University of ULSTER

Energy Intakes and Childhood Obesity.....is the evidence all that it seems?

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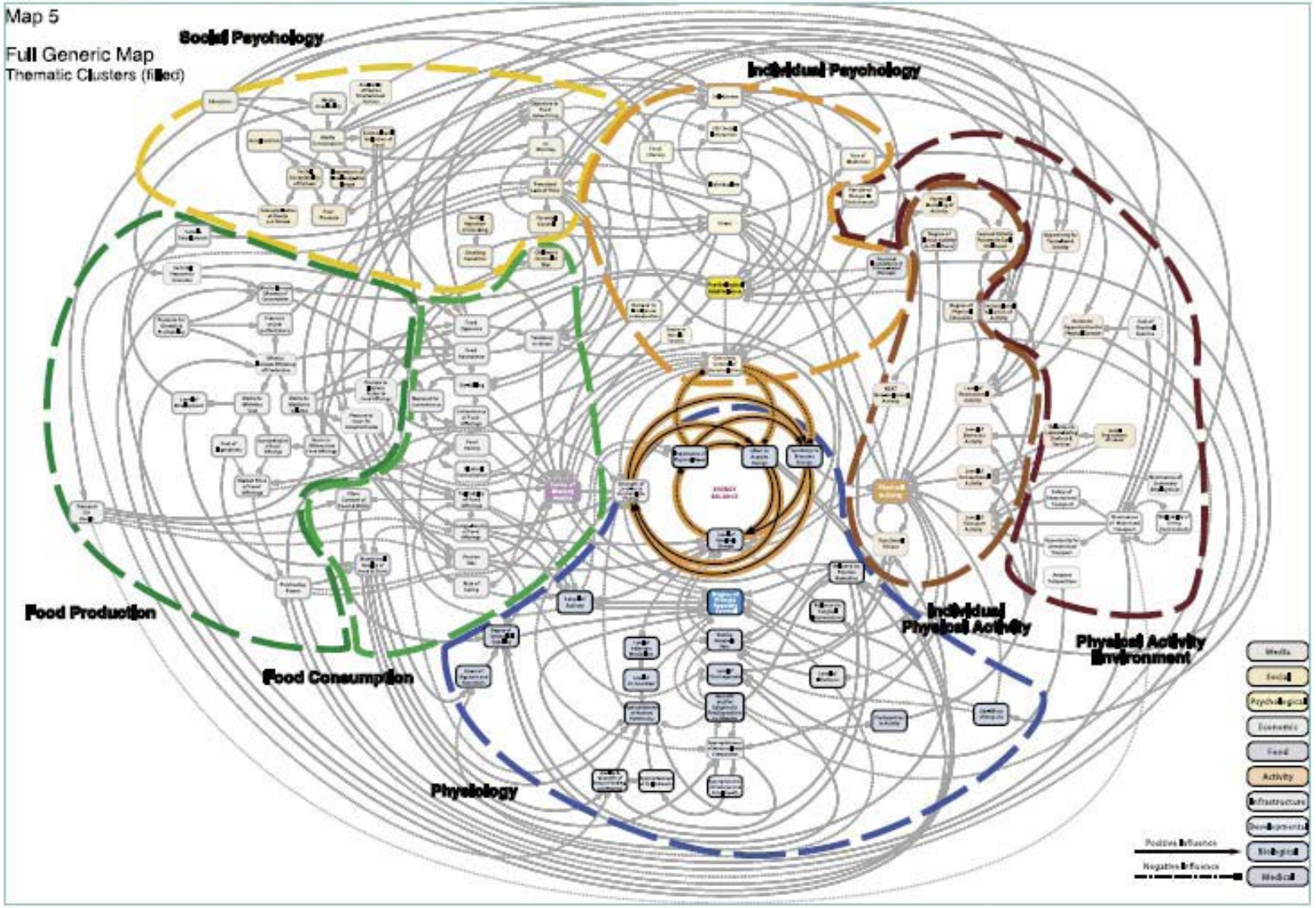
"(Childhood) obesity is a normal **response** to an **abnormal** environment"

Egger & Swinburn, 1997

.... Children are ill-equipped to handle the modern food environment

..... especially when they do so little!

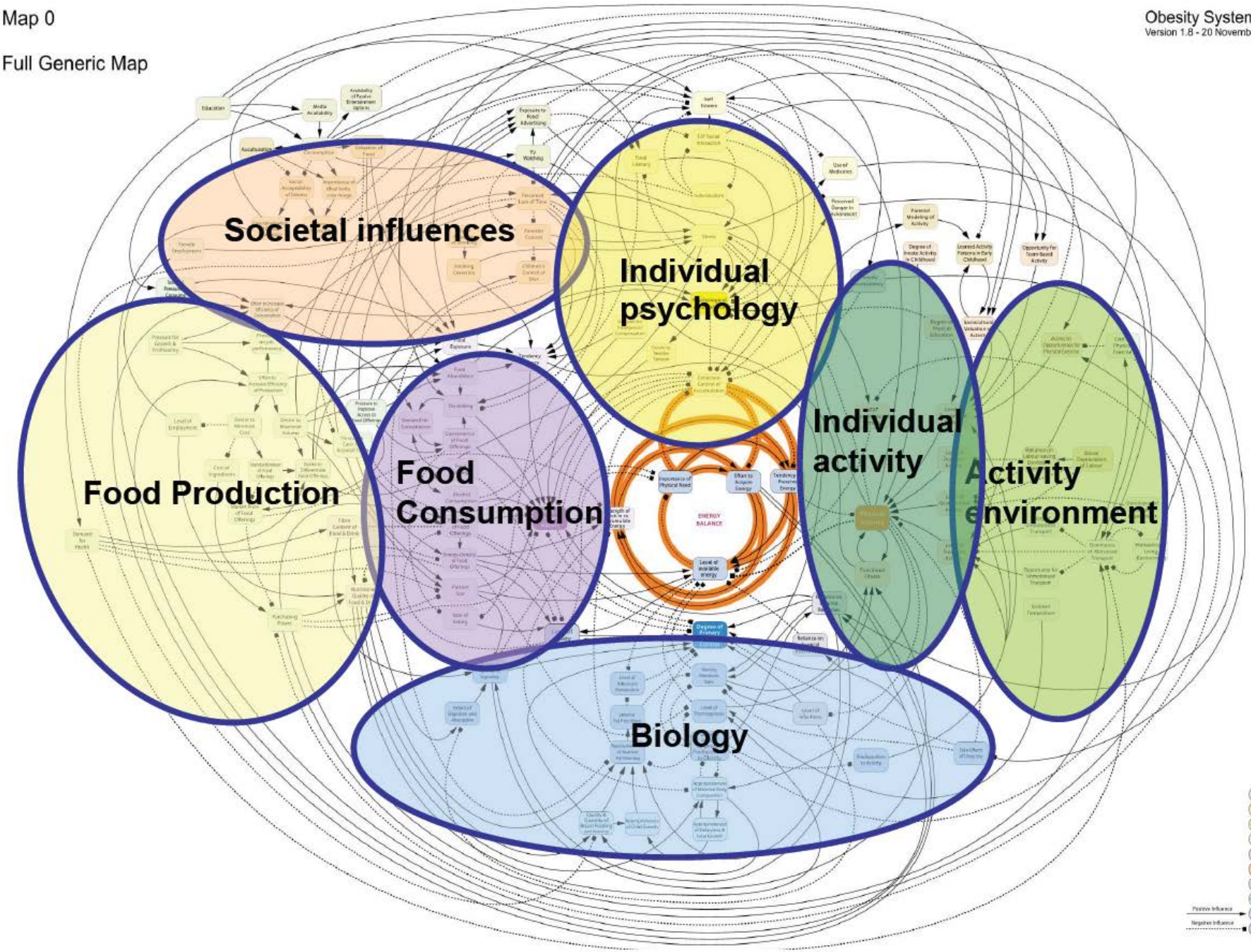
How complex is it?.....this complex !!



Map 0

Full Generic Map

Obesity System Map
Version 1.8 - 20 November 2006



Presentation Overview

DIETARY FACTORS

- Energy density
- Portion size
- Sugar sweetened drinks

EATING CONTEXTS

- Snacking
- Fast food
- Sedentary lifestyles (TV viewing)
- Family environment

DIETARY FACTORS

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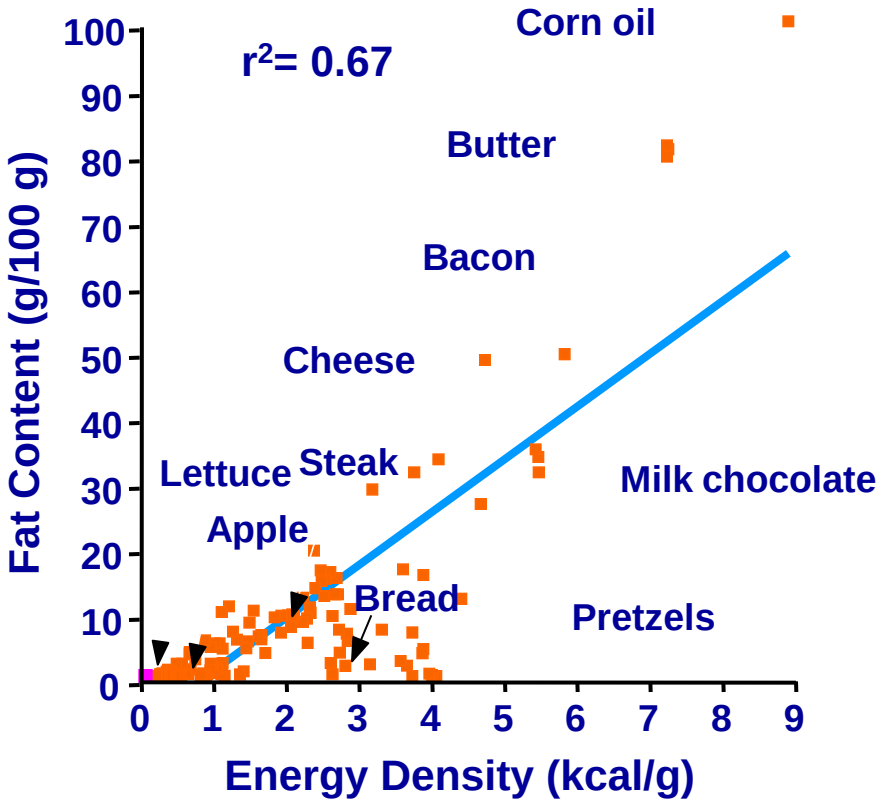
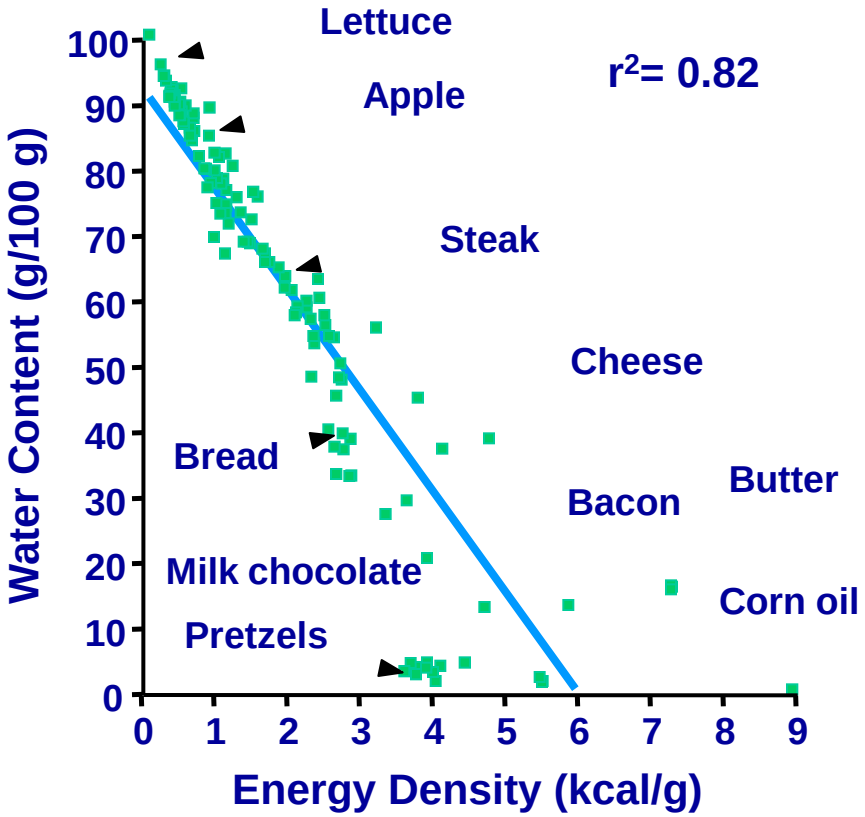
Effects of Fat and Water Content on Energy Density





Rolls and Bell. *Med Clin North Am* 2000;84:401.

Is Dietary Energy Density (ED) associated with adiposity in children?

Conclusion:

Moderately strong evidence from a (limited) number

- ✓ Methodologically rigorous
- ✓ Longitudinal cohort studies

Positive association between the ED of the diet and increased adiposity in children

Johnson et al. 2008a, 2008b, 2009

McCaffrey et al. 2008

Strengths of the studies

- Objective measures of adiposity (DEXA or doubly labelled water)
- Adjusted for under- and over-reporting of energy intake
- Calculated ED by methods that excluded all or most beverages

Coleraine Cohort Study

Baseline

1996 – 1998

n = 116 (5 – 8 yr olds)

→

Height, weight, BMI

Total energy expenditure (TEE) by doubly-labelled water (DLW)

Body fat by total body water (TBW)

7 day weighed food diary (self-defined eating occasions)

Follow up study

2005 – 2006

n = 50 (13 – 16 yr olds)

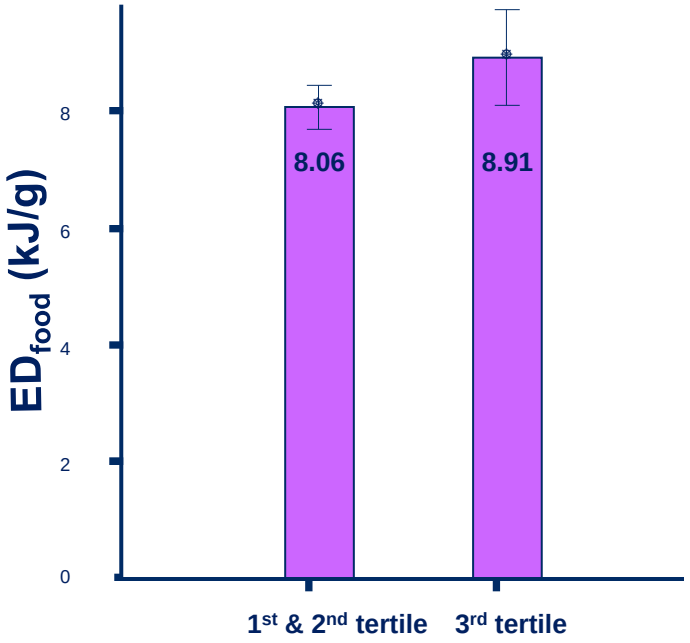
→

Height, weight, BMI

TEE by DLW

Body fat by TBW

Does energy density predict change in fat mass between Baseline and Follow-Up? (1st & 2nd tertiles Vs 3rd tertile)



Tertiles of change in FMI
(1st & 2nd tertile Vs 3rd)

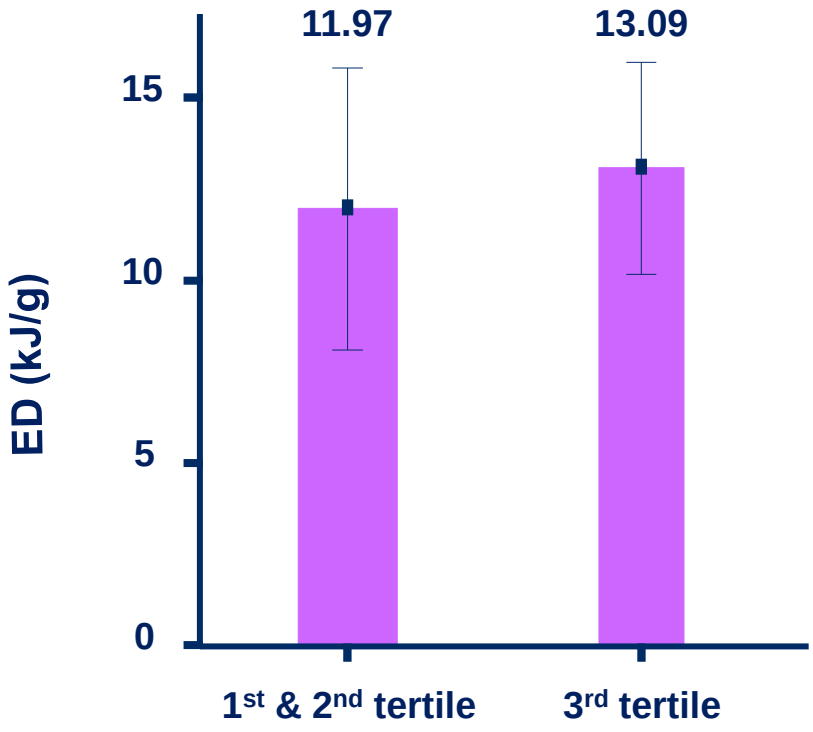
Model 1 ED_{food} p = 0.029

Model 2 ED_{food} p = 0.029

Model 1 covariates = sex (1 & 2) + pubertal status (stages 1 to 3 Vs stages 4 & 5) + ED method

Model 2 = sex (1 & 2) + pubertal status (stages 1 to 3 Vs stages 4 & 5) + EI:EE + ED method

Does energy density of self-defined snacks at baseline predict change in fat mass index between baseline and follow-up (1st & 2nd tertiles Vs 3rd tertile)



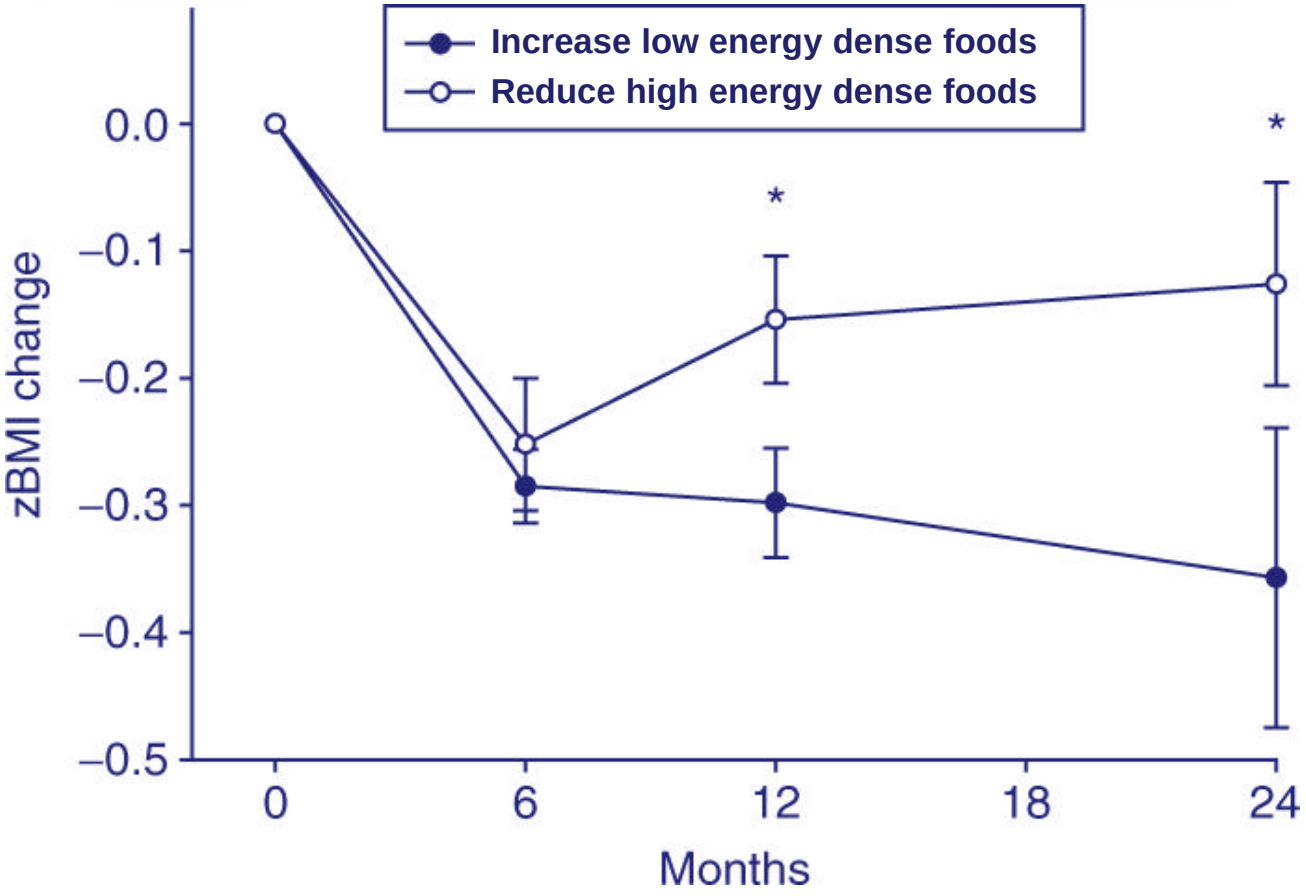
Model 1 ED p =0.268

Model 2 ED p =0.268

Model 1 covariates = sex (1 & 2) + pubertal status (stages 1 to 3 Vs stages 4 & 5) + ED method

Model 2 = sex (1 & 2) + pubertal status (stages 1 to 3 Vs stages 4 & 5) + EI:EE + ED method

Does a reduction in dietary ED → a decrease in adiposity in children



zBMI changes from baseline (mean ± s.e.m.) between the increase healthy food and reduce high energy-dense food groups. Mixed effects regression models showed an interaction of group by months (*P* = 0.03). Significant (*) between group differences were observed at 12 months (*P* = 0.01) and 24 months (*P* = 0.04) Epstein *et al.* 2008

DIETARY FACTORS

- Energy density
- **Portion size**
- Sugar sweetened drinks

EATING CONTEXTS

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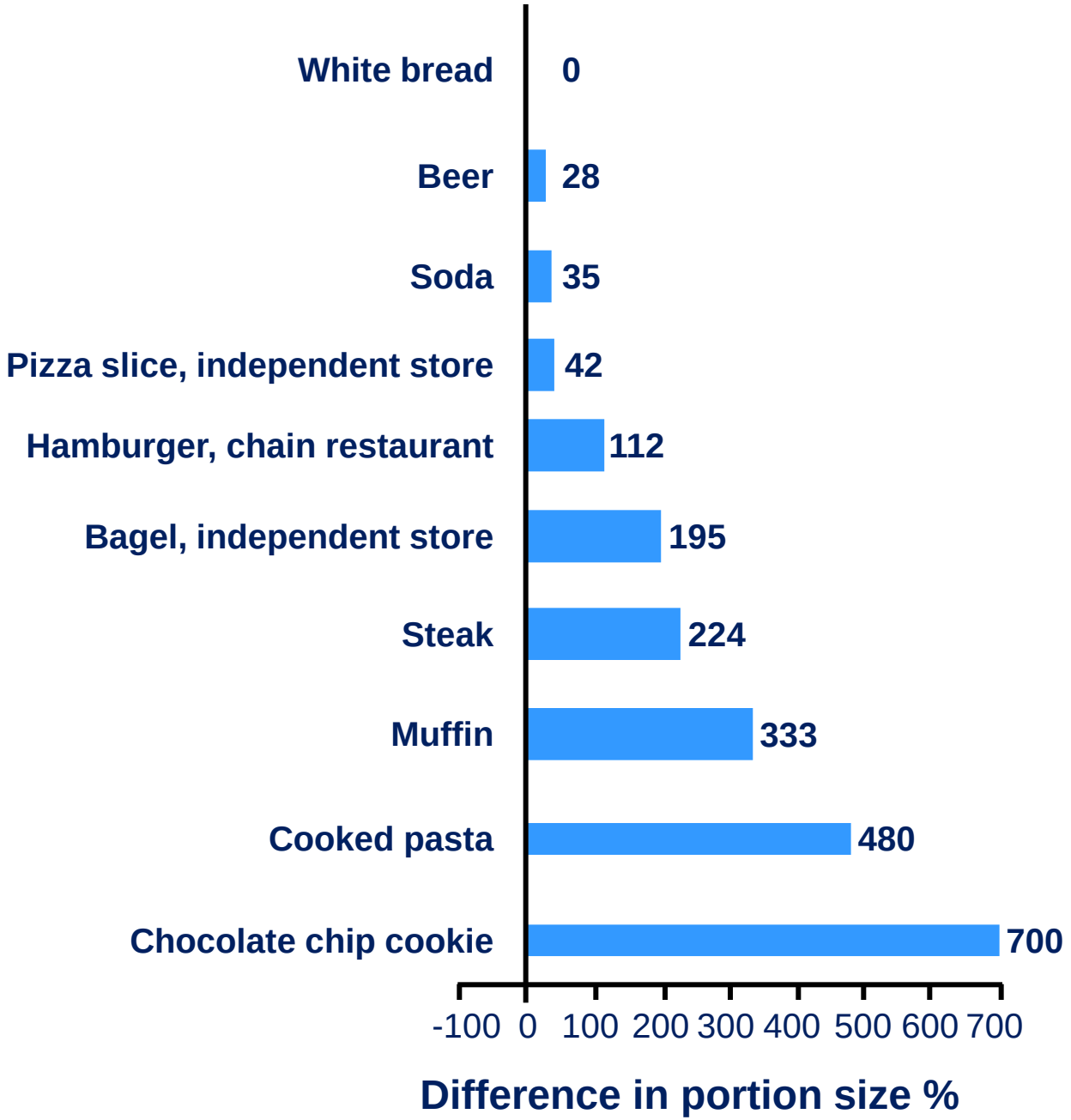
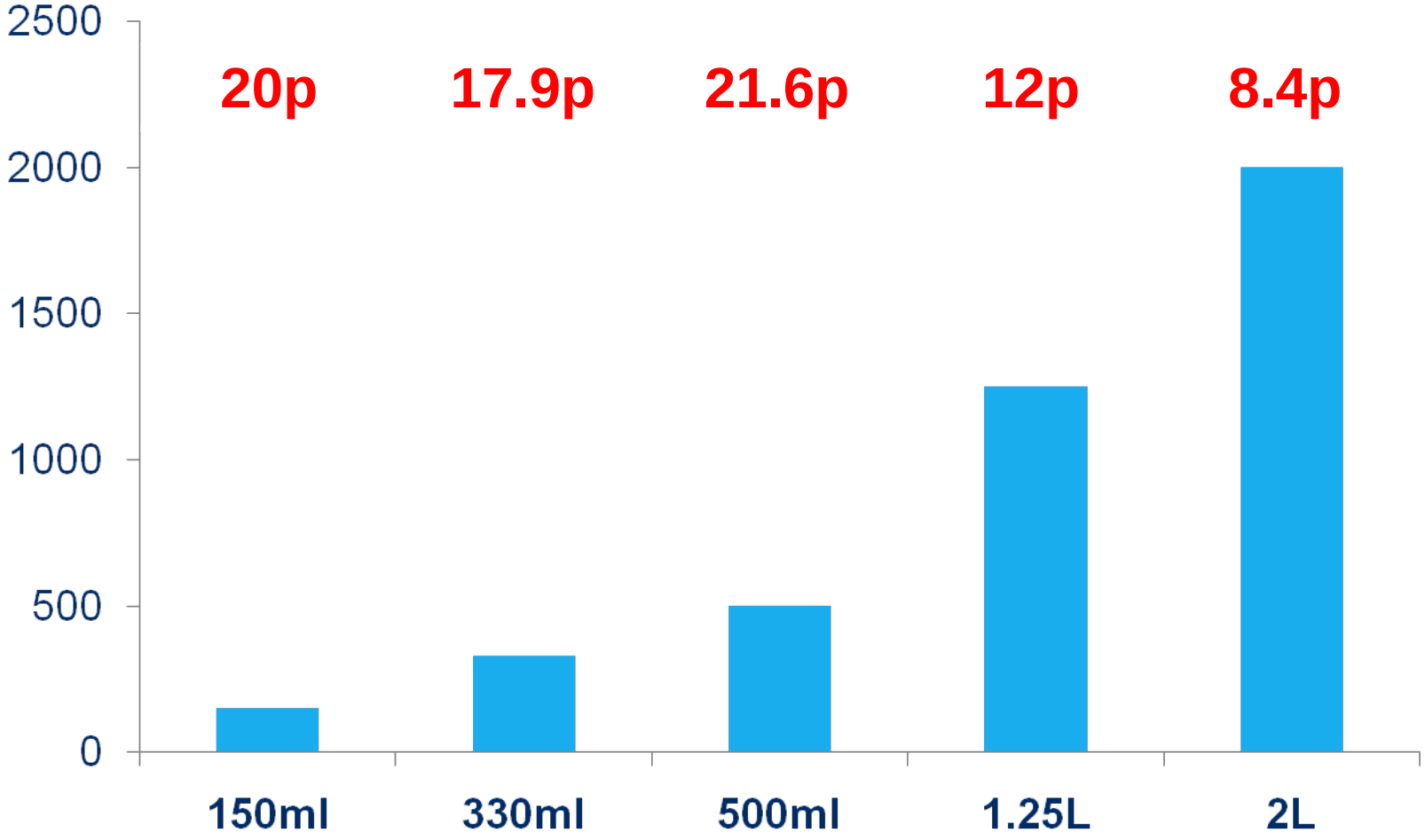
Percentage difference between actual portion sizes of ready-to-eat prepared foods and standard US Department of Agriculture (USDA) portion sizes



Increased portion size may be inciting over-eating because:

- Cheap for food industries to provide
- Larger portions are seen as “value for money”
- Consumers have a distorted perception of what is an appropriate portion size
- Consumers have trouble accurately estimating portion sizes

Value-sized pricing



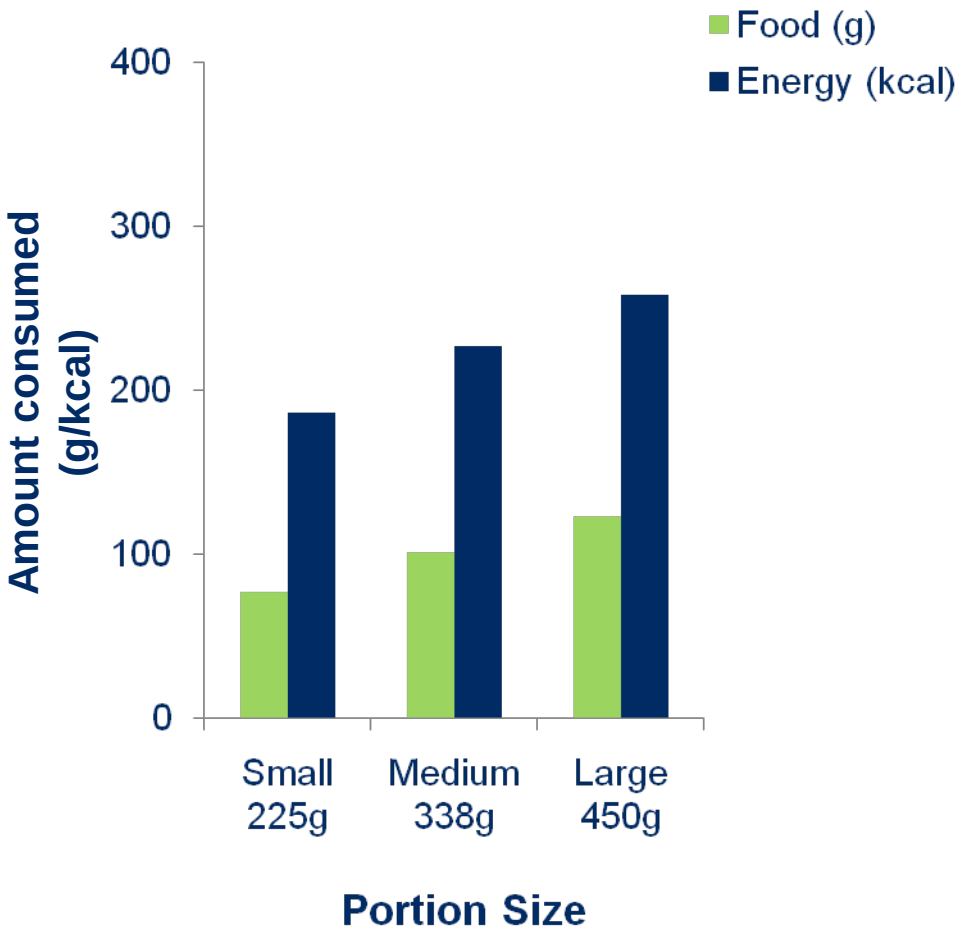
Average price/100ml from 3 supermarkets, where available (Aug 2011)

Will children respond to larger portions?

- 5 intervention studies
  - 4 x acute
  - 1 x 24-hr
- All studies conducted:
  - in the US
  - with preschool children
  - using similar meals

Initial findings

- 16 preschoolers (10 girls; 6 boys)
- Mean age 5yrs
- Food (g) ↑ 60%
- EI (kcal) ↑ 39%
- Effect not apparent in younger children (3yrs)



Rolls et al. *J am Diet Assoc* 2000; 100:232-4

Overall findings

- Effect of ↑ PS has since been observed in children as young as 2 years (Fisher et al, 2003, 2007a, 2007b)
- PS and ED act additively to promote EI (Fisher et al, 2007a)
- Effects are sustained over 24 hours with no evidence of compensation of intake (Fisher et al, 2007c)
- Tendency to overeat when presented with large portions is not specific to overweight children (or adults)
- PS effects seen in children mirror those seen in adults

Fisher et al. *Am J Clin Nutr* 2003; 77:1164-70
Fisher et al. *Am J Clin Nutr* 2007a; 86:174-9
Fisher et al. *Obesity* 2007b; 15:403-12
Fisher et al. *Am J Clin Nutr* 2007c; 86:1709-16

DIETARY FACTORS

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- **Sugar sweetened drinks**

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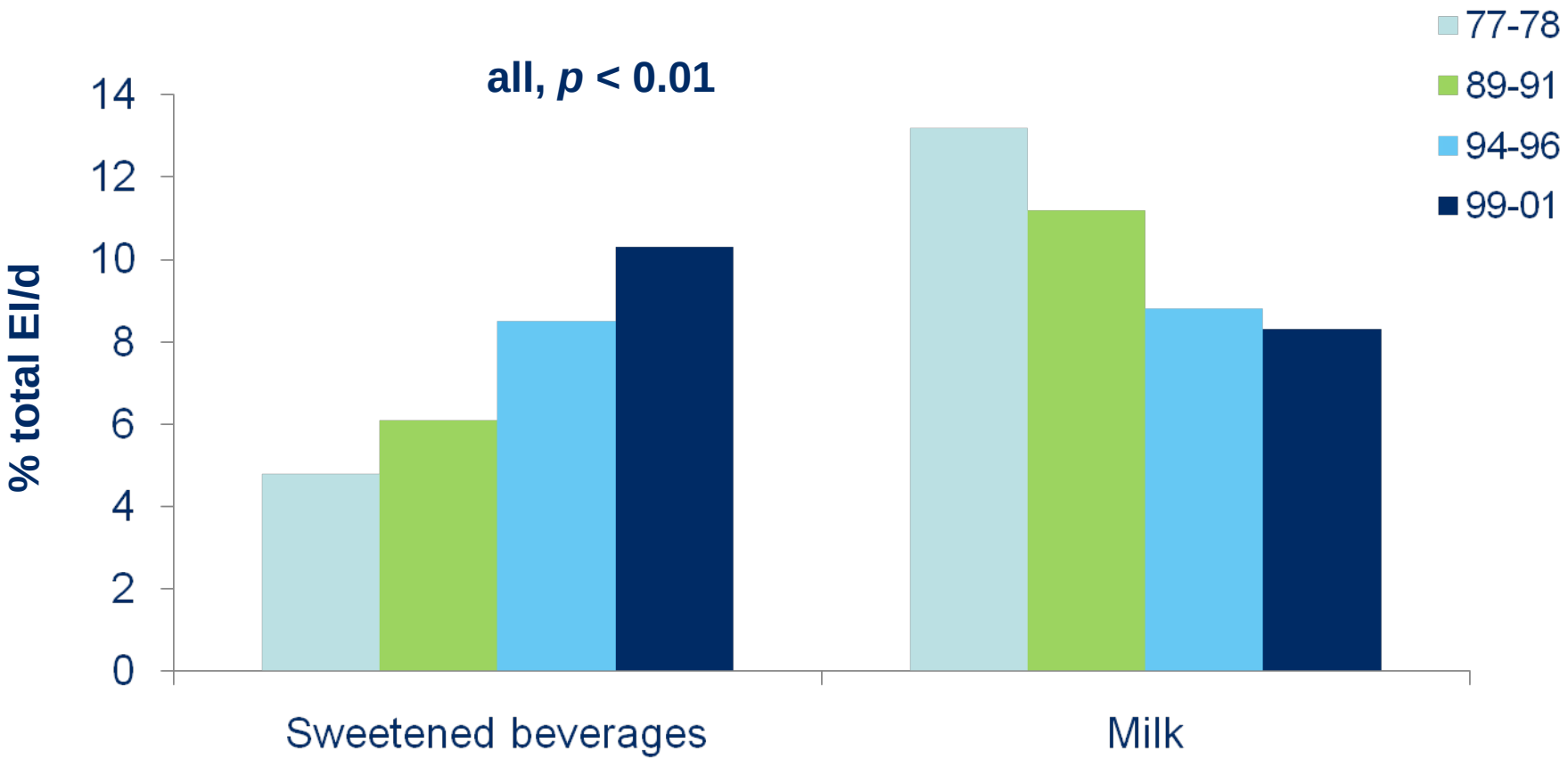
Trends in US beverage consumption in 2-18 yr-olds



Nielsen & Popkin *Am J Prev Med* 2004; 27:205-10

Mechanisms

- There is no clear evidence that sugar consumption *per se* promotes food intake or obesity in a unique manner
  (Hill & Prentice 1995;62:264S)

- Sugar in **liquid** form may be:
  - less satiating (filling)
    and
  - less well compensated for than sugar in **solid** form
    (DiMeglio & Mattes 2000;24:794)

Sugar Sweetened Drinks (SSD)

Publications: → 2008:

- > 52 studies

  - 23 cross-sectional (majority show no sig. association between SSD and BMI)

  - 17 longitudinal (50% show a sig. +ve association, but effect size is small)

  - 12 intervention

Intervention Studies

- Conclusions → no definitive evidence that SSD consumption
  - UNIQUELY contributes to obesity
  - ↓ SSB will ↓BMI levels in general
- Primary focus: impact of an educational intervention on SSD consumption
- Secondary outcomes: change in indices of adiposity
- Short duration

SSD…….the evidence

Publications: → 2008:

- 7 critical reviews/formal meta-analyses

…….and the reviews concluded:

- 2 = evidence was strong
- 1 = association was probable
- 4 = evidence was inconclusive/equivocal or near zero

White Hat Bias.....!

- “bias leading to the distortion of information in the service of what may be perceived to be righteous ends”
  (Cope & Allison , 2010)

- “the distortion of scientific thinking that arises from a misplaced confidence that WISHING to solve a problem automatically delivers insights as to HOW to solve a problem”

White Hat Bias.....!

- World Cancer Research Fund (2008)
- 2005 – commissioned a systematic literature review (SLR) on the role of SSD in promoting obesity
- Remit: to assess the totality of the evidence
- Later: excluded cross-sectional and longitudinal observation studies
- SIX experimental studies, including ONLY 1 RCT (James et al. 2004)
- Expert group – evidence was “limited-suggestive”

Outcome – **“a recommendation to “avoid sugary drinks”**

.....beware of WHB

- Especially likely where there is a pressing public health issue (e.g) obesity

- → Demonization of some foods(e.g SSD)
  → Sanctification of other foods(e.g) F+V
  → such casting has ignited feelings of righteous zeal !!

- Selective and inaccurate interpretation of the literature to fit with a preferred view of the problem

- Decreases inhibitions about breaching the rules of scientific enquiry and reporting
  (ie) the commitment to objectivity: thoroughness: truthfulness

.....beware of WHB

- Publication bias

  (i.e. Studies with sig. positive association between SSD and BMI are more likely to be published than non sig. findings)

- WHB can inappropriately influence public health policy and future research

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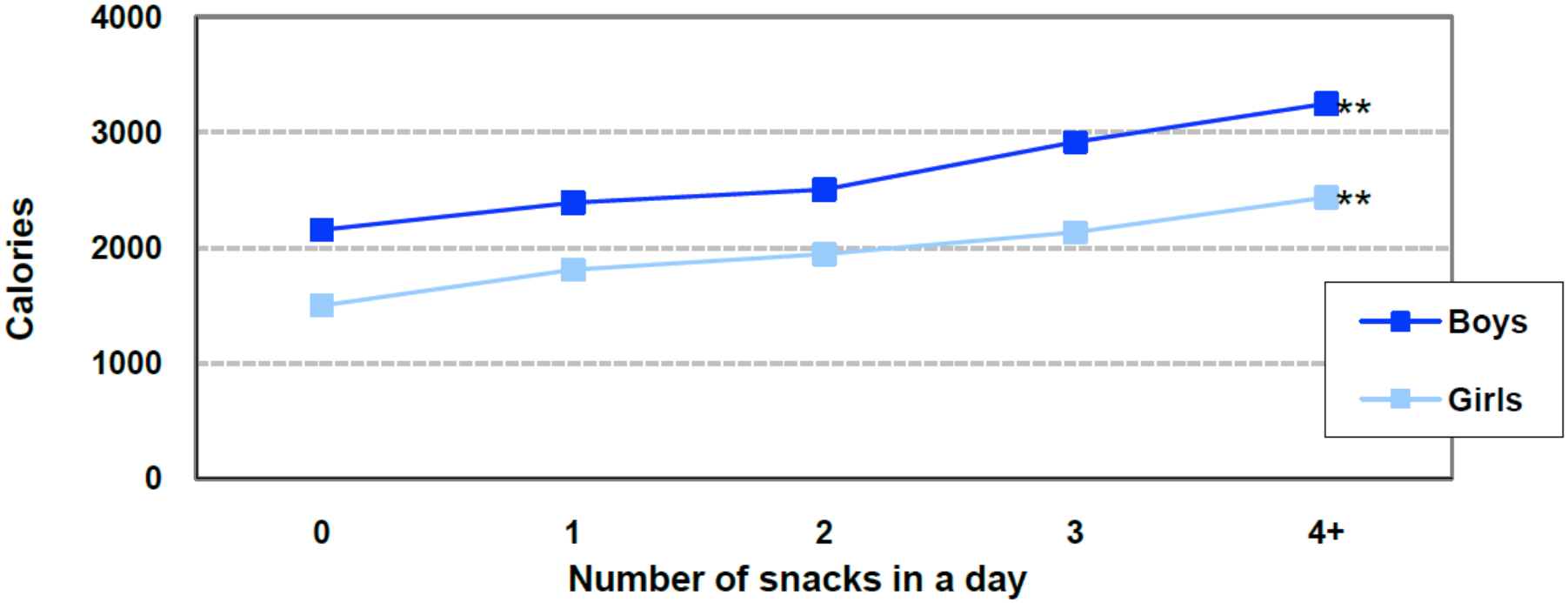
Snacking

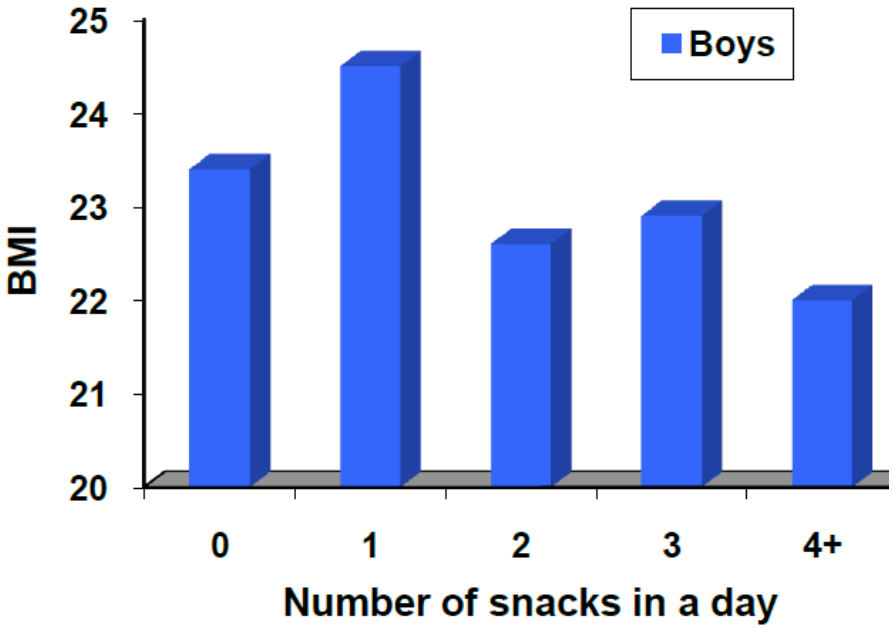
- Lack of consensus definition
- Measurement problems
- Distinction between MEAL and SNACK FOODS is no longer valid
- EI from snacking has increased (30%) in USA and UK

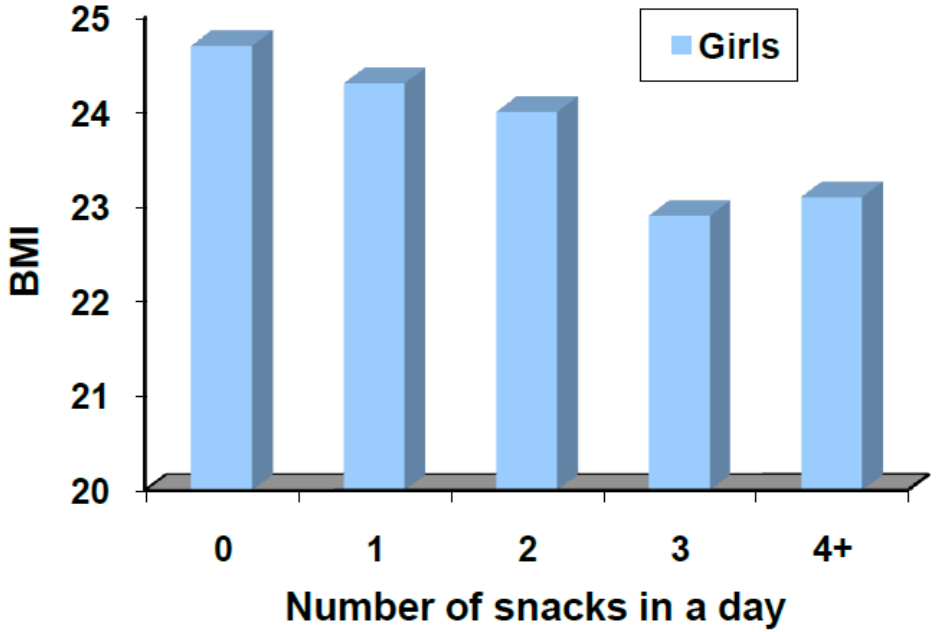
Mean calorie intake by snacking frequency in adolescents age 12-19 years, 2005-06



NOTES: Adjusted for age, race/ethnicity, percentage of poverty threshold, consumption of three main meals, physical activity, and weight status *(see definitions on page 5)*. **Statistically significant trend (p<.001).
SOURCE: What We Eat in America, NHANES 2005-2006, Day 1 dietary intake data, weighted.

Mean BMI by snacking frequency in adolescents age 12-19 years, 2005-06





NOTES: Adjusted for age, race/ethnicity, percentage of poverty threshold, consumption of three main meals, and physical activity *(see definitions on page 5)*. Not significantly different (p>.001) for either sex.
SOURCE: What We Eat in America, NHANES 2005-2006, Day 1 dietary intake data, weighted.

Snacking: Conclusions

- Limited and inconsistent evidence to suggest that snacking is associated with increased body weight
- Snacking *per se* does not cause obesity
- Public health messages → should focus more on reduction of specific types of foods and/or their portion size rather than the context (meal or snack) of eating

Fast Food Consumption

- Bowman et al. 2004
- n=6212 (4-19 yrs)
- 30% consumed fast food
- Children who ate fast food consumed

MORE:
- total energy/total fat
- added sugars
- energy dense foods
- sugar-sweetened beverages

BUT LESS:
- milk
- fewer fruits and vegetables

Why eat it? (Rydell et al 2008)

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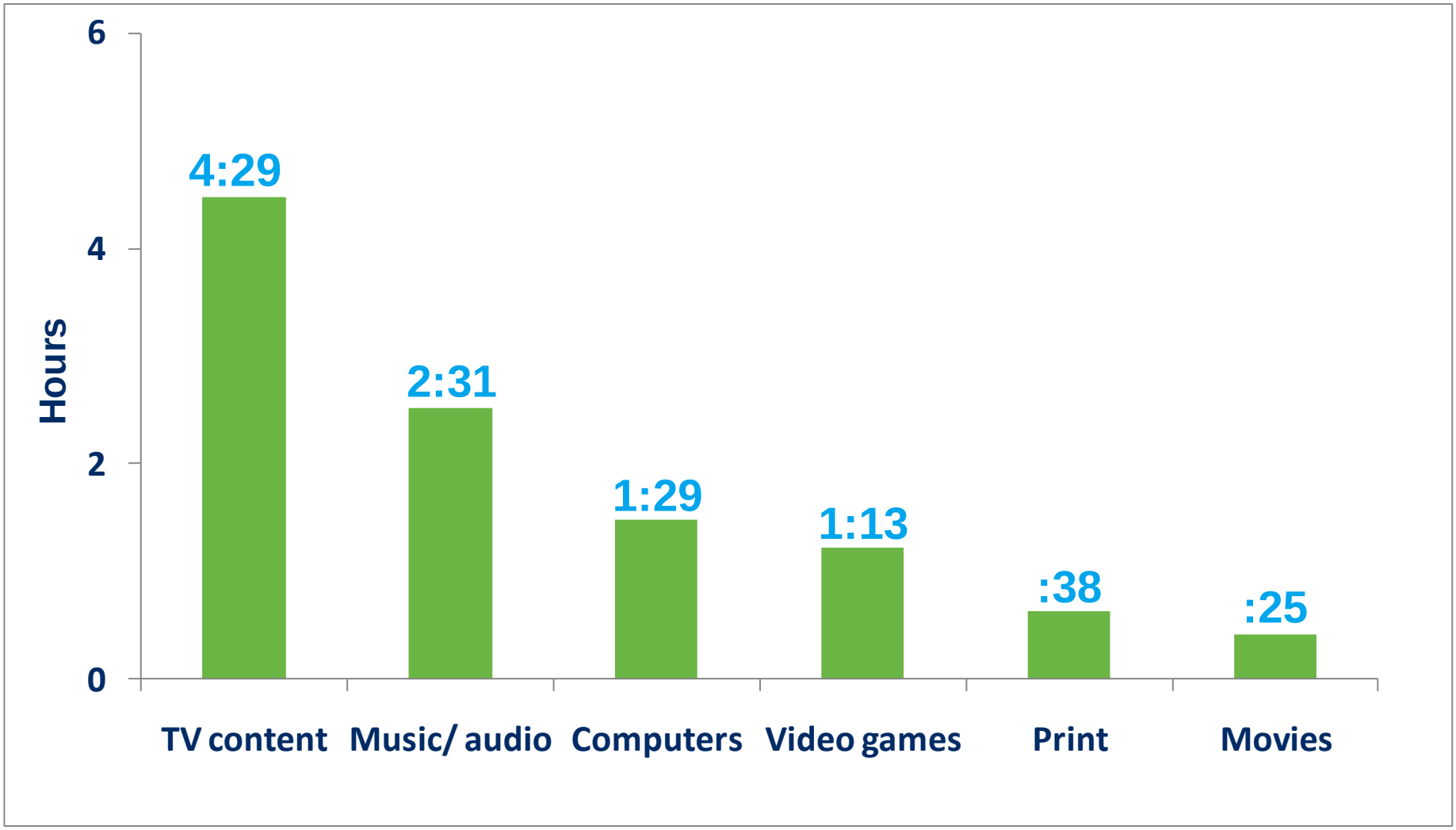
Recreational electronic media use (hrs/d) among 8- to 18-year-olds

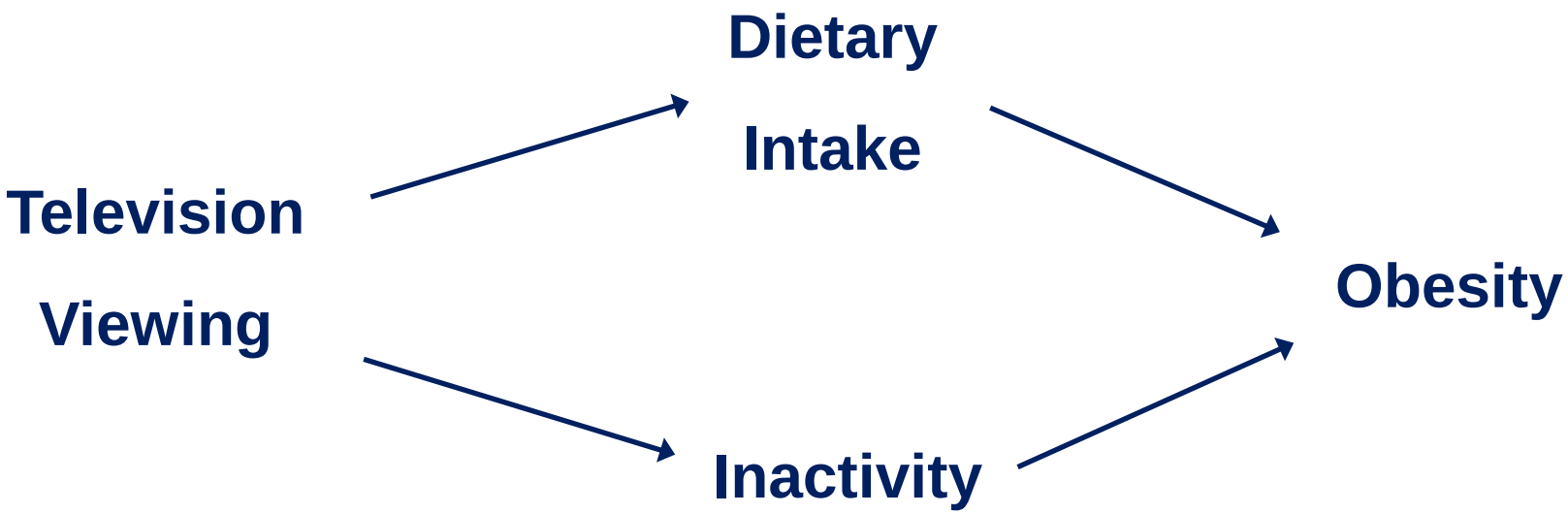


Kaiser Family Foundation, Generation M^2: Media in the Lives of 8- to 18-year-olds, 2010.

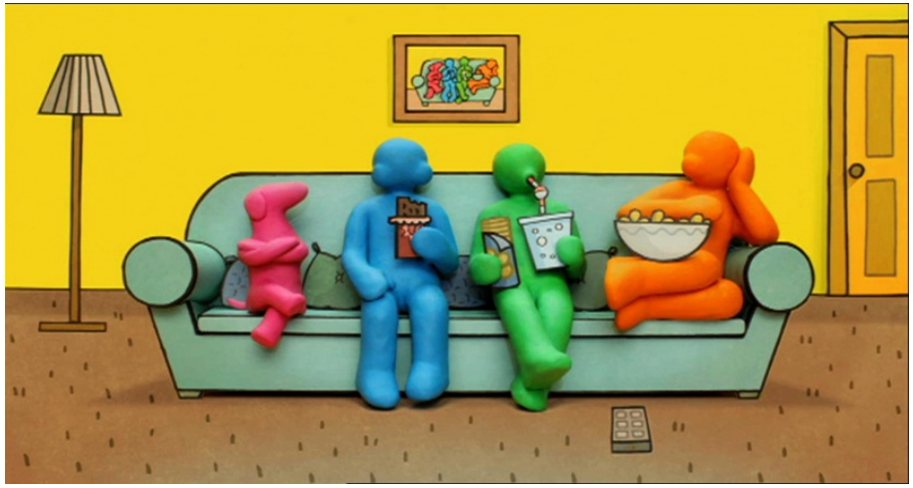
“The major impact of television is not the behavior it produces, but the behavior it prevents [& prompts]”

(Tucker, 1990)

Hypothesized Impact of Television Viewing on Obesity



Television and energy intake



Television viewing is associated with:

- **Increased meal frequency/snacking** (Stroebele & Castro 2004; Snoek et al. 2006; Thompson et al. 2006)
- **Fast food consumption** (Taveras et al. 2006)
- **Increased intake of dietary fat** (Epstein et al. 2005; Miller et al. 2008)
- **Lower intake of fruit and vegetables** (Boyton-Jarrett et al. 2003)

Television and appetite control

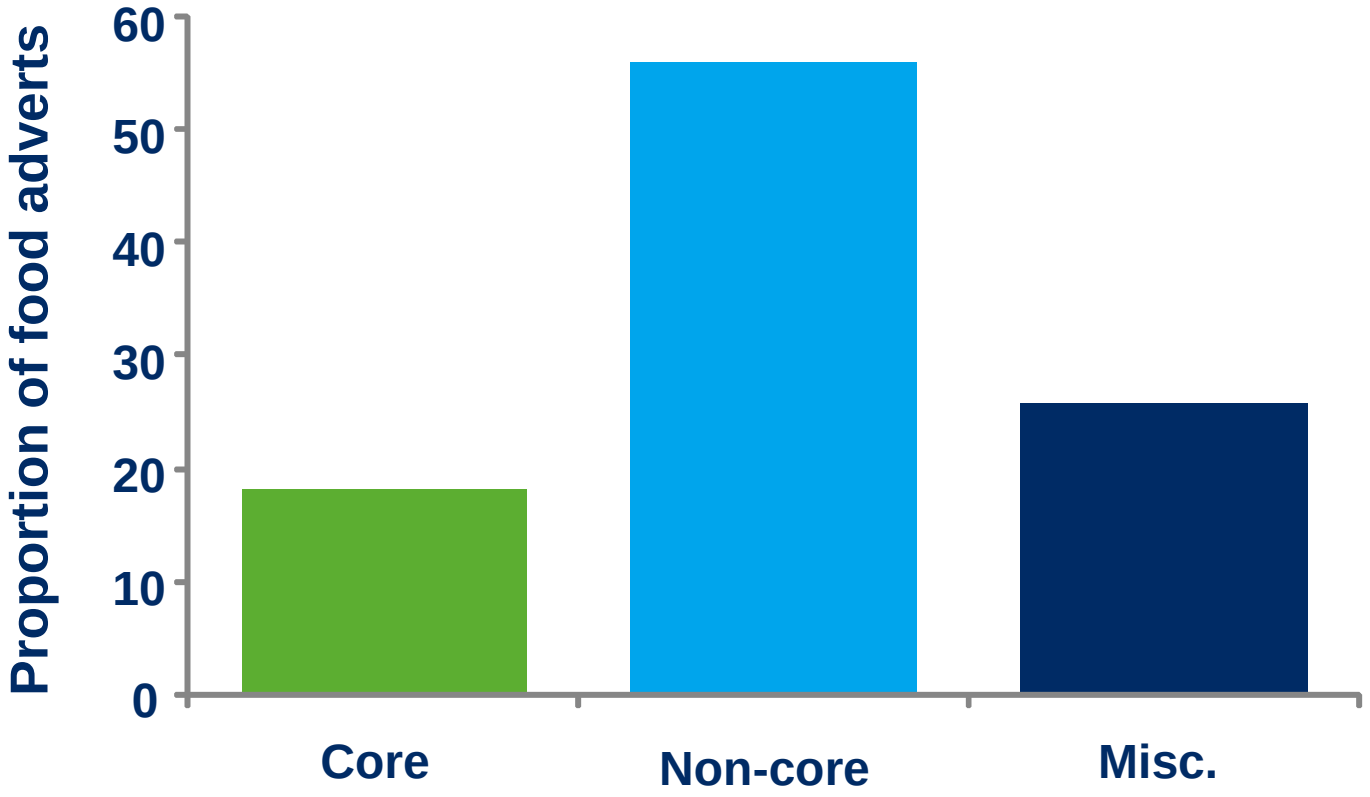
- TV stimulates food intake regardless of hunger-satiety cues

  (Bellisle et al, 2004)

- Associative learning (i.e. TV = time to eat)

  (Stroebele & de Castro, 2004; Wansink, 2004)

Current picture – extent and nature of food advertising on UK TV in 2008



Evidence of an effect

- **Stirling University systematic review for the World Health Organisation (2009)**
  - Extent and nature of food promotion to children
  - Effects of food promotion to children.
- **Concluded that:**

  "*the evidence to date does clearly illustrate that food promotion does influence children's food preferences, purchase behaviour and consumption, and that these effects are significant, independent of other influences and operate at both brand and category level*"
- **Issue is NOT about whether there is an effect, but how BIG it is**

Why focus on the (early) family environment?

Evidence

Rationale for a focus on parents?

Lifestyle behaviours are learnt early...

…and they are learnt primarily in the home

Early diet is important because:

...dietary patterns track across early life

Dietary patterns track.....

From early to later childhood:

Avon Longitudinal Study of Parents and Children (ALSPAC)

- consistent dietary patterns between ages 2 and 5 years (*Northstone & Emmett 2005*)
- moderately stable dietary patterns between ages 3, 4, 7 and 9 years (*Northstone & Emmett 2008*)

Across adolescence and into adulthood:

The Cardiovascular Risk in Young Finns Study (n=~1000)

- childhood diet was a significant determinant of adult diet after 21 years

(*Mikkila et al. 2004, 2005, 2007*)

Parental impacts on childhood obesity: A complex continuum

Maternal nutrition /feeding knowledge

.....some concluding thoughts

- Lots of candidates .....but little evidence !!
- Examining any one aspect of eating behaviour (e.g.) eating frequency, portion size, sugar sweetened drinks is difficult to do in isolation.....in the real world they are so highly inter-related
- Selective citation of research will inform a **belief-based** public policy, not an **evidence-based** one.
- If we are to develop sustainable interventions to tackle childhood obesity.....care must be taken to evaluate all the emerging evidence equally and to ensure that **science**, not **emotion** drives policy