Review of Dietary Research On Overweight Among Children And Adolescents

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Dietary determinants of overweight in youth

1. Breastfeeding and infant feeding
2. Macronutrients
   - Protein
   - Fat
   - Energy
   - Carbohydrates
     - Sugars
     - Sweetened beverages
3. Eating away from home
4. Meal patterns
   - Breakfast eating
   - Snacking
5. Other diet relationships
   - Fruits and vegetables
   - Fiber
   - Calcium and dairy foods
   - Food insecurity

Relationship between breastfeeding and overweight

Parsons et al review, Int'l J Obesity, 1999

- Breast vs formula feeding
  - 4 of 5 within childhood studies found no influence on fatness at 2-7 y
  - 1 found a small association between breastfeeding and fatness in men at 32 y but not women
- Duration of breastfeeding
  - 3 no relationship
  - 1 negative association, 1 positive, 1 mixed

Protective effect of breastfeeding on fatness

Study	Yr	n	Age(y)	Adjusted OR (CI)
vonKries	1999	9,357	5-6	.75 (.57-.98)
Liese	2001	2,108	9-10	.66 (.52-.87)
Gillman	2001	15,341	9-14	.78 (.66-.91)
Toschke	2002	33,768	6-14	.80 (.72-.90)
Armstrong	2002	32,000	3-4	.70 (.61-.80)
Bergman	2003	918	6	.53 (.31-.89)
Grummer-Straun	2004	12,587	4	.70 (.50-.99) Non-Hispanic whites only for 6-12 mo vs. never
Hediger	2001	2,685	3-5	.84 (.62-1.13)
Li	2003	2,631	4-18	NS
Victora	2003	2,250	18	NS

Is increasing duration of breastfeeding associated with lower risk of overweight?

Hediger et al (JAMA 2001) 2,865 children, 3-5 yrs, NHANES

- No clear dose-dependent effect of the duration of full breastfeeding on overweight status

Grummer-Strawn et al (Pediatrics, 2004) 12,587 children up to 60 months in the PNSS

- The duration of breastfeeding showed a dose-response, protective effect among non-Hispanic whites at 6 months plus.

Is earlier introduction of solid foods associated with an increased risk of overweight?

- In Parsons et al 1999 review of longitudinal studies, 3 found no relationship; 2 negative (earlier introduction of solids associated with lower risk of fatness at 1-7 yrs)
- Early introduction of solid foods may displace energy intake from liquid sources rather than supplying additional energy that would contribute to overweight.

Dietary assessment tools may not accurately measure true dietary intake

Limitation/biases

- Underreporting (social desirability, memory, obesity)
- Underestimating portion sizes
- Selective underreporting (foods high in fat, sugar, CHOs, snacks)
- Difficulty assessing diet in children
- Reliance in child's parent or teacher for young children

Protein

- Rolland-Cachera et al (Int'l J Obesity, 1995) in a study of French children (n =112) found that higher protein intake at age 2 was associated with an earlier adiposity rebound, which was associated with increased fatness at 8 yrs.
- They hypothesized that a high protein intake during early childhood can increase the level of insulin-like growth factors (IFGs) triggering early adipocyte multiplication.

Protein

- Dorosty et al (Pediatrics, 2000) longitudinal cohort study of 889 children in UK followed from birth to 5 yrs.
- No association between dietary protein intake and timing of the adiposity rebound. Parental obesity was associated with earlier adiposity rebound.

Relationship between protein (% energy) and subsequent fatness: Longitudinal studies of 50+children at follow-up

		n	Age at Measurement	Age at Outcome	Relationship
Nicklas	1988	50	6m	7 y	None
Maffeis	1998	112	8 y	12 y	None
Alexy	1999	205	3 y	5 y	None
Magarey	2001	243	2 y	15 y	None
Gunnarsdottir	2003	90	2 m	6 y	None in girls **Positive in boys**
Rolland-Cachera	1995	112	2 y	8 y	**Positive**
Scaglioni	2000	147	1 y	4 y	**Positive**
Carruth	2001	53	2 m	96 m	**Positive**
Stunkard	2004	78	3 m	2 y	**Positive**
Skinner	2004	70	2 y	8 y	**Positive**

Dietary fat and obesity

- Dietary fat is the most energy dense of the macronutrients (9 Kcal/g vs 4 Kcal/g for CHO and protein)
- Because it is energy dense, highly palatable, and efficiently converted to body fat, theoretically is thought to be more obesigenic than other energy sources

Relationship between % energy from fat and overweight in children: Longitudinal studies

Amsterdam Growth & Health Study

	Yr	n	Baseline	Outcome	
Twisk	1997	181	13 y	29 y	None
Post	1997	182	13 y	27 y	None
Twisk	1997	181	13 y	27 y	None
Van Lenthe	1998	182	13 y	27 y	None

Relationship between percent energy from fat and overweight: Longitudinal studies with children

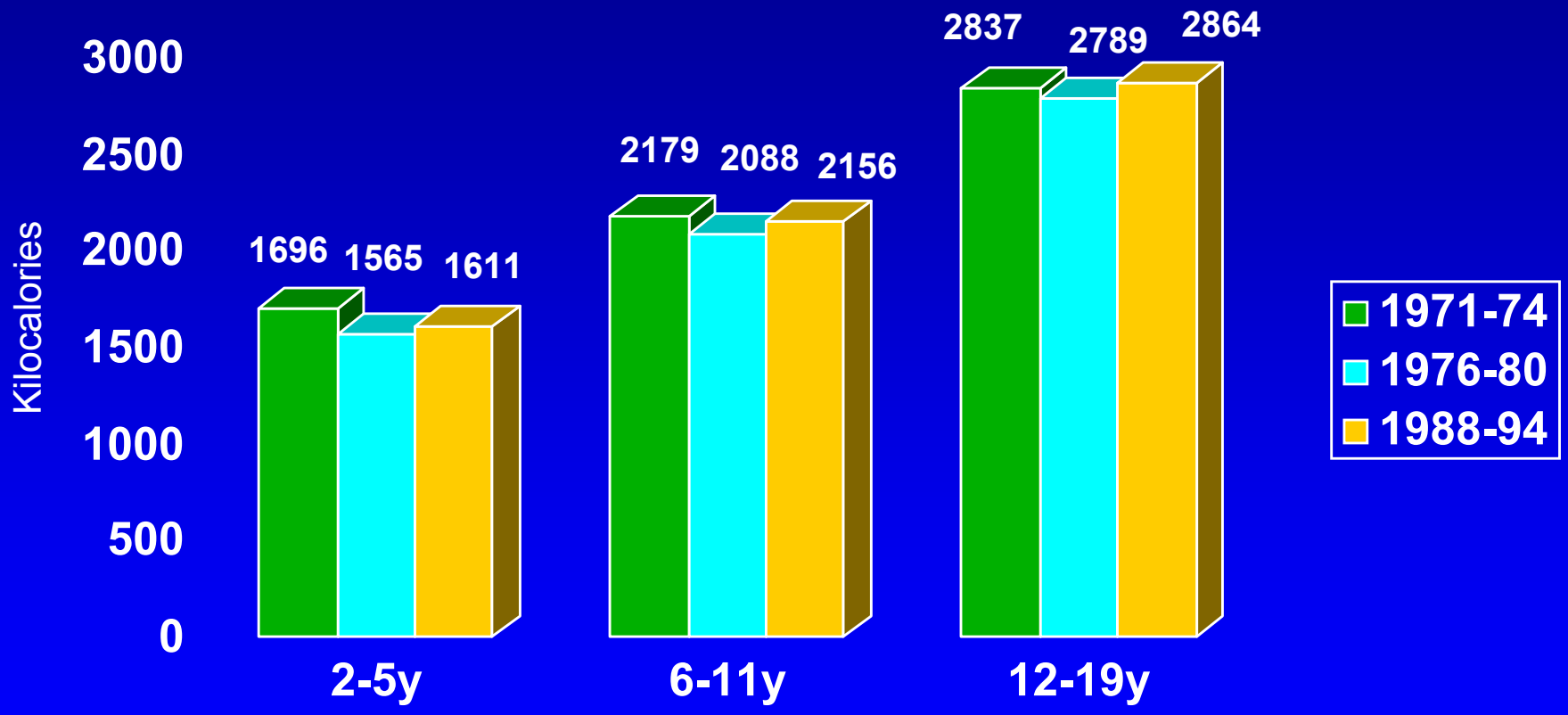
	Yr	n	Baseline	Outcome	
Nicklas	1988	50	6 m	7 y	None
Shea	1993	215	3-4 y	4-6 y	None
Rolland-Cachera	1995	112	2 y	8 y	None
Moffers	1998	112	8.6 y	12.6 y	None
Berkey	2000	10,769	9-14 y	1 y later	None
Newby	2003	1,379	2-5 y	(6-12 m later)	None
Klesges	1995	146	2 y	6.4 y	**Positive**
Skinner	2002	70	2 y	8 y	**Positive**

Cross-sectional studies with children

- The majority have not found a positive association between dietary fat and adiposity
- In NHANES III intakes of energy, total fat did not differ significantly between overweight and nonoverweight (Troiano, AJCN, 2000)

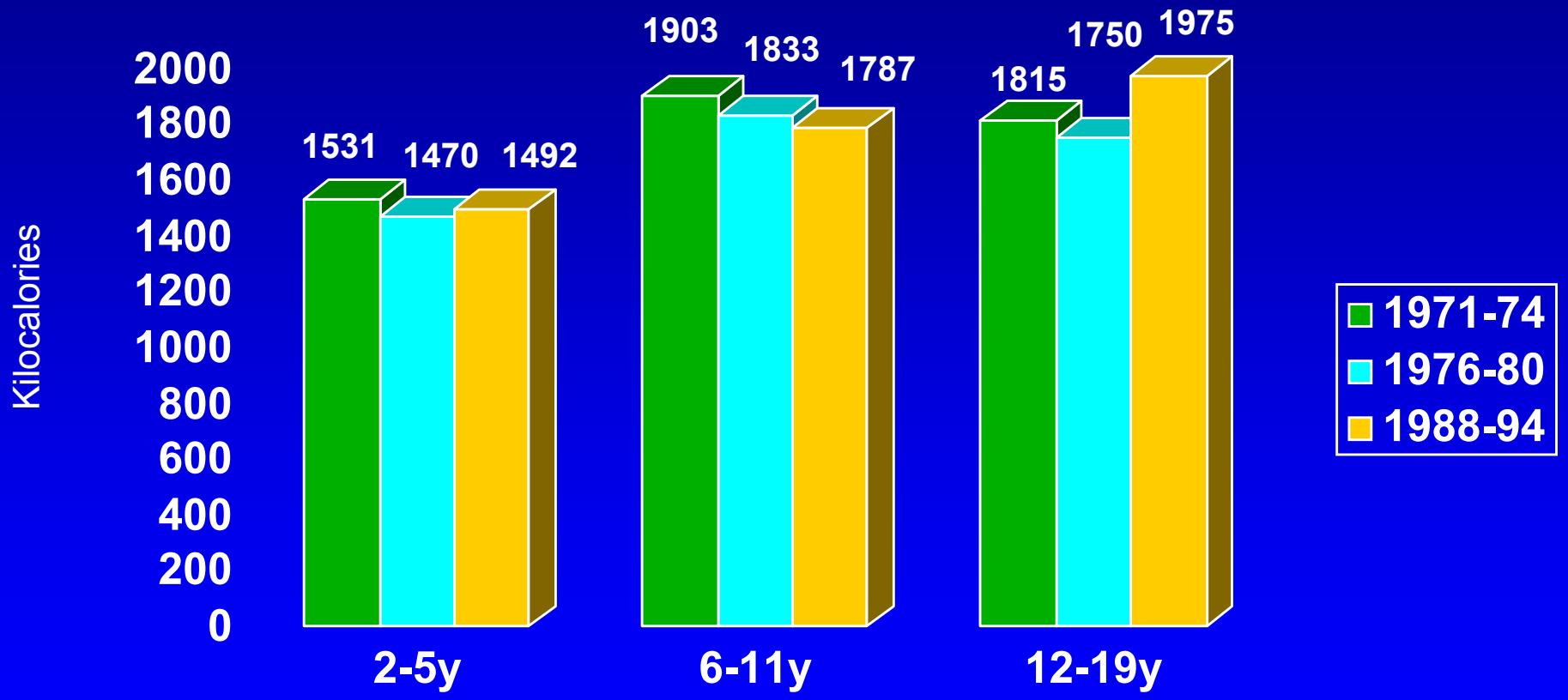
Energy Intake

Secular trends in age-adjusted mean energy intake of males 2-19 y (NHANES I,II, III) 1971-94



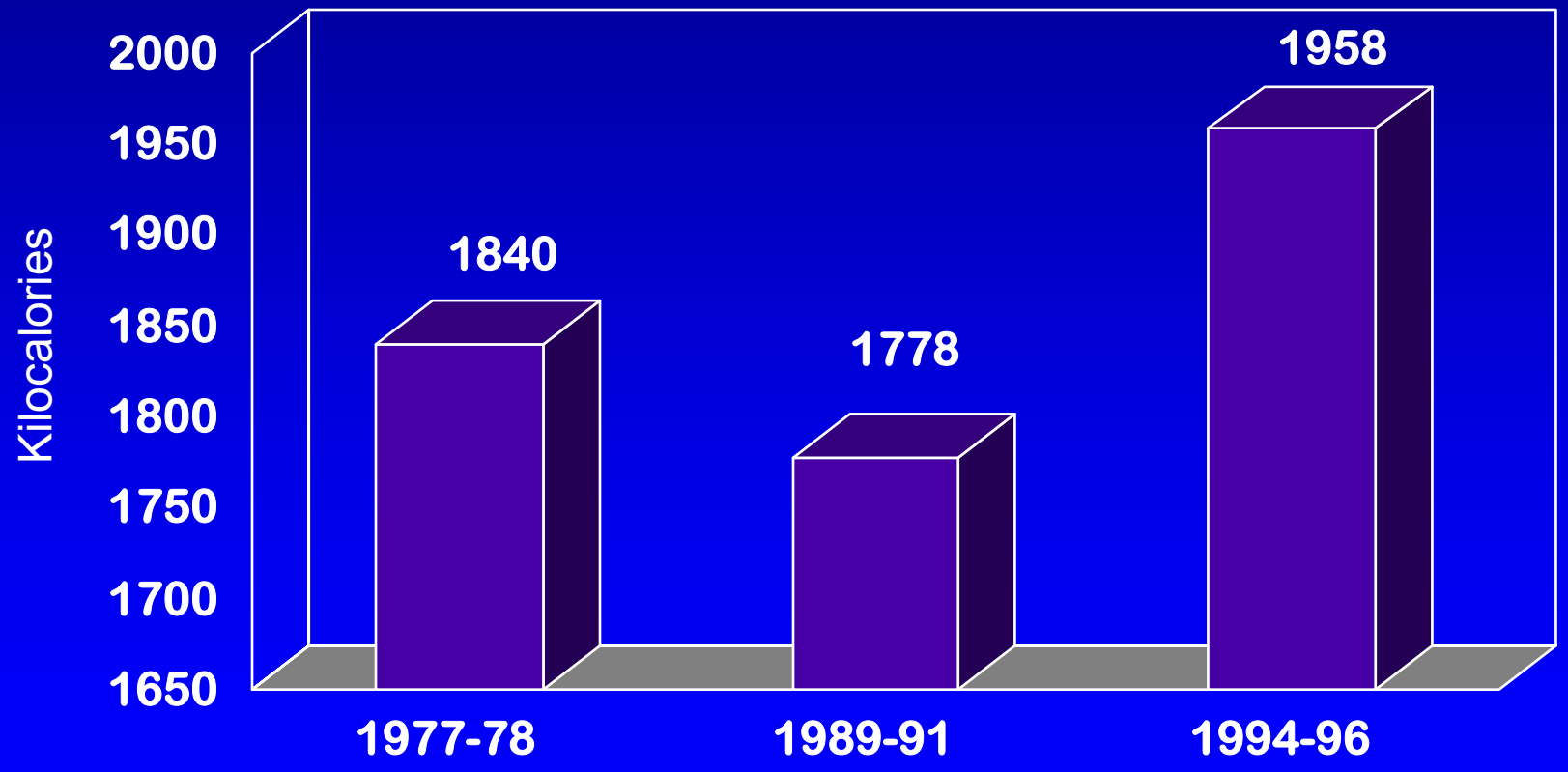
Troiano et al, Am J Clin Nutr, 2000

Secular trends in age-adjusted mean energy intake of females 2-19 y (NHANES I, II, III) 1971-94



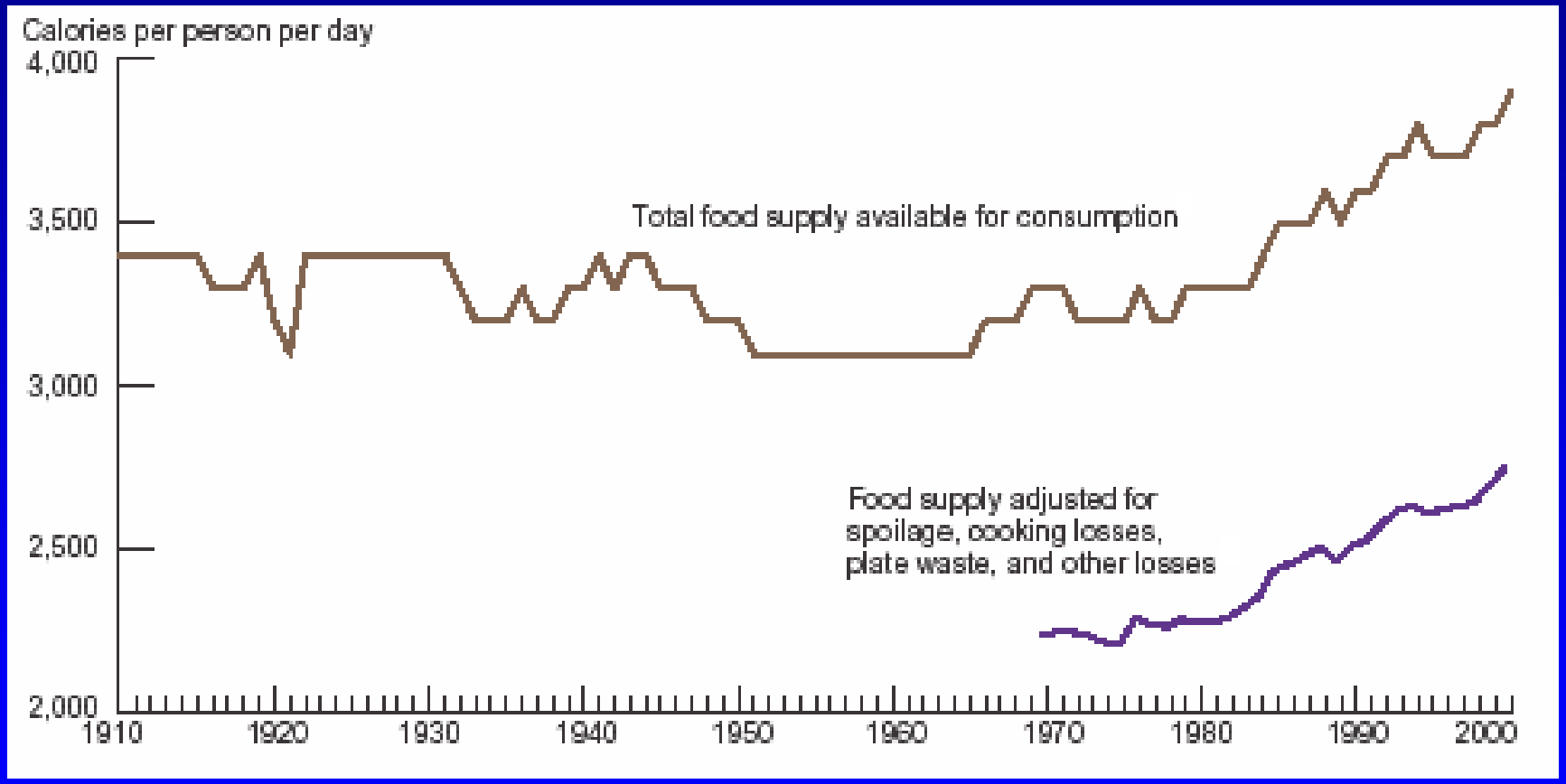
Troiano et al, Am J Clin Nutr. 2000

Trends for age-adjusted mean energy intake of children and adolescents, 2-18 yr (NFCS & CSFII) 1977-1996



Nielson, Siega-Riz, Popkin, Obes Res, 2002

Calories from the US per capita food supply, adjusted for losses, increased 20% between 1982 and 2000



Average daily Kcal consumption in 2000 was 300 Kcal above the 1985 level

Putnam et al, FoodReview, 2002

Relationship between energy intake and subsequent fatness: Longitudinal studies

	Yr	N	Age at Measurement	Age at Outcome	Relationship
Shapiro	1984	149	6 m	9 y	Negative
Post	1997	182	13 y	27 y	Negative
Griffiths	1990	25	3-4 y	15 y	Negative in females None in males
van Lenthe	1998	182	13 y	27 y	Negative in females None in males
Deheeger	1996	112	10 m	8 y	None/ positive
Rolland-Cachera	1995	112	2 y	8 y	None
Klesges	1995	146	4.4 y	6.4 y	None
Maffeis	1998	112	8.6 y	12 y	None

Parsons et al, review from Int'l J Obesity, 1999

Longitudinal study of dietary intake and weight change in 9-14 year olds

Berkey, Rockett, Field, Gillman et al, Pediatrics 2000.

GUT Study.10,769 9-14 yr olds. 94% white. 1 yr follow-up. Self-reported BMI. Dietary intake FFQ

- Larger increases in BMI from 1996-97 were among girls who reported higher caloric intakes
- For both boys and girls, a larger rise in caloric intake from 1996-97 predicted larger BMI increases

Conclusion

Little evidence from longitudinal studies that absolute energy intake is positively related to later fatness. However there are many methodological limitations in the studies.

Energy-dense snack (EDS) food intake in adolescence: Longitudinal relationship to weight and fatness

Phillips, Bandini et al, Obesity Research, 2004

- MIT Growth & Development Study
- Followed 1996 normal weight premenarcheal girls 8-12 y until 4 years postmenarche
- Willit FFQ: categories of EDS foods– baked goods, ice cream, chips, soda, candy
- Soda was the only EDS food related to BMI z score over the 10-yr period. Not related to %BF
- Overall, EDS food consumption did not influence weight status or fatness change

Consumption of low-nutrient density (LND) foods to BMI in children and adolescents: NHANES III, 1988-94

Kant, Arch Pediatr Adol Med 2003

- 4852 youth ages 8-18 yrs
- Foods in 24 hour recall were grouped into 5 LND categories: 1) visible fat, 2) sweets [candy, beverages], 3) desserts, 4) salty snacks, 5) misc
- LND foods contributed more than 30% of daily energy, with sweeteners and desserts accounting for ~25%
- Consumption of LND foods not related to BMI

The Bogalusa Heart Study

- Cross-sectional sample of 1562 10-yr-olds, between 1973-94
- Single 24-hour recall. Measured weights
- Consumption of the foods below were positively associated with overweight
  - sweetened beverages
  - sweets
  - meats
  - low-quality foods [fats/oils, sweets, sweetened beverages, salty snacks]
- Lack of congruency across 4 ethnic-gender groups (most relationships only seen for whites)

Nicklas et al, Am J Prev Med, 2003

Carbohydrates

- Total CHO intake has increased in both absolute terms (grams) and as a proportion of total energy intake.
- Of all the longitudinal studies with youth, none have found a significant positive relationship between total CHO intake and adiposity.
- A few of these studies have found negative (inverse) relationships (i.e., children who consume large amounts of CHO are leaner). May reflect high levels of physical activity.

Per capita consumption of added sugars in the US (USDA data)

	Annual Per Capita (lbs, dry-weight equivalent)		
	Total caloric sweeteners	Refined cane\ beet sugar	High fructose corn syrup
1970-74	124	101	2
1975-79	124	92	9
1980-84	122	75	27
1985-89	131	62	47
1990-94	141	64	53
1995-99	148	65	60
2000	149	66	63
% Change 1970-74 to 2000	+20%	-35%	+4,080%

Putnam, FoodReview, 2002

Mean intake of total added sweeteners (USDA CSFII 1994-96)

Age group	Gram-equivalents	% of total energy
2-5 y	61	16
6-11 y	91	19
12- 17 y F	98	20
12-17 y M	142	20
18-34 y F	82	18
18-34 y M	115	17
35+ y F	53	13
35+ y M	73	13

Guthrie & Morton, JADA, 2000

Relationship between sugar intake and obesity

- Most U.S. population studies show children and adults who have high total energy intakes tend to have high total sugar intakes.
- Studies in adults and children consistently show an inverse relationship between sugar intake and BMI.

National trends in soft drink consumption among youth 6-17 yrs old (USDA surveys: 1977-78, 1994-96, 1998)

		Mean Intake (Fluid oz)		
		77/78	94/98	% Increase
Overall		5	12	123%
Boys	6-10 y	4	7	88%
	11-13 y	5	13	165%
	14-17 y	7	22	196%
Girls	6-10 y	3	6	77%
	11-13 y	5	11	127%
	14-17 y	7	14	93%

French et al, JADA, 2003

Trends in share of soft drink consumption by source, (USDA CSFII 1994-96, 1998)

Source	%
Home	49
Restaurant/fast food	22
Vending machine	4
School cafeteria	3
Other	22

French, Lin, Guthrie, JADA, 2003

Soft drink consumption is associated with higher energy intake

Harnack et al (1999) CSFII 1994-96

Adol. nonconsumers of soft drinks	Adol. 26+ oz/day soft drinks
1984 Kcal/day	2605 Kcal/day

Troiano et al (2000) NHANES 1988-94

Proportion of daily energy from soft drinks

	Overweight	Non-overweight
Adol. males	10.3%	7.6%
Adol. females	8.6%	7.9%

Studies on sugar-sweetened drinks and childhood obesity

Longitudinal

Ludwig et al, 2001: 548 children, 11-12 y, Planet Health subsample (followed 19 months)

- For each additional serving of sugar-sweetened drink consumed, the odds of becoming obese ↑ by 60%

Phillips et al, 2004: 196 children, 8-12 y, Boston

- Soda was related to BMI-z score but not to % BF

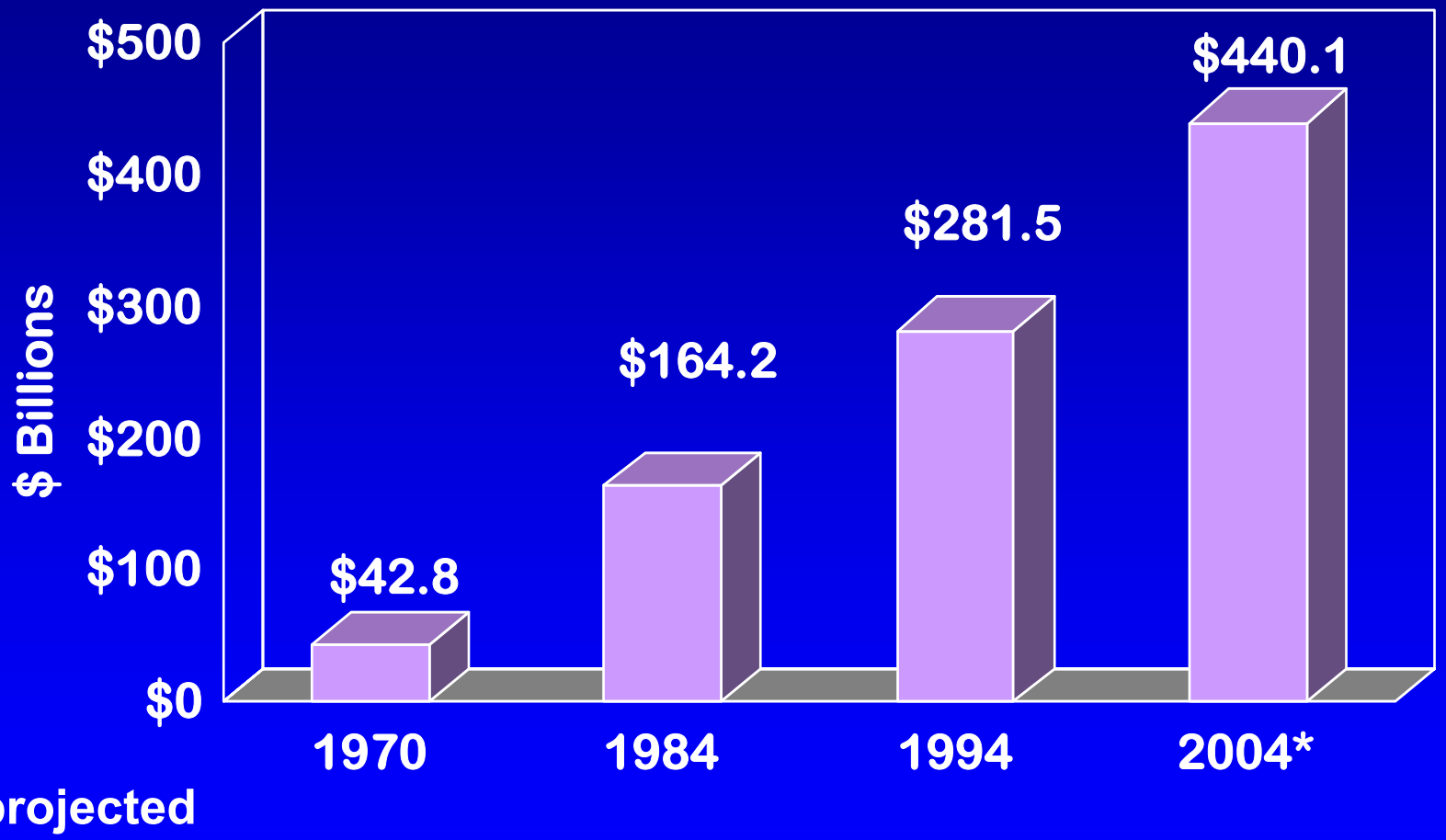
James et al, 2004: Randomized controlled-school trial

644 children, 7-11 y, England (followed 1 school yr)

- There was a modest reduction in soft drinks consumed and ↓ mean percentage of overweight children. No diff in BMI or z score between control and intervention groups.

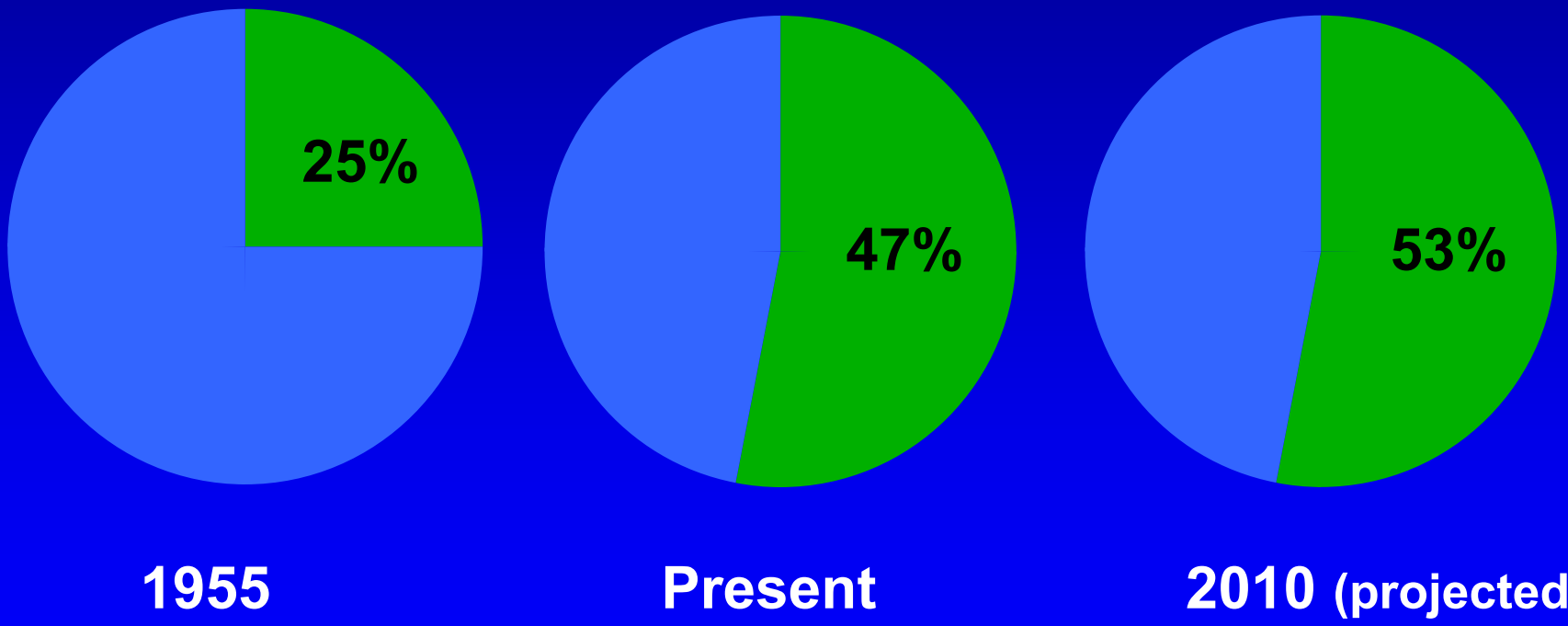
Eating Away From Home

Eating out: U.S. food and drink sales



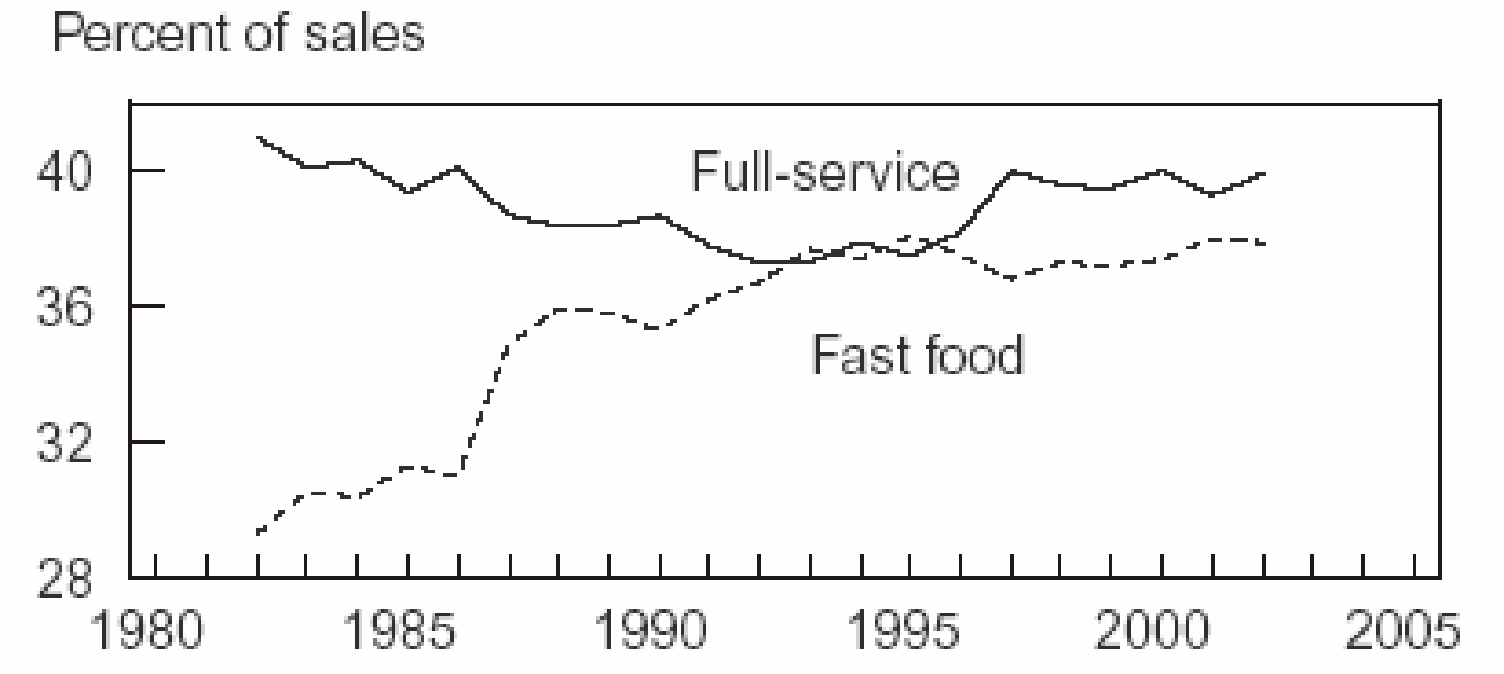
National Restaurant Association, 2004

Eating away from home: Share of the food dollar



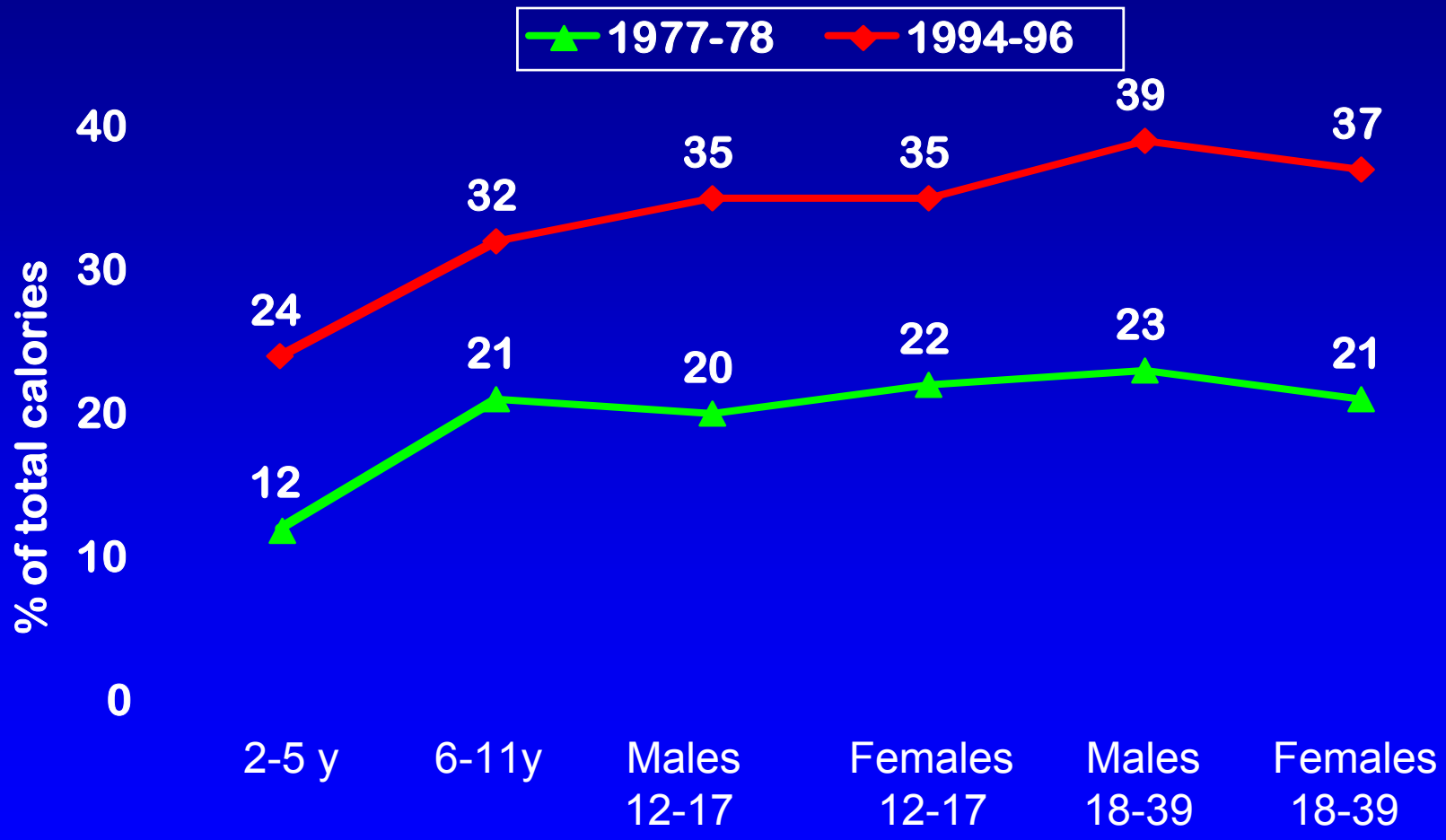
National Restaurant Association, 2004

Away-from-home market by outlet type



ERS, USDA, 2004

Percent of total calories obtained from "away" food, 1977-78 vs 1994-96 (CSFII)



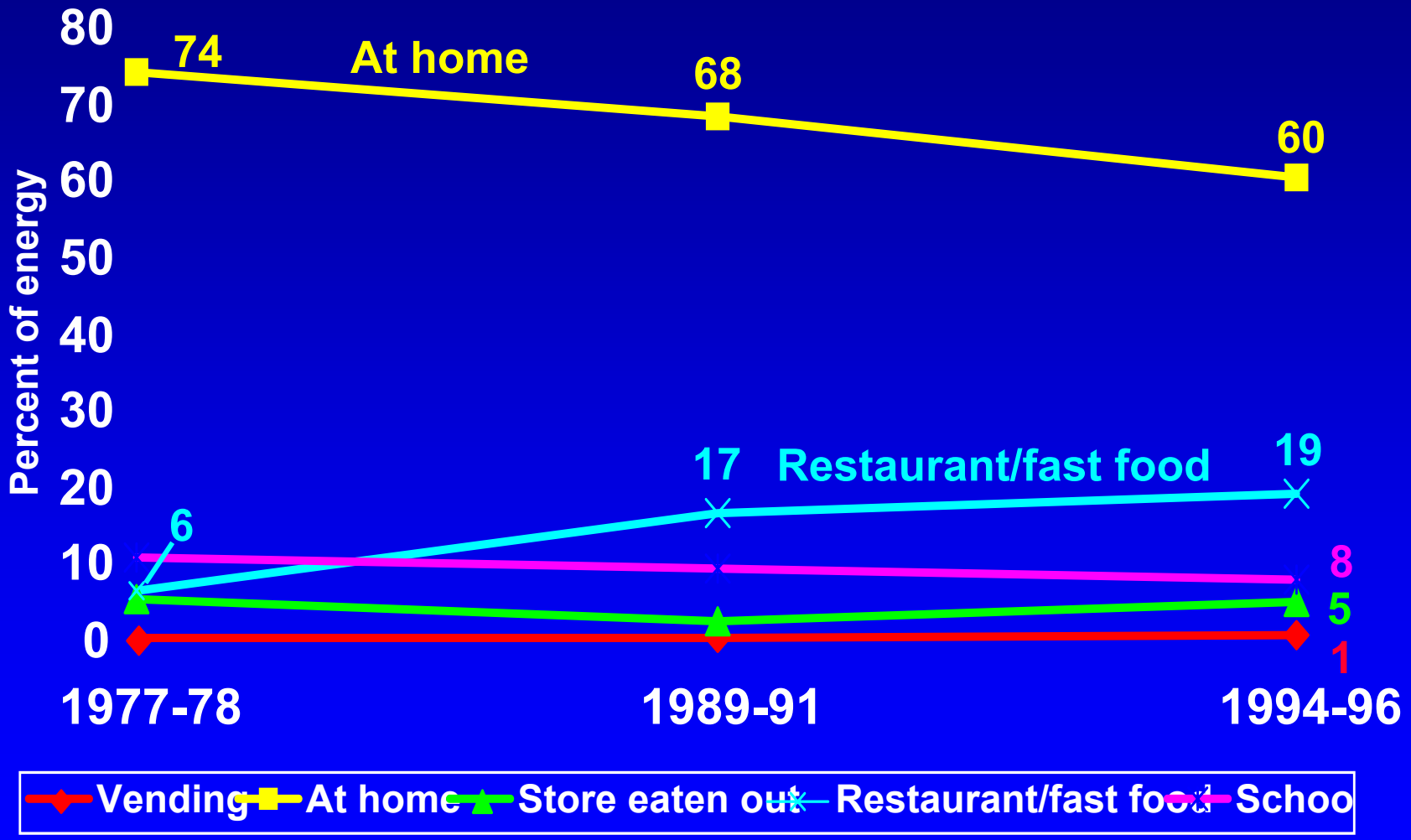
Guthrie et al, J Nutr Ed & Behav, 2002

Away-from-home foods are higher in total fat compared to home foods for children 2-19 (CSFII 1994-96)

	% Energy from Fat
Home foods	31.5
Away-from-home foods	36.2
Fast food	38.2
Schools	36.4
Restaurants	38.4
Others	32.8

Lin, Guthrie, Frazao, FoodReview, 1999

Trends in energy intake by food locations among adolescents 12-18 yrs (NFCS/CSFII)



Source: Nielsen SJ et al, Preventive Medicine, 2002.

Percent of youth eating food from a fast food place on the day of the survey (CSFII 1994-96,98)

(weighted means)

4-8 y	25%
9-13 y	26%
14-19 y	39%
Total	30%

Adjusted analysis: ↑ fast food intake was associated with males, older age, higher household income, black

Bowman, Gortmaker, Ebbeling, Pereira, Ludwig, Pediatrics, 2004

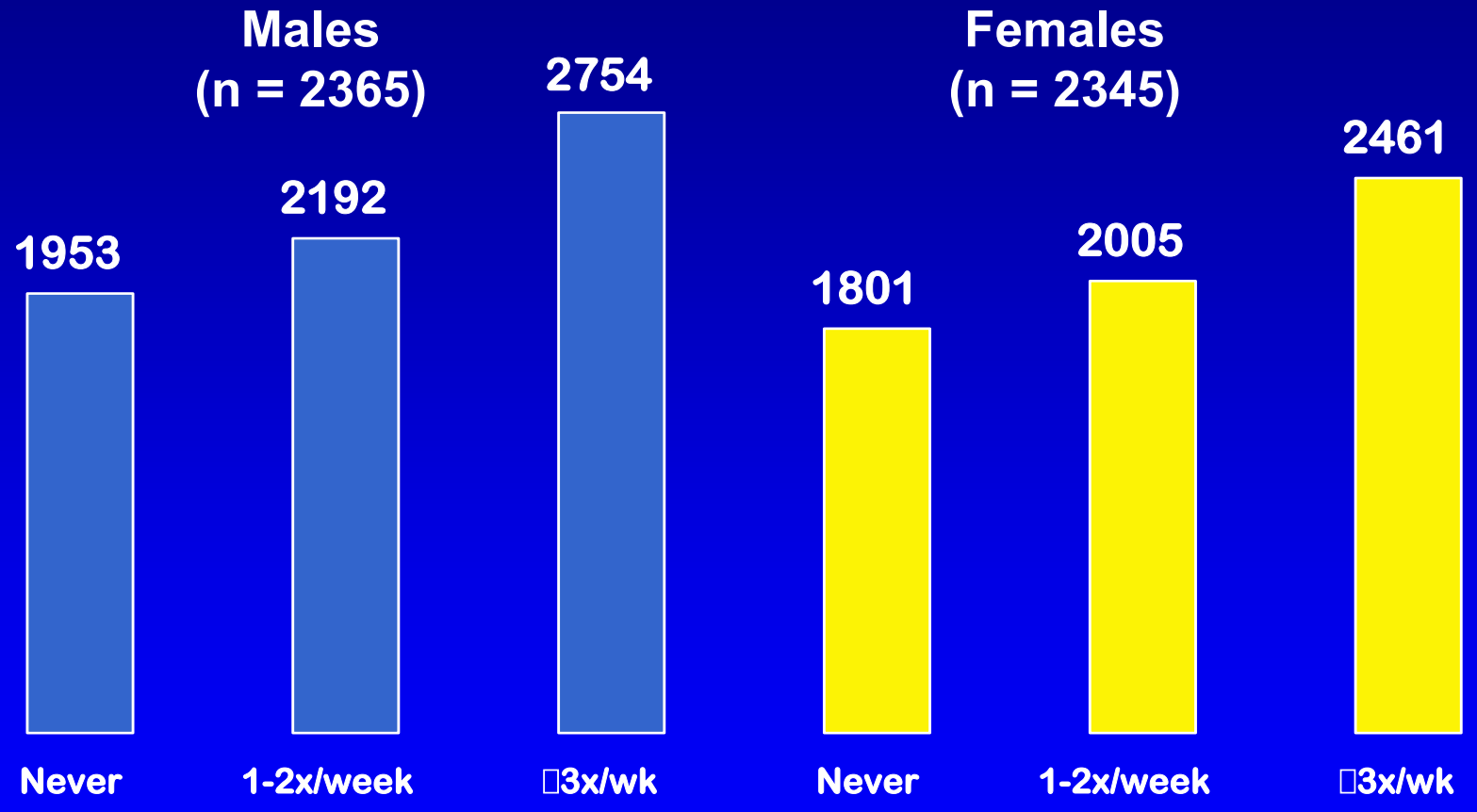
Effects of fast food intake on diet among children
(1 day survey, n=6212 youth, 4-19 y) CSFII 1994-96, 1998

	Had no FF	Had FF	Difference
Energy (Kcal)	2049	2236	+187
Total fat (g)	75	84	+9
Added sugars (g)	94	122	+28
Fiber (g)	14.3	13.2	-1.1
Energy density (Kcal/g)	2.06	2.36	+.30

Adjusted for demographic and SES factors

Bowman, Gortmaker, Ebbeling, Pereira, Ludwig, Pediatrics, 2004

Energy intake among adolescents by fast food usage (Project EAT)



French, Story, Neumark Sztainer Int'l J Obesity, 2001

Fast food restaurant use and association with overweight among adolescents: Project EAT

	Males (n =2365)			Females (n =2345)		
	0	1-2x/wk	≥3x/wk	0	1-2x/wk	≥3x/wk
Overweight %>95%tile	19.4	17.1	12.4 (NS)	14.6	14.2	12.7 (NS)
Mean BMI	23.5	23.2	22.4 (p=0.001)	23.5	23.5	23.2 (NS)

(adjusted for grade, race, SES)

French, Int'l J Obesity, 2001

Compensation for energy intake from fast food among overweight and lean adolescents

Ebbeling et al, JAMA, June 16, 2004

- Subjects: 26 overweight and 28 lean 13-17 yr olds.
- Study 1: were fed “extra large” fast food meal in a food court. Energy intake was 1652 Kcal. Overweight ate more.
- Study 2: assessed energy intake (24 hour recalls) for 2 fast food days and 2 non-fast food days. Overweight consumed more energy on fast food days (2703 Kcal/day) than non-fast food days (2295 Kcal/day)
- Conclusion: Overweight youth less likely to compensate for the energy in fast food by adjusting energy intake throughout the day compared to lean youth.

Food purchased away from home as a predictor of change in BMI z-score among girls

Thompson, Ballew, Resnicow, Must, Bandini, Cyr, Dietz Int'l J Obesity, 2004

- 101 non-obese, mostly white girls, between 8-12 y at baseline and 11-19 y at follow-up at MIT
- Girls kept 7-day dietary records at 2 points in time

Results:

Frequency of eating quick-service food at baseline was positively associated with change in BMI z-score ($F=6.49$ $p<0.01$). Girls who ate quick service food 2+ times a week had the greatest mean increase in BMI z-score.

No relationship between eating in restaurants and BMI change

Proximity of neighborhood fast food restaurants and relationship to overweight in low-income preschool children

- Cross-sectional study of 7,020 low-income children (3-5 y) in Cincinnati, Ohio
- Measured BMI
- Distance between each child's residence and FF restaurant was determined by GIS

Results:

No association between child overweight and proximity to FF restaurants

Burdette & Whitaker, Prev Med, 2004

Issues

No consensus for what constitutes a fast food restaurant

Bowman (2004) (USDA)	Obtain food from a fast-food or pizza place
French (2001) (Project Eat)	'How often did you eat something from a fast food restaurant (like McDonald's, Burger King, Hardee's, etc.)'
Thompson (2004) (MIT Growth and Development study)	Quick service food: from a quick-service food outlet or from local sub (sandwich) shops, ice cream parlors, street vendors Restaurant food: from a pizza parlor, self-service restaurant, or a wait-staff restaurant

Food portions have increased in restaurants, fast food outlets and at home (USDA data 1977-96)

	Portion size, oz.		
	1977-78	1989-91	1994-96
Salty snacks	1.0	1.4	1.6
Soft drinks	13.1	16.8	19.9
Fruit drinks	11.3	12.6	15.1
Fast food	3.1	3.5	3.6
Hamburger	5.7	5.9	7.0

Nielsen and Popkin, JAMA, 2003

What is the effect of portion size on overall energy intake?

- Few studies have examined this in children, most are short-term controlled trials
- In 3-5 yr old children, energy intake increased (15%) at lunch when portion size of an entrée doubled (response not related to BMI) (Fisher, Rolls, Birch, AJCN, 2003)
- Increasing portion size of lunch (macaroni and cheese) resulted in increased food intake at lunch among 5 yr olds, but not 3 yr olds (Rolls, Engell, Birch, JADA, 2000)

Meal and Snack Patterns

- Breakfast
- Snacking

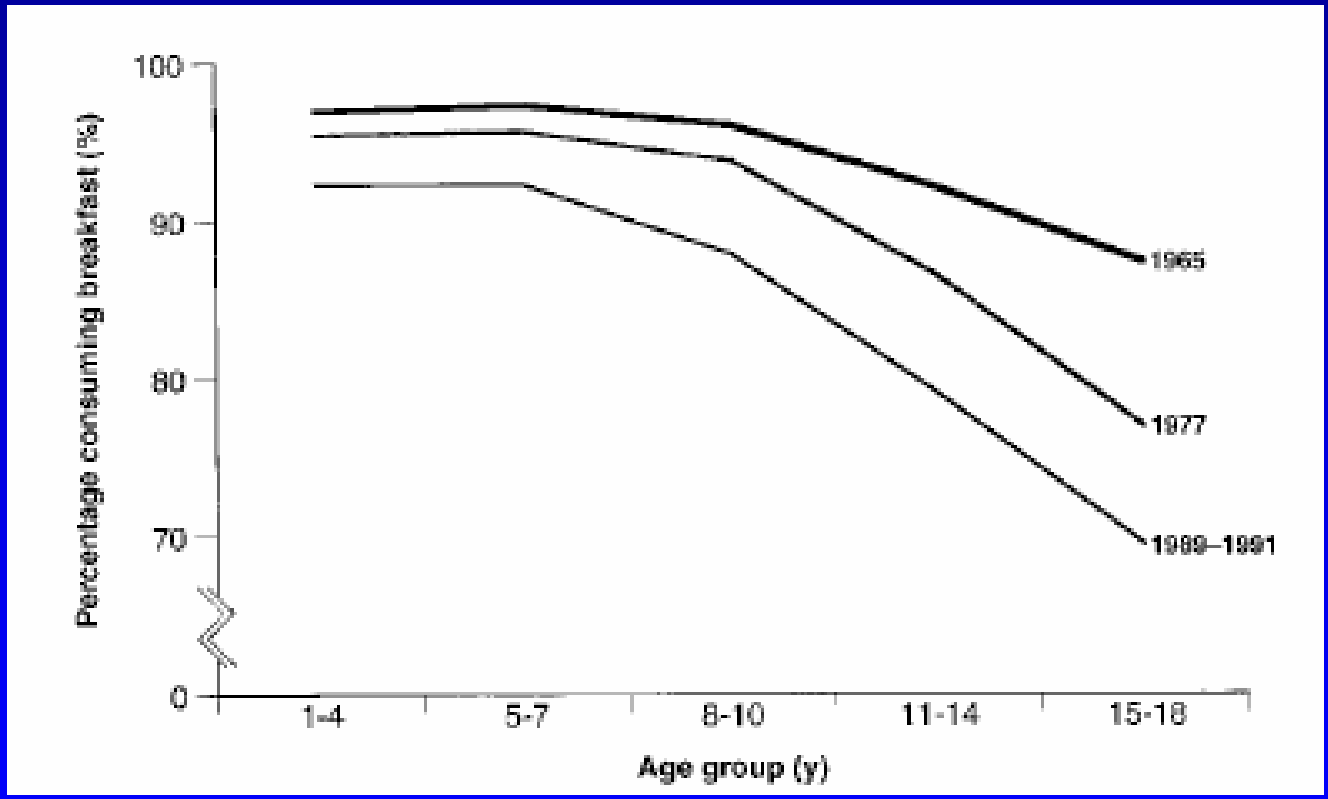
Trends in children's meal patterns from 1973-94 and associations with overweight: The Bogalusa Heart Study (n =1584, 10 yr olds)

- Breakfast skipping ↓
- Eating dinner at home↓
- Eating dinner at restaurants ↑
- Snacks ↓
- Total eating episodes ↓

No associations between meal patterns and overweight status.

Nicklas et al, JADA, 2004

Trends in breakfast consumption among youth from 1965-1991 (NFCS 1965, 1977, CSFII 1989-91)



Siega-Riz, Popkin, Carson AJCN, 1998

Breakfast skipping and fatness in children

Cross-sectional studies have consistently reported positive associations between breakfast skipping and fatness

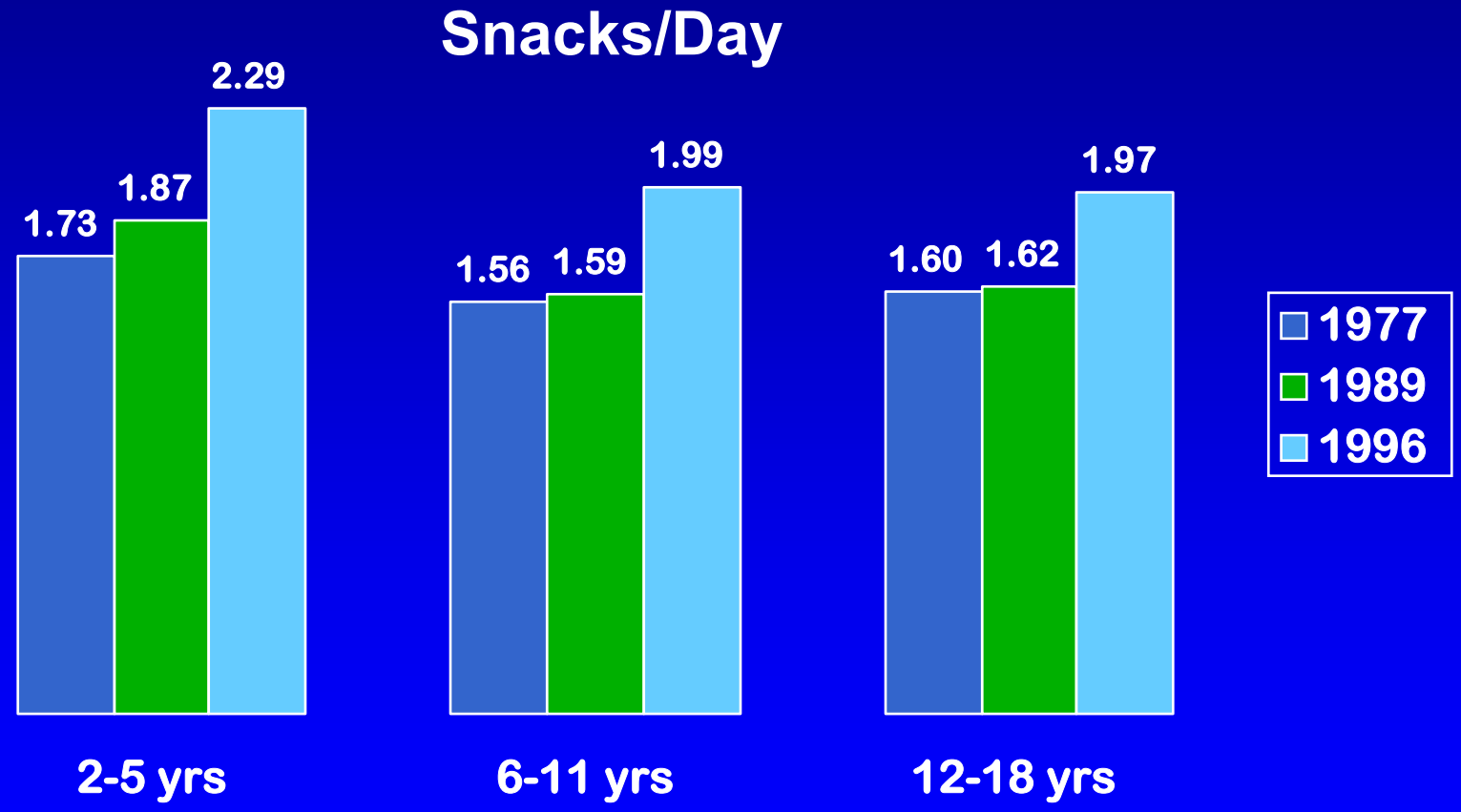
Longitudinal study of skipping breakfast and weight change in adolescents

Berkey, Rockett, Gillman, Field, Colditz

Int'l J Obesity 2003. >14,000 9-14 yr olds. GUT Study (1 yr follow-up. Self-reported BMI)

- Children who never ate breakfast had lower energy intakes than those who ate breakfast
- Overweight children who never ate breakfast lost BMI over the following year compared to overweight children who ate breakfast
- Normal weight children who never ate breakfast gained weight compared to those who ate breakfast

Increasing prevalence of snacking among children from 1977 to 1996 (NFCS, CSFII)



Jahns, Siega-Riz, Popkin, J Pediar, 2001

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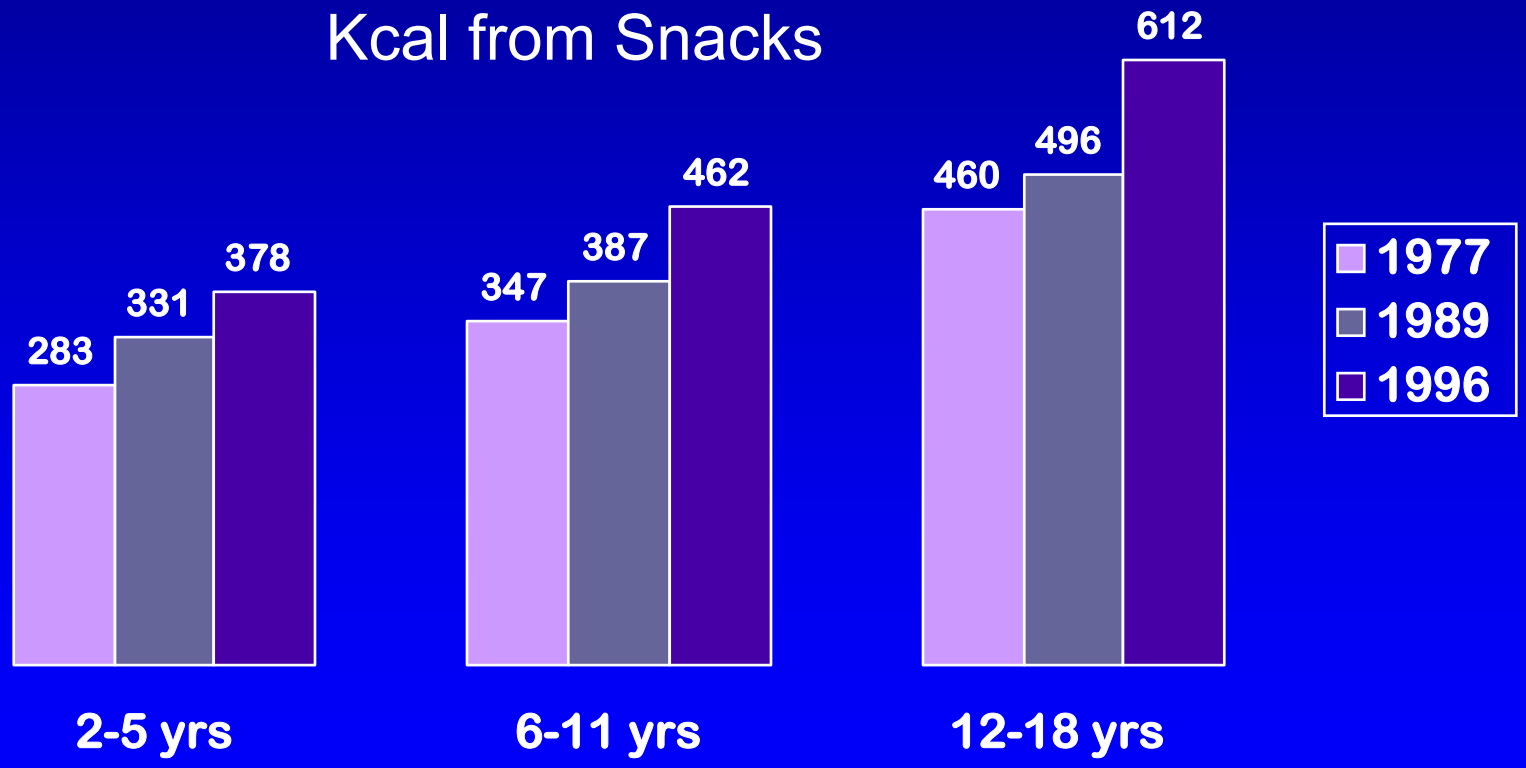


Jahns, Siega-Riz, Popkin, J Pediar, 2001

Association between snacking and obesity in children

Cross-sectional studies

- All studies (n =11) have reported either a negative association (snackers less likely to be overweight) or no association.

Longitudinal

(Francis, Lee, Birch, Obes. Res., 2003) 173 white girls

- In families where 1 or both parents were overweight, girls who watched TV snacked more, had higher intakes of fat from snacks, which predicted BMI increase from 5-9 yrs. No relationship in families where neither parent was overweight.

Other Dietary Relationships and Overweight

- Fruits and Vegetables
- Fiber
- Calcium and Dairy Foods
- Food Insecurity

Fruits and Vegetables: Relation to Overweight

- 1 longitudinal study (Field et al, Int'l J Obesity, 2003)
- N=14, 918, 9-14 yr olds followed 3 yrs
  - Outcome: Girls- no relation between F,J,V intake (alone or in combo) and changes in BMI z-score. Boys- No relation between F&J. Inverse relationship with V. After adjusting for calories, not significant.
- 8 cross-sectional studies
  - Fruits: 6 no relationship, 2 negative
  - Vegetables: 7 no relationship, 1 negative

Limitations with studies on F&V

- Few controlled for energy intake, physical activity
- Some include potatoes, fried vegetables
- Some include juice with the fruits
- Inadequate F&V assessment tool

100% Fruit juice intake and relationship to overweight in children

- 3 longitudinal studies
  - Alexy 1999 205 3-5 yr olds (3 yr follow-up): none
  - Skinner 1999 105 2-3 yr olds (4 m - 1 yr): none
  - Skinner 2001 72 2-3 yr olds (4 yr): none
- 6 cross-sectional studies
  - 3 found no relationships
  - 3 found a positive relationship (1 apple juice only)

Dietary fiber and relationship to overweight

- In adults there is convincing evidence that dietary fiber is protective against weight gain and obesity (WHO report, 2003)
- “Few studies of dietary fiber have involved children as subjects; however, no physiologic reason exists to believe that results of studies of fiber in adults should not be applicable to pediatrics” (Pereira, Ludwig, Pediatr Clin N Amer, 2001)
- Mechanisms: 1) may act to decrease food intake by promoting satiation (lower meal energy content) or 2) satiety (longer duration between meals or 3) by influencing metabolic fuel partitioning (increased fat oxidation and decreased fat storage)

Longitudinal Studies

Newby et al, 2003 Arch Pediatr Adol Med

- Sample: N = 1379, WIC participants, 84% white
- Age at entry (follow-up): 2-5 yrs (6-12 mo)
- Fiber examined energy-adjusted and crude
- Outcome: No association

Berkey et al , 2000 Pediatrics

- Sample: N = 10,769, Children of nurses, 95% white
- Age at entry (follow-up): 9-14 yrs (1 yr)
- Energy-adjusted dietary fiber
- Outcome: No association

Calcium/dairy intake: Relationship to overweight

- Results of longitudinal and cross-sectional studies are mixed.
- Methodological differences (calcium/dairy, 24 hr recall vs FFQ)
- Some do not adjust for energy intake

Longitudinal study: Dairy food consumption and body fatness

Phillips, Bandini, Cyr, Douglas, Naumova, Must
Int'l J Obesity, 2003

- Sample: nonobese, primarily white (74%) premenarcheal girls
- N =196
- Age at entry: 8-12 yrs. Follow-up time:up to 4 yrs postmenarche
- Outcome: No association with BMI z-score or % body fat for
  - calcium intake
  - dairy intake
  - % daily Kcal from full- or low-fat dairy

Longitudinal study: calcium and body fatness

Skinner, Bounds, Carruth, Ziegler JADA, 2003

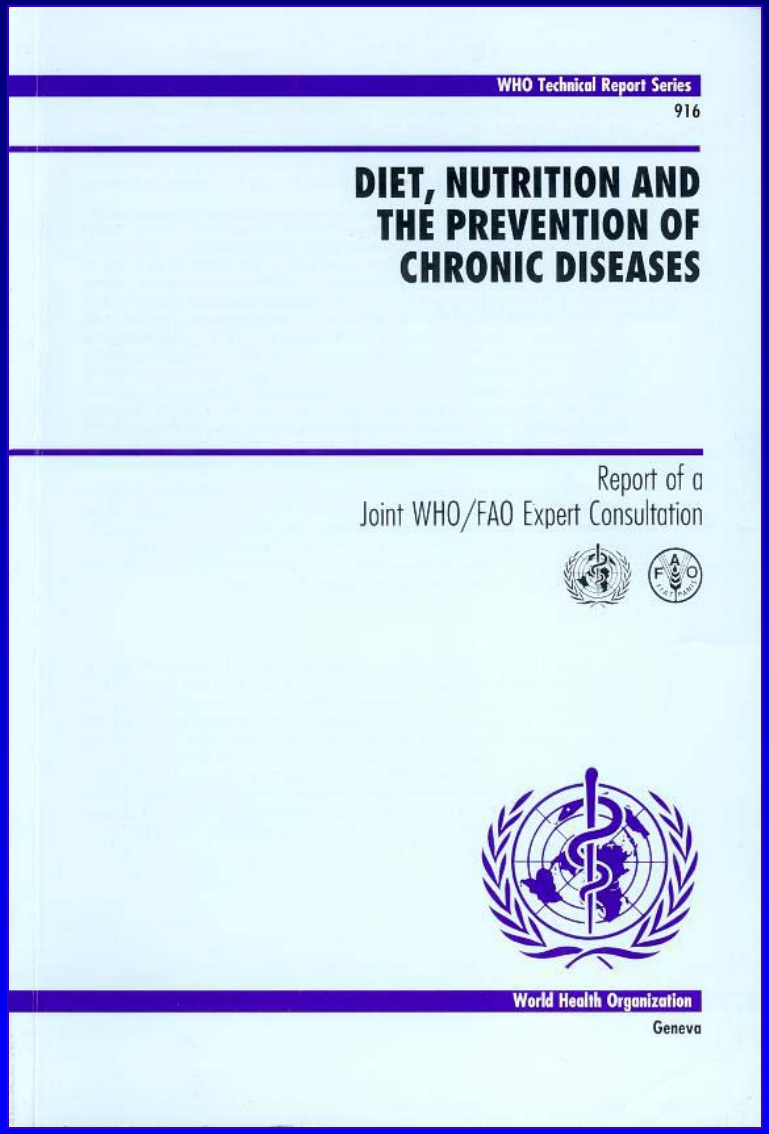
- Sample: 52 white, upper/middle SES boys and girls
- Age at entry: 2 months. Follow-up time: 8 yrs
- Outcome: calcium intakes were negatively related to % body fat assessed by DEXA

Food insecurity and overweight in children

- Almost all cross-sectional studies in adults have found a positive association between mild to moderate household food insecurity and overweight in adult US women (even after adjusting for SES).
- No longitudinal studies have been done with adults or children.
- Studies with children have major limitations (parent report of child's ht/wt, small sample sizes).
- The few studies with children have shown no relationship or a negative relationship.

Dietary determinants of obesity in youth

- Studies are limited and inconclusive
- Confounding variables often not accounted for (parental fatness, SES, energy expenditure or PA)
- Different methods of assessing diet
- Different methods of assessing adiposity
- BMI self-reported in some studies
- A major challenge is assessing dietary intake
- Dietary measures lack the capacity to identify the small daily imbalances probably associated with the development of obesity



Examined the strength of evidence linking diet and lifestyle factors to obesity.

Four levels of evidence:

- convincing
- probable
- possible
- insufficient

WHO/FAO Report, 2003

Strength of evidence on factors that might promote or protect against weight gain and obesity

Evidence	Decreased risk	No relation	Increased risk
Convincing	•Regular physical activity •High fiber intake		•Sedentary lifestyles •High intake of energy-dense micronutrient-poor food
Probable	•Home and school environments that support healthy food choice for children •Breastfeeding		•Heavy marketing of energy-dense foods and fast-food outlets •High intake of sugar-sweetened soft drinks and fruit juices •Adverse socioeconomic conditions
Possible		•Protein content of the diet	•Large portion sizes •High proportion of food prepared outside the home •“Rigid restraint/periodic disinhibition” eating patterns
Insufficient	•Increased eating frequency		•Alcohol

Center for Weight and Health, University of California, Berkeley, 2001: Literature Review

Summary of Evidence of Associations with Childhood Overweight

Repeatedly Documented Evidence

None

Weak Evidence

Fat
Fruit & vegetables
Fast foods/eating out
Snack foods
Sugar-sweetened beverages
Meal skipping

Mixed or Very Weak Evidence

Total calories
Energy density
Fruit juice
Food insecurity