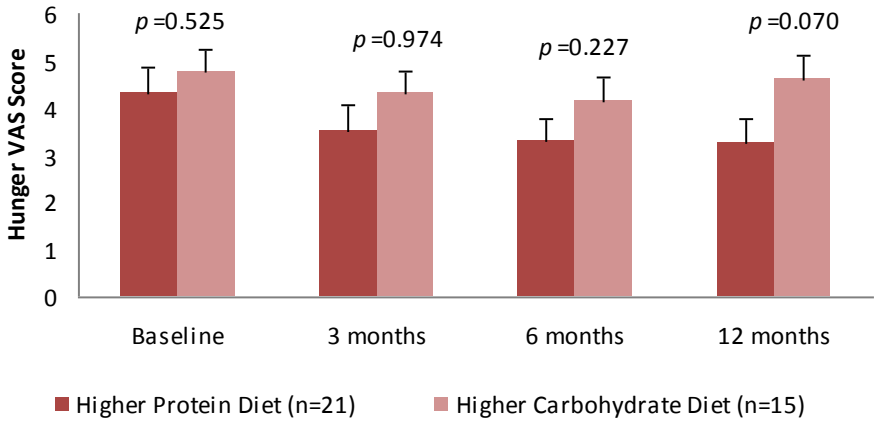
- Lean humans n=22
- Studied 3 x 4 day periods
- *Ad libitum* energy intake
  - 10%, 15% & 25% protein
- Fix menus similar in:
  - Palatability, variety & sensory
- Lowering protein from 10-15%
  - ~12% increase in energy intake (savoury snacks)
  - If maintained = gain of 1 kg per month
  - Greater increase in hunger score 10 vs 25%

**Below the 15% of E Protein Target**
1 kJ decrease in protein resulted in a 4.5 kJ increase in non-protein energy

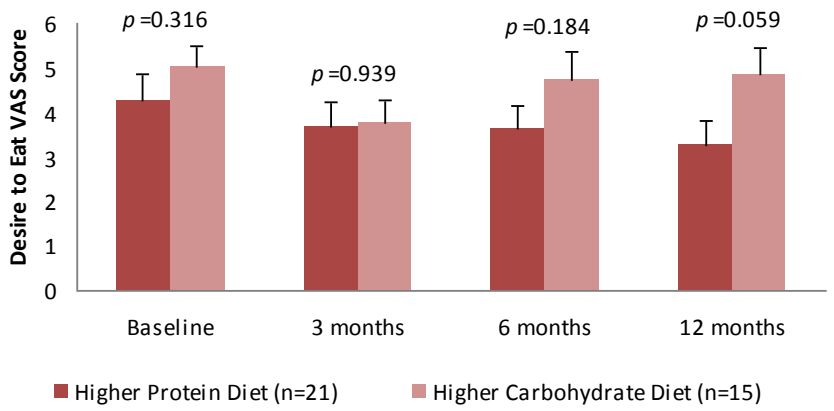
**More human studies are required but PLH offers a possible mechanism for satiating effects of protein**

Gosby et al 2011

# WOW Hunger & Desire to Eat VAS




**Repeated Measures ANOVA:**
**Diet: 0.184; Diet*Time: 0.229; Time: 0.459**




**Repeated Measures ANOVA:**
**Diet: 0.138; Diet*Time: 0.337; Time: 0.203**

**VAS:** **Hunger** extremely hungry → not at all hungry
**Desire** extremely strong → not at all strong

# Higher Protein Diet Other Benefits

- **Nutrient density & adequacy on energy restriction**
  - Careful planning to meet nutrient requirements on energy restriction
  - Higher protein diets tend to be more nutrient dense
- **WOW study diets assessed by diet modelling**
  - Match fibre, fat, calcium
  - Model the GI, GL and nutrient adequacy

206 *Asia Pac J Clin Nutr 2011;20 (2):206-211*

Original Article

**Nutritional adequacy of energy restricted diets for young obese women**

Helen O'Connor PhD[1], Zahra Munas BSc Nutrition (Hons)[1], Hayley Griffin PhD[1], Kieron Rooney PhD[1], Hoi Lun Cheng BSc Nutrition (Hons)[1], Katharine Steinbeck PhD[2]

# Micronutrients - Study Diets

| Nutrient | EAR/AI | HP Diet | HC Diet |
|---|---|---|---|
| Thiamin (mg) | 0.9 | 1.6 | 1.8 |
| Riboflavin (mg) | 0.9 | 2.5 | 2.5 |
| Niacin Equiv (mg) | 11 | 47 | 32 |
| Vitamin C (mg) | 30 | 156 | 160 |
| Total Folate (μg) | 320 | 332 | 355 |
| Vitamin A Equiv (μg) | 500 | 1058 | 1307 |
| Sodium (mg) | 460-920 | 2186 | 1940 |
| Potassium (mg) | 2800 | 3554 | 3[illegible] |
| Magnesium (mg) | 255 | 318 | [illegible]8 |
| Calcium (mg) | 840 | 908 | 877 |
| Phosphorus (mg) | 580 | 1725 | 1282 |
| Iron (mg) | 8.0 | 12.2 | 9.9 |
| Zinc (mg) | 6.5 | 11.7 | 7.6 |

Red meat 4 times a week only nutrient still short (70%) of the RDI. More Haeme iron than HC

# Iron Deficiency in Overweight/Obese Young Women

Table 1: Prevalence of iron deficiency in Australian women

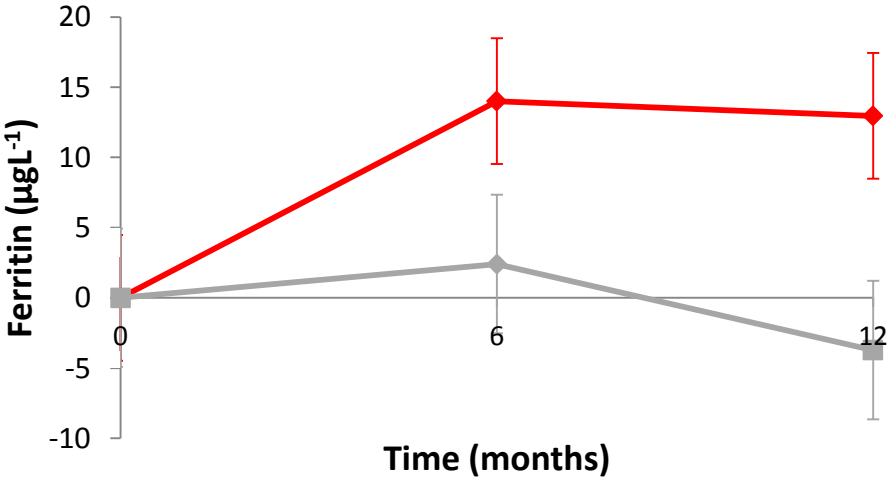
| Study | Age (years) | Cut-off (Ferritin) µg/L | Prevalence |
|---|---|---|---|
| AusDiab[1] | 25–50 | <12 | 10.6 |
| Fayet[2] | 18–35 | <15 | 34.0 |
| O'Connor[4] | 18–25 | <15 | 16.9 |

Possibly higher prevalence in younger women?

1. Ahmed et al 2008
2. Fayet & Samman 2007
4. Manuscript in preparation

# Micronutrient Status - Iron

| Ferritin (15-165μgL$^{-1}$) | Diet | | P Value | |
|---|---|---|---|---|
| | HP | HC | Diet | D*T |
| **6 month completers** | | | | |
| **Ferritin at 6 months (μgL$^{-1}$)** | **52.8 ± 6.2** | **45.9 ± 7.4** | | |
| **Δ 6 months** | 14.4 ± 4.8 | -3.2 ± 5.1 | 0.007 | N/A |
| **12 month completers** | | | | |
| **Ferritin at 6 months (μgL$^{-1}$)** | **53.8 ± 6.6** | **44.1 ± 6.2** | | |
| **Ferritin at 12 months (μgL$^{-1}$)** | **52.7 ± 6.6** | **38.0 ± 5.4** | | |
| **Δ 6 months** | 14.0 ± 4.4 | 2.4 ± 5.0 | 0.02 | 0.38 |
| **Δ 12 months** | 13.0 ± 4.6 | -3.7 ± 4.9 | | |



# Iron Status & Obesity

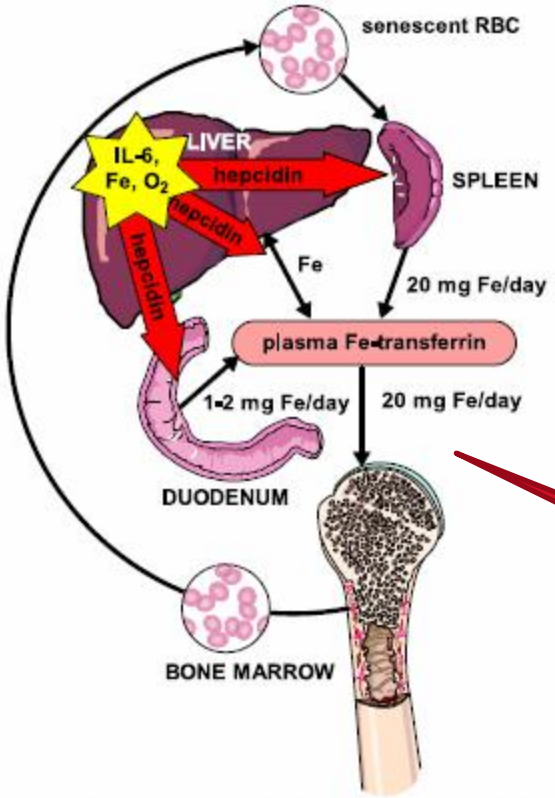
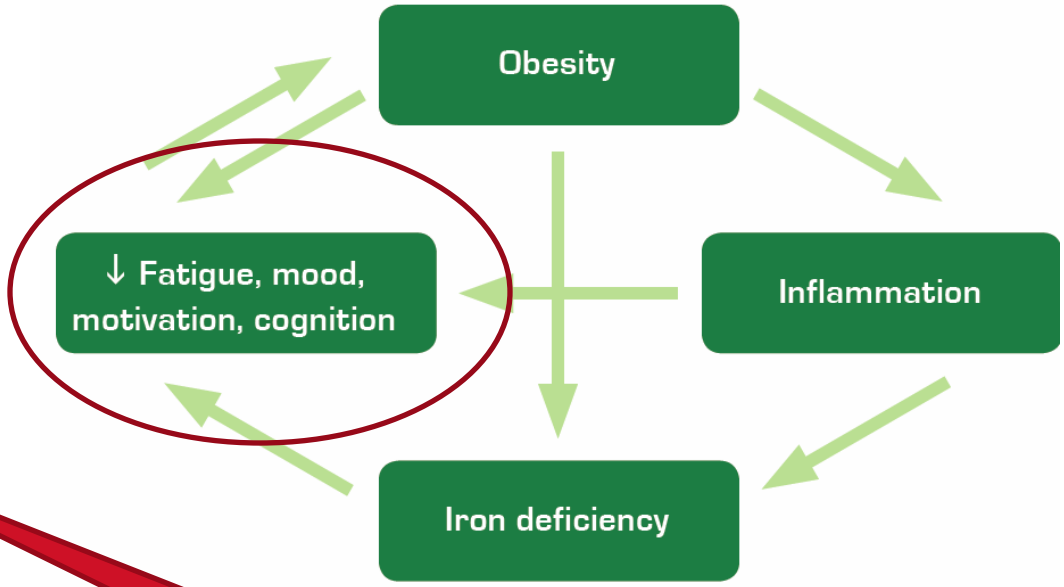


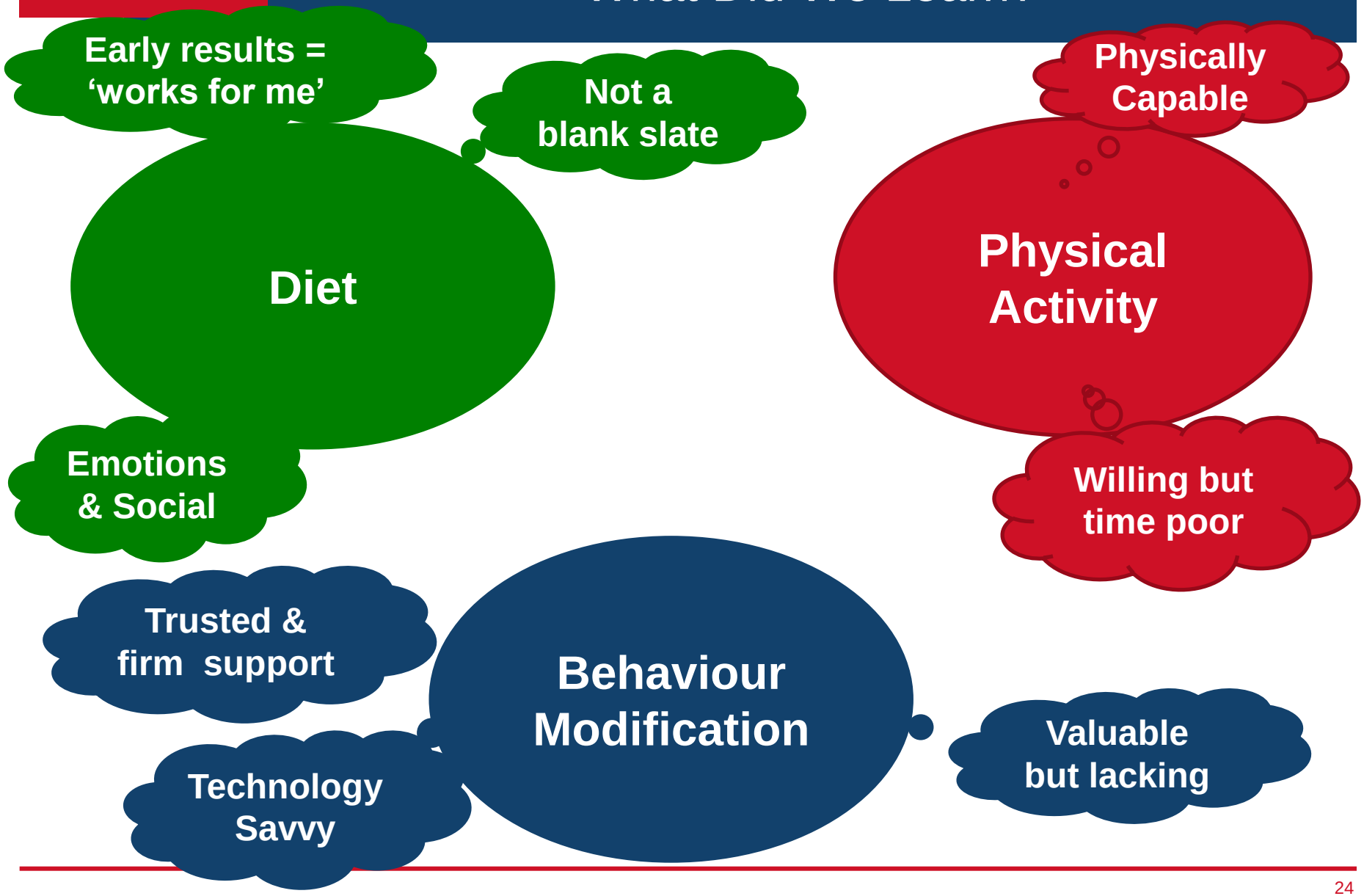

Fig. 3. Role of hepcidin in iron regulation. Hepcidin regulates intestinal iron absorption, iron recycling by macrophages, and iron release from hepatic stores. In turn, hepcidin secretion is regulated by iron stores, oxygenation, and inflammatory signals, chiefly IL-6. RBC, red blood cells.

Ganz & Nemeth 2006




**Obesity related inflammation alters iron absorption & metabolism**

# Young Women & Weight Management
# What Did We Learn?



# Higher Protein Diets & Young Women

- **Evidence HP works faster earlier**
  - Young women = ‘works for me’
- **Evidence HP low GI works longer**
  - Maintaining weight loss is most challenging
  - Beneficial metabolic outcomes
- **HP low GI approach**
  - Benefit to satiety
  - Enhance ‘control’ of eating
  - May benefit ‘emotional eating’
- **Microutrient needs**
  - HP energy restricted diets more nutrient dense
  - Iron deficiency common at this age stage
  - Red meat 3-4 times a week for iron and zinc (co-existing deficiencies)

**More Research**

**Gen Y Approaches**
**Technology**
**Social Network Support**

# Acknowledgements

## Research Team

**Dr Hayley Griffin**
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**Dr Kieron Rooney**
**Biochemist**

**Prof Kate Steinbeck**
**MBBS**

**Thanks to A/Prof Peter Petocz (Macquarie University) & Ms Bri-Ellen Claes for assistance with statistics**

**Metabolism & Obesity RPAH**
Janet Franklin PhD
Elisia Manson RN