FEEDING DYNAMICS
ANNOTATED SELECTED REFERENCES
Ellyn Satter

Abraham S, Collins G, Nordsieck M. Relationships of childhood weight status to morbidity in adults. *HSMHA Health Reports.* 1971;86:273-284.

Notes: This 35 year longitudinal study was done of 1,963 Hagerstown, MD white males who were 9-13 years old between 1923 and 1928 and 47/48 years old at followup. It showed that lean boys who became fat men had a twofold elevated risk of cardiovascular disease, whereas fat boys who remained fat as adults had only an average risk. The study demonstrated that prevalence rates for hypertensive vascular and cardiovascular renal disease varied within the average, moderately overweight, and markedly overweight adult groups, and that the adult who had been a below average weight child had the highest rate in each category, respectively. ES note: It appears that it is not fatness, per se, but unstable body weight that is correlated with cardiovascular disease.

Anliker JA, Laus MJ, Samonds KW, Beal VA. Mothers' reports of their three-year-old children's control over foods and involvement in food-related activities. *Journal of Nutrition Education.* 1992;24(6):285-291.

Notes: Parents provided children with structured meals and snacks but controlled food choices and portion sizes at those times. Between times, most children were allowed to help themselves with no limits to the refrigerator, cupboards, etc. ES note: The implications to nurturing and child development are grave. Children need their parents' presence. However, when parents were around they spoiled eating by putting pressure on it. The only way children could eat without interference was by going off on their own to do it. The learning? That to be your own person, you have to be by yourself.

Bender R, Trautner C, Spraul M, Berger M. Assessment of excess mortality in obesity. *American Journal of Epidemiology.* 1998;147:42-48.

Notes: Patients 18-75 years at entry (n=6,193) with BMI between 25 and 74 were recruited between 1961 and 1994 in Dusseldorf, Germany and followed for an average of 14 years. During 87,179 patient-years of follow-up, 1,028 patients died (16.6%). Compared with subjects with BMI in the lowest quartile (BMI between 25 and 32), relative risks (RRs) of death for subjects with BMIs in the second quartile (BMI between 32 and 36), third quartile (BMI between 36 and 40), and highest quartile (BMI>40) were 1.02, 1.50, and 2.10, respectively, for men and 1.23, 1.33, and 2.25, for women.

Bhargava SK, Sachdev HS, Fall CHD, et al. Relation of Serial Changes in Childhood Body-Mass Index to Impaired Glucose Tolerance in Young Adulthood. *New England Journal of Medicine.* 2004;350:865-875.

Notes: 1492 men and women in India. Thinness in infancy and crossing into higher categories of body-mass index after age two years was associated with impaired glucose tolerance or diabetes in the young adult. However, despite an increase in body-mass index between the ages of 2 and 12 years, none of the subjects was obese at age 12 years. The odds ratio for disease associated with an increase in the body-mass index of 1 SD from 2 to 12 years of age was 1.36 (95 percent confidence interval, 1.18 to 1.57; P<0.001).

Birch LL, Fisher JO. Mothers' child-feeding practices influence daughters' eating and weight. *American Journal of Clinical Nutrition.* 2000;71 :1054-1061.

Notes: Mothers' dietary restraint and perceptions of their daughters' risk of overweight predicted maternal child-feeding practices, which in turn predicted daughters' eating and relative weight. Daughters were heavier when mothers restrained then disinhibited with their own eating.

Black MM, Hutcheson JJ, Dubowitz HH, Berenson-Howard J. Parenting style and developmental status among children with nonorganic failure to thrive. *Journal of Pediatric Psychology.* 1994;19 (6):689-707.

Notes: Low income, single parents of mean-age 13.3 month old children with nonorganic failure to thrive, compared with controls, were either less nurturant and more neglecting or more authoritarian

with their children.

Braddon FEM, Rodgers B, Wadsworth MEJ, Davies JMC. Onset of obesity in a 36 year birth cohort study. *British Medical Journal.* 1986;293:299-303.
Notes: Most 36 year old adults first surveyed in 1946 were not obese at age 11. Subjects showed a pattern of increasing incidence of obesity throughout life and the odds of remaining obese increased with age of onset. This longitudinal study of over 3000 36 year olds in Britain shows that only 21% of obese adults had been obese at age 11 years, even when associated social factors (social class, education level, income) were taken into account. Among men obese at age 36, 51% were overweight and 10% were obese at age 11. Of these obese 36 year olds, 92% were above normal weight ranges by age 26. Of obese 36 year old women, 54% were above normal weight at age 11, and 83% by age 26. Pregnancy increased the likelihood of obesity, as did remaining unmarried for women. Over 40% of people who were obese at age 36 could not have been identified 10 years earlier. 79% of obese 36 year olds first became obese in early adult life. Individuals who became obese between 11 and 36 were often not the most overweight in childhood.. Demographic factors that correlated with obesity included low social class, low income, low educational level, increased parity and being single for women. ES note: This study demonstrates the futility of trying to prevent obesity in adults by preventing it in children. In fact, since the pattern of unstable body weight emerges, the question becomes, what destabalizes body weight? My speculation is this: Poor ability to regulate food intake, probably growing out of overcontrol or undersupport in childhood.

Brown, L. and Weil, J., Executive Director, Center on Hunger and Poverty and President of the Food Research and Action Center. The Paradox of Hunger and Obesity in America. July 14, 2003. Web Page. Available at: http://www.frac.org/html/news/071403hungerandObesity.htm.
Notes: Makes the link between food insecurity and obesity by ponting to the need to maximize caloric intake, the need to economize by buying food of low nutritional quality, by overeating when food is avilable and through physiological changes. All of the supplemental nutrition programs--Food Stamps, School Nutrition, WIC, CACFP--demonstrate improveed nutritional quality in recipients diets.

Chatoor I, Dickson L, Shaefer S, Egan J; A developmental classification of feeding disorders associated with failure to thrive: Diagnosis and treatment. Drotar D. *New Directions in Failure to Thrive: Implications for Research and Practice*. New York: Plenum; 1986:235-258.
Notes: When medically stable children grew poorly, there was a disruption in any one or all three stages of development: Homeostasis, attachment or separation-individuation. The newborn may be colicky and have difficulty achieving regulation of state. The 2-6 month old and parent show a lack of pleasure in each other and the child may vomit or have diarrhea. The 6-36 month old refuses food and struggles for control, peaking at age 9 months. Poorly-growing children showed no delays in cognitive or speech development.

Costanzo PR, Woody EZ. Domain-specific parenting styles and their impact on the child's development of particular deviance: The example of obesity proneness. *Journal of Social and Clinical Psychology.* 1985;8(4):425-445.
Notes: Increased fatness in eight year olds is correlated with restrained eating. A history of restrained feeding and patterns of easily-disrupted food control is correlated with obesity in university freshmen women. Parents who are overconcerned about their child's weight tend to constrain the child's eating and may use emotionally charged tactics to enforce constraint, such as withdrawal of love. As a consequence, the child may emerge with relatively ineffective self control and strong feelings of self-disparagement when they lose control.

Crawford PB, Shapiro LR; How obesity develops: a new look at nature and nurture. Berg FM. *Obesity & Health* . Hettinger, ND: Healthy Living Institute; 1991;5:40-41.
Notes: Longitudinal study of 185 of an original sample of 450 San Francisco Bay area children followed from age 6 months to age 16.5 years. Fat infants are at no greater risk than thin ones of growing up fat. Risk of remaining obese only exceeds 50% at age 6-9 or older. Children who later became fat compared with children who remained slim: Ate no more calories, low nutrient-density or sweet foods; were no more likely to have been bottle feed; were started no earlier on solid foods; were

no more likely to have been given high-fat milk; were no more likely to have been raised in single-parent families. However, the risk of later obesity increased: With toddler lack of structure in feeding times; with increased parental concern about obesity; with increased incidence of toddler feeding problems; with decreased activity prior to the onset of obesity; with parental wish that a child would be more active. **ES note:** This study also observes how distortions in eating attitudes and behaviors develop early on and persist. This fine study has not been published in its entirety and is available only as the occasional newsletter or workshop summary. The nine-year cohort is reported in Shapiro, *American Journal of Public Health.* 1984;74(9):968-972.

Crow RA, Fawcett JN, Wright P. Maternal behavior during breast- and bottle-feeding. *Journal of Behavioral Medicine.* 1980;3(3):259-277.
Notes: Bottle-feeding parents of small babies were more active in feeding and their babies grew less well than breast feeding mothers of small babies, who were not overactive. Average-sized breast- and bottle-fed babies were fed similarly and grew equally well.

Donnelly JE, Jacobsen DJ, Whatley JE, et al. Nutrition and physical activity program to attenuate obesity and promote physical and metabolic fitness in elementary school children. *Obesity Research.* 1996;4:229-243.
Notes: School-aged children compensated at home for reduced fat and energy in school nutrition program and for increased activity in school physical education programs. After two years, there were no differences between intervention and control children in body weight, body fat, blood total cholesterol, insulin, and glucose. Cohorts from grades 3 to 5 in two school districts in rural Nebraska (Intervention/Control) participated in a 2-year study of physical activity and modified school lunch program. Data collection for aerobic capacity, body composition, blood chemistry, nutrition knowledge, energy intake, and physical activity was at the beginning and end of each year. The intervention group (*Int*) received enhanced physical activity, grade specific nutrition education, and a 25% fat, low sodium school lunch program. Control (*Con*) continued with a regular school lunch (35% fat) and team sports activity program. At year 2, *Int* children *at school* consumed less sodium (631 mg vs 742 mg) and energy (9%) and more fiber (17%) and a lower percentages of calories from fat (31% in the intervention school compared with 33% in the control school). However, measures of 24-hour food intake for *Int* and *Con* showed significant differences for sodium only. Physical activity in the classroom was 6% greater for *Int* compared to *Con* ($p<0.05$) but physical activity outside of schools was ~16% less for *Int* compared to *Con* ($p<0.05$). Body weight and body fat were no different between schools for either normal weight or obese children. No differences were found for blood cholesterol, insulin, and glucose. It appears that compensation in both energy intake and physical activity outside of school is responsible for the lack of differences between *Int* and *Con*. HDL cholesterol was significantly greater and cholesterol/HDL was significantly less for *Int* compared to *Con* ($p<0.05$)

Drewnowski A, Ahlstrom Henderson S, Shore AB, Fischler C, Preziosi P, Hercberg S. Diet quality and dietary diversity in France: Implications for the French Paradox. *Journal of the American Dietetic Association.* 1996;96:663-669.
Notes: The French paradox is the lower-than-expected rate of mortality from coronary heart disease in a society where the diet is rich in fat and saturated fat. Habitual dietary intakes of a representative sample of 837 adults were evaluated using a dietary quality index (DQI) to assess compliance with the Dietary Guidelines, a dietary (DD) score to count the number of major food groups consumed; and a dietary variety score (DVS) to count the total number of foods consumed on a regular basis. Only 14% of respondents ate less than 30% of energy from fat and only 4% consumed less than 10% of energy from saturated fat. As a result, 63% had DQI scores of 0 or 1. In contrast, close to 90% of respondents scored a maximum of 5 in DD (as compared with 33% of Americans from other studies). The average repertoire of core foods appeared to be around 30 items (compared with about half that in American diets). As DQI went up, DVS went down. Persons whose diets met US dietary recommendations also had the lowest DVS scores. There was no correlation between dietary fat and cholesterol and DD.

Drewnowski A, Hann C. Food preferences and reported frequencies of food consumption as predictors of current diet in young women. *American Journal of Clinical Nutrition.* 1999;70:28-36.

Notes: Reported frequencies of food consumption, the core of the food-frequency approach, were associated with food likes and dislikes. Food preferences were a predictor of dietary intakes. College-age women (n = 87) completed a 98-item food-frequency questionnaire and rated preferences for many of the same foods on a 9-point category scale. Estimated intakes of fat, fiber, and vitamin C were obtained by using 3-d food records.

Eisenmann JC, Katzmarzyk PT, Arnall DA, Kanuho V, Interpreter C, Malina RM. Growth and overweight of Navajo youth: secular changes from 1955 to 1997. *International Journal of Obesity.* 2000;24:211-218.
Notes: Mean age-specific stature appeared to be relatively stable around the 50th percentile of US reference values. Mean age-specific mass appeared to be relatively stable between the 50th and 90th percentiles of the reference values, while the mean BMI tended to fluctuate about the 85th percentile.

Eriksson J, Forsen T, Tuomilehto J, Osmond C, Barker D. Fetal and childhood growth and hypertension in adult life. *Hypertension.* 2000;36:790-4.
Notes: Men and women who developed hypertension had low birth weight (P=0.002). They were also shorter in body length at birth (P=0.02). After birth they experienced accelerated growth, so that by 7 years their heights and weights were approximately average. Children who later developed both hypertension and type 2 diabetes, rather than hypertension alone, had small placental size as well as small body size at birth, and their accelerated postnatal growth continued beyond 7 years. ES: Unclear whether the precipitant is poor fetal growth or divergence in early life.

Eriksson JG, Forsen T, Tuomilehto J, Osmond C, Barker DJ. Early growth and coronary heart disease in later life: longitudinal study. *British Medical Journal.* 2001;322:949-53.
Notes: Improvements in fetal, infant, and child growth could lead to substantial reductions in the incidence of coronary heart disease. Low weight and low BMI at birth and at age 1 year were associated with increased risk of coronary heart disease. After age 1 year, the combination of low early weight and rapid gain in weight and body mass index increased the risk of coronary heart disease in men as measured by hospital admission or death. For each SD increase in BMI between ages 1 and 12 years, hazard ratio was increased by 1.27.

Ernsberger P, Koletsky RJ. Biomedical rationale for a wellness approach to obesity: An alternative to a focus on weight loss. *Journal of Social Issues.* 2000;55:221-259.
Notes: Despite considerable moderating evidence, the prevailing wisdom is that obesity is a severely life-threatening condition. Health professionals, the media and the general public remain convinced that even modest elevations in BMI drastically shorten life expectancy and increase incidence of degenerative diseases such as heart disease, cancer and diabetes. Ernsberger gives abundant evidence that current thinking on extreme health risks associated with obesity has survived due to biased thinking and selective perception of both clinical practice and the literature. Obesity experts have maintained their certainty by reviewing and citing articles that assign a high risk to obesity, including relying primarily on cross-sectional morbidity studies. Participants are asked height and weight and diseases their doctors have told them they have. Physicians expect certain diseases in obese persons and diagnose them more readily. Obesity experts cite with far less frequency clinically unbiased mortality studies which show elevated body weight to be more benign and even show low body weight and/or weight loss to carry health risks. The resulting conviction that obesity is medically extremely dangerous has produced health policy that consistently recommends weight loss as the first line of intervention, even though it is abundantly clear that there is no method for achieving and maintaining weight loss. In fact, the conviction is so powerful that policy makers have even stated that it is better to lose and *gain weight back again* than it is not lose at all. Defining the problem so narrowly (and fervently) as *excess weight* and the solution as *weight loss* has denied ill patients medical treatment as well as delayed framing the problem in a way that it can be solved. Weight stabilization (or the avoidance of weight fluctuation secondary to attempts at weight loss) is associated with positive health benefit, as is improved nutritional status and improved physical fitness.

Faith MS, Scanlon KS, Birch LL, Francis LA, Sherry B. Parent-Child Feeding Strategies and Their Relationships to Child Eating and Weight Status. *Obes Res.* 2004;12:1711-1722.

Notes: Of 22 studies isolated from a comprehensive literature review, parental feeding restriction was associated with increased child food intake and body weight. Child's rate of eating... but no other feeding domain

Fisher JO, Mitchell DC, Smiciklas-Wright H, Birch LL. Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes. *Journal of the American Dietetic Association.* 2002;1025:58-64.
Notes: Parents who consumed more fruits and vegetables had daughters who consumed more fruits and vegetables. Parents with lower fruit and vegetable intakes tended to report using greater pressure in child feeding. Girls' total number of combined fruit and vegetable servings were highest among parents who consumed high amounts of fruits and vegetables and used low pressure in child feeding. Girls who received more pressure to eat tended to have lower fruit and vegetable and micronutrient intakes.

Fomon SJ, Filer LJJr., Thomas LN, Anderson TA, Nelson SE. Influence of formula concentration on caloric intake and growth of normal infants. *Acta Paediatrica Scandanavica.* 1975;64:172-181.
Notes: Infants over six weeks of age were able to compensate for formula concentration or dilution and grow at the same rate. Infants under age six weeks compensated, but incompletely, and growth was accelerated or decreased.

Forsen T, Eriksson J, Tuomilehto J, Reunanen A, Osmond C, Barker D. The fetal and childhood growth of persons who develop type 2 diabetes. *Annals of Internal Medicine.* 2000;133:176-82.
Notes: The increased risk for type 2 diabetes associated with small size at birth is further increased by high growth rates after 7 years of age. The odds ratio for type 2 diabetes was 1.38 for each 1-kg decrease in birthweight. The odds ratio for development of type 2 diabetes was 1.39 for each standard deviation increase in weight between 7 and 15 years of age. The odds ratio was 1.83 with persons whose birthweights were below 3,000 g.

Garn SM, Clark DC. Trends in fatness and the origins of obesity. *Pediatrics.* 1976;57:443-456.
Notes: Based on the Ten-State Nutrition Survey. Levels of fatness of children rise progressively with the level of fatness of parental mating combinations. Both boys and girls with two lean parents tend to be the leanest, those with two obese parents tend to be the fattest, and those with both obese and lean parents in between. Overall patterns show preschool losses (in boys), a clear prepubertal gain, an adolescent loss (boys), and a later adult gain which reaches a peak at age 50 to 60 years and decreases thereafter. ES note: This very significant piece of work on the genetic origins of body fatness--and one would assume, the conclusion that fatness is a normal condition for some people--is contaminated by the caveat that follows: "the extent to which fatness runs in families represents the challenge in the identification of the obese, the prevention of obesity, the management of those who are obese and the reversal of obesity...." The moral of the story, particularly in today's weight obsessed climate, is not to settle for reading the author's conclusions.

Hamill PVV, Drizd TA, Johnson CL, Reed RB, Roche AF, Moore WM. Physical growth: National Center for Health Statistics percentiles. *American Journal of Clinical Nutrition.* 1979;32:607-629.
Notes: Growth is within normal limits by current standards when values follow central or intermediate percentiles. For the purposes of nutrition and health screening, measurements between the 10th and 25th, and the 75th and 90th %tiles may or may not be normal depending on the pattern of earlier measurements, genetic and environmental factors. Children whose weight-for-stature (or length) is below the 5th %tile or above the 95th %tile should be checked, followed up and possibly referred. ES note: This guideline is often used to define the upper and lower cutoffs for obesity and failure to thrive, respectively. However, note that the article says "followed." Presumably, the following is to determine whether children grow consistently at those extremes and, therefore, demonstrate the internal integrity of that growth pattern.

Himes JH, Roche AF, Thissen D, Moore WM. Parent-specific adjustments for evaluation of recumbent length and stature of children. *Pediatrics.* 1985;75(2):304-313.
Notes: Correlations between stature of children and their parents is low during the first years of life (.1-

.2) and increases rapidly for both girls and boys to age 6-7 (.4-.5). It then flattens somewhat in girls but continues to increase in boys. Adjustments are zero when midparent height is at or near the norm and get larger (minus or plus) as the midparent stature is shorter or taller.

Holbrook TL, Barrett-Conner E. The association of lifetime weight and weight control patterns with bone mineral density in an adult community. *Bone and Mineral.* 1993;20:141-149.
Notes: Community-based population of 1043 older white men and women. In those currently overweight (body mass indices (BMI)>26), the age-adjusted mean BMD (bone mineral density) at all sites was significantly higher than in those with BMI less than 26. Lifetime maximum BMI was also positively and significantly associated with a higher age-adjusted BMD at all sites except the ultradistal wrist in men. Weight gain or fluctuation of 10 lbs. or more between the ages of 40 and 60 was associated with significantly higher age-adjusted mean BMD at all sites compared to weight loss or no weight change in both men and women. Weight at age 18 was unassociated with BMD but weight gain after age 18 was associated with significantly higher age-adjusted mean BMD at all sites. Conversely, dieting, weight loss or a lifetime maximum BMI or less than 24 were all associated with markedly lower BMD at all sites in both sexes.

Hood MY, Moore LL, Sundarajan-Ramamurti A, Singer M, Cupples LA, Ellison RC. Parental eating attitudes and the development of obesity in children. The Framingham Children's Study . *International Journal of Obesity.* 2000;24:1319-1325.
Notes: Parents who displayed high levels of disinhibited eating, especially when coupled with high dietary restraint, appeared to foster the development of excess body fat in their children. Children whose parents had particularly high scores on both restraint and disinhibition had particularly high increases in BMI. Children of parents who "successfully" restrained, ie, had no disinhibition, had no increases in BMI. This 6-year longitudinal study of ninety-two 3-5 year old children and their parents was of subjects enrolled in 1987 in the Framingham Children's Study. Self-reported levels of parental dietary restraint, disinhibition and perceived hunger were estimated using Stunkard and Messick's Three Factor Eating Questionnaire. Parental scores on the perceived hunger scale (one of the three factors on the questionnaire) had no clear effect on body fat change of children.

Johnson SL, Birch LL. Parents' and children's adiposity and eating style. *Pediatrics.* 1994;94:653-661.
Notes: A previous self-regulation trial (Birch et. al, Appetite 20:83, 1993) showed most children were able to compensate for caloric variations in meal preloads. Some were not. This study examined the parents dieting patterns and child feeding practices. It found that parents who were controlling of their own and their children's food intake had children who were less able to self-regulate.

Kern DL, McPhee L, Fisher JO, Johnson S, Birch LL . The postingestive consequences of fat condition preferences for flavors associated with high dietary fat. *Physiology and Behavior*. 1993;54:71-76.
Notes: Hungry 3- and 4-year-old children showed a marked preference for food they had found by previous experience to be calorically dense. **ES note:** This appears to be a sophisticated tactic that children instinctively use to maintain their energy balance. When their energy needs are high, ie, when they are growing fast or very active, they choose food of higher caloric densities (higher in fat or sugar) to supply them with the energy they need. Conversely, when their energy needs are low, they are less likely to eat high-caloric-density foods.

Klesges RC, Malott JM, Boschee PF, Weber JM. The effects of parental influences on children's food intake, physical activity and relative weight. *International Journal of Eating Disorders.* 1986;5:335-346.
Notes: If parents merely offer/present food, children spend more time eating but don't weigh any more. If parents encourage eating, children spend longer eating and weigh more.

Krick J. Using the Z score as a descriptor of discrete changes in growth. *Nutritional Support Services.* 1986;6(8):14-21.
Notes: Biological characteristics, like height and weight, are distributed in populations according to a bell-shaped curve. The highest frequency of values is close to the mean, with 50% of people's heights and weights plotting within one standard deviation above and below the mean. As values progress to

the extremes of the curve, those values are seen with lower and lower frequencies. The Z score, which denotes standard deviation units from the median, is compared to the two most frequently used methods of reporting anthropometric data. Use of the Z score in interpreting, recording, and reporting height/age, weight/age, and weight/height data is recommended. ES note: Compared with growth charts, the Z score gives far more precise way of tracking growth and is particularly helpful when following a small or poorly growing infant.

Lauer RM, Clarke WR. Childhood risk factors for high adult blood pressure: the Muscatine Study. *Pediatrics.* 1989;84:633-41.
Notes: The Muscoda study of 2,445 children observed initially at 7 years of age and at follow-up at 18 years of age and between 20 and 30 years of age. Correlations for blood pressure between childhood and adulthood were 0.21 to 0.39 for systolic blood pressure and –0.01 to 0.50 for diastolic blood pressure. Risk factors evaluated as variables included using oral contraceptives, smoking cigarettes, or having a family history of hypertension, ischemic heart disease, or stroke. Results (analyzing the data with stepwise regression) showed that the two most important predictors of adult high blood pressure are childhood blood pressure and increases in weight from childhood to adulthood. ES note: Stepwise regression exaggerated and may have distorted results.

Legler JD, Rose LC. Assessment of abnormal growth curves. *American Family Physician.* 1998;58:158-168.
Notes: An important part of well-child care is the assessment of a child's growth. While growth in the vast majority of children falls within normal percentile ranges on standard growth curves, an occasional child demonstrates worrisome deviations in weight, height or head size. A single growth percentile value at any particular point in a child's life is only of limited usefulness to the physician. More important is the child's rate of growth. Children whose growth parameters are at the extremes of the growth curve but whose growth rates are normal are likely to be healthy. Conversely, accelerated or slowed growth rates are rarely normal and warrant further evaluation. This article addresses the initial steps to be taken when evaluating children with suspected growth abnormalities, the guiding principles that apply to all growth problems, and the most common growth curve deviations and approaches to their management.

Lissau I, Breum L, Sorensen TI. Maternal attitude to sweet eating habits and risk of overweight in offspring: a ten-year prospective population study. *International Journal of Obesity.* 1993;17:125-129.
Notes: It wasn't the sweets, per se, but the mother's disinterest in the child's sweet-eating. The risk of the child's overweight was significantly increased if the mother reported lacking knowledge about her offspring's sweet eating habits. The risk was insignificantly increased if the mothers expressed acceptance of sweet eating habits. The findings suggested that lack of parental support is a rather strong risk factor.

Lissau I, Sorensen TI. Parental neglect during childhood and increased risk of obesity in young adulthood. *Lancet.* 1994;343:324-327.
Notes: 881 (756- 86%) Danish 9- to 10 year olds who received inadequate parental support were fatter Correlations persisted 10 years later when 756 children were followed up 10 years. Dirty and neglected children appeared to increase the risk of fatness; other family factors did not, including family structure (biological or other parents and number of siblings) or parental overprotectiveness. Comment: Parental neglect may cause a psychological state that affects energy balance by altering behavior (overeating and physical inactivity) or hormone balances influencing fat storage (corticosteroids like cortisol, catecholamines, or insulin). In a related study (Int J Obesity 17:125, 1993), mothers' *not-knowing* about children's sweets intake (not the children's sweets intake *per se*) correlated with higher body weight. **ES note:** Applying feeding dynamics principles to these results raises the possibility that these children suffered from food insecurity or erratic and unreliable feeding, thereby promoting periodic overeating and weight gain.

Olson DH. Circumplex model of marital and family systems. *Journal of Family Therapy.* 2000;22:144-167.
Notes: The Circumplex Model focuses on the 3 central dimensions of marital and family systems: cohesion, flexibility and communication. The major hypothesis of the Circumplex Model is that

balanced couple and family systems tend to be more functional compared to unbalanced systems. In over 250 studies using the Family Adaptability and Cohesion Scales (FACES), a linear self-report measure, strong support has been found for this hypothesis. In several studies using the Clinical Rating Scale (CRS), a curvilinear observational measure, the hypothesis was also supported. These two assessment tools, the FACES and the CRS, are designed for research, clinical assessment and treatment planning with couples and families.

Peck RE, Marks JS, Dibley MJ, Lee S, Trowbridge FL. Birth weight and subsequent growth among Navajo children. *Public Health Reports.* 1987;102(5):500-507.
Notes: Navajo children studied from birth to 2 years tended to have low length/age (around the 40th %tile or lower) and high weight/age (around the 60th %tile) and high weight/length (between the 60th and 75th %tile). Even the low birth weight children had weight/lengths that increased to the 60th %tile by age 24 months. Like the Mexican children discussed in the Ryan article, the weight/length of Navaho children must be interpreted in the context of their longitudinal growth pattern, not by comparing with Caucasian norms. Average weight/length for Navajo children appears to be above the 60th or even the 75th %tile.

Pelchat ML, Pliner P. Antecedents and correlates of feeding problems in young children. *Journal of Nutrition Education.* 1986;18(1):23-28.
Notes: Half of 79 mothers or 2-7 year old children complained about their children's poor food acceptance, preference for "junk" food and poor behavior at the table. Children with high problem scores with eating grew less well, acted out more in other areas, and had mothers who prodded, rewarded and punished more around feeding. Children who were reluctant to try new foods had mothers who presented a limited array of food and catered to the child's food preferences.

Pliner P, Loewen ER. Temperament and food neophobia in children and their mothers. *Appetite.* 1997;28 :239-254.
Notes: Five to 11 year old children who were emotionally expressive, shy and reacted negatively to novel foods became more willing over time to experiment with novel food. However, they remained shy and continued to react negatively. In contrast, children who were more outgoing and positive toward new food liked good-tasting novel food more readily.

Rhee KE, Lumeng JC, Appugliese DP, Kaciroti N, Bradley RH. Parenting Styles and Overweight Status in First Grade. *Pediatrics.* 2006;117:2047-2054.
Notes: 10.1542/peds.2005-2259

Rose HE, Mayer J. Activity, calorie intake, fat storage, and the energy balance of infants. *Pediatrics.* 1968;41:18-29.
Notes: Infants show apparently constitutionally determined activity levels, energy intake and body type. In this observational study of 30 babies, the least active 4-6 month-old infants ate the least and were the fattest and the most active infants ate the most and were the leanest.

Ryan AS, Martinez GA, Roche AF. An evaluation of the association between socioeconomic status and the growth of American children: Data from the Hispanic Health and Nutrition Examination Survey--NHANES 1982-1984. *American Journal of Clinical Nutrition.* 1990;51:944S-952S.
Notes: Mexican American children from poor and nonpoor groups tended to be shorter, heavier and fatter than either white or black children. The norm is around 85th percentile W/H. ES note: When evaluating the size and shape of Mexican children, it is important to remember that 85th percentile weight/height is closer to normal growth than 50th percentile. In fact, rather than evaluating growth based on any one plotting, it is far better to evaluate integrity of growth by following for several months or years.

Satter EM. The feeding relationship. *Journal of the American Dietetic Association.* 1986;86:352-356.
Notes: The feeding relationship is the complex of interactions that takes place between parent and child as they engage in food selection, ingestion and regulation behaviors. The parent is responsible for what is presented to the child to eat, as well as for the physical and emotional setting. The child is

responsible for how much is eaten or even whether anything is eaten. Successful feeding demands a caretaker who trusts and depends on information coming from the child about timing, amount, preference, pacing and eating capability. An appropriate feeding relationship supports the child's developmental tasks and helps the child develop positive attitudes about self and the world. It helps him/her learn to discriminate feeding cues and respond appropriately to them. It enhances the child's ability to consume a nutritionally adequate diet and to regulate appropriately the quantity eaten. The feeding relationship is characteristic of the overall parent/child relationship. Distortions that show up in feeding are likely to appear in other aspects of the interaction. Health professionals who intervene with feeding must be aware of the implications for the relationship. A primary objective with any feeding intervention is to increase or protect the parents' sensitivity to the child's feeding cues. If the feeding relationship is disrupted, the health professional should consider a referral for psychosocial evaluation.

Satter EM. Internal regulation and the evolution of normal growth as the basis for prevention of obesity in childhood. *Journal of the American Dietetic Association.* 1996;96:860-864.
Notes: Rather than defining obesity as an arbitrary BMI, percentile or weight on the scale, obesity can be defined as weight instability: divergence from a weight that is normal for the individual. Children who show high weight-for-height can be as consistent, reliable and predictable in their growth as children whose weight-for-height is closer to the mean. However, children whose weight diverges from what is apparently their normal growth pattern need to be evaluated to identify the source of the disruption and that disruption corrected so genetically appropriate growth can resume. Children may diverge from a normal growth curve if they are being fed in restrained fashion, at times of family crisis and if they are being systematically encouraged to overeat. Trusting children's innate processes allows supporting them with positive feeding and lifestyle patterns that let them grow into adults whose bodies reflect their genetic endowment.

Satter EM. *Secrets of Feeding a Healthy Family*. Madison, WI: Kelcy Press ; 1999.
Notes: Not only what to feed and how to feed, but also how to get a meal on the table. "The secret of raising a healthy eater is to love good food, enjoy eating--and teach your child to do the same." Chapters on being a role model, establishing a positive feeding relationship, and managing food (choosing, planning, shopping and cooking) reinforce Satter's principles of "seeking, not avoiding food." Satter is careful to avoid finger-wagging as she emphasizes that "when the joy goes out of eating, nutrition suffers." Satter also applies her principles to nutrition education for children: "Expose children to the possibilities, encourage them to explore and allow them to develop their capabilities with eating."

Satter EM; Appendix I. Children and food acceptance: The research . *Child of Mine; Feeding With Love and Good Sense*. Palo Alto, CA: Bull Publishing; 2000.
Notes: Over time, children will learn to be competent with eating. They will eat the foods that appear regularly on the family table, and they will automatically eat a variety. Variety, in turn, is correlated with positive nutritional status. However, typical childhood eating behaviors and poor information about feeding lead parents to feed in ways that hinder, rather than foster, competent eating. Children need exposure to the food, they need the support of trusted adults and they need *not* to be pressured in any way to eat. Even seemingly positive pressure, like a reward, decreases children's food acceptance. In contrast, children have trouble learning to like new food if they have either too few opportunities to learn or too much pressure on their learning. What does the research have to say about what goes wrong with feeding? In brief, children eat poorly when parents pressure and persuade, limit menus to food that children readily accept and fail to provide regular and reliable opportunities to eat.

Satter EM; Appendix J. Children and food regulation: The research . *Child of Mine; Feeding With Love and Good Sense*. Palo Alto, CA: Bull Publishing; 2000.
Notes: Children know how much they need to eat, and virtually from birth they are resilient and resourceful regulators. From birth on, to do well with food regulation, children depend on responsive parenting. They need help from adults if they are to act on and retain their capability with food regulation. Children need to be able to tune in on what goes on inside of them and be aware of how hungry or how full they are. If adults give them insufficient support–don't offer food regularly or fail to offer appropriate emotional support at feeding times–children can have trouble knowing how hungry

or how full they are and can eat too little or too much. If adults are too active and controlling in feeding, children experience so much static and interference from the outside that they can't tune in on their own sensations. Sometimes children go along with pressure from the outside and eat more or less than they really want. Sometimes they fight against that pressure, and, again, eat more or less than they really want. Either way, they lose sensitivity to how much they need and make errors in regulation. They eat too much or too little, and get too fat or too thin.

Satter EM; Chapter 1, "Feeding *is* parenting" . *Child of Mine; Feeding With Love and Good Sense*. Palo Alto, CA: Bull Publishing; 2000.
Notes: My goal is to help you feel comfortable in your role as parent so you can enjoy feeding and eating with your child. Rather than getting bogged down with your sense of responsibility or carried away by your agenda, remind yourself of why you decided to have a child in the first place. I hope a major reason is for the sheer joy of it. It is a grand privilege to have a front-row seat on someone else's life. Certainly do your homework, but then set the homework aside and pick up your sense of wonder and your sense of humor. Relax and enjoy your child.

Satter EM; Chapter 2, "Your child knows how to eat and grow". *Child of Mine; Feeding With Love and Good Sense*. Palo Alto, CA: Bull Publishing; 2000:31-76.
Notes: If you do a good job of feeding, the chances are very good that your child will grow up to have the size and shape body that is right for him and that he will have a stable and appropriate weight as an adult. However, like no other topic in child nutrition, food regulation and growth is permeated with misunderstanding and pifalls. Obesity has been targeted as the number one child nutritional problem, and parents who have a child who is chubby--or who just has a family history of fatness--try to take evasive action by restricting their child's food intake. Parents who fear their child is growing "too slowly" will find the issue just as troublesome as those whose child is supposedly growing "too fast." As with restricting a child who presumably eats "too much," trying to "get" a slow-growing child to eat more is an uphill battle that can be extraordinarily unpleasant for everyone concerned and destructive of nurturing relationships. Given our culturally distorted eating attitudes and behaviors, however, we are all too ready to interfere with our children's eating and growth, simply because we are accustomed to interfering with our own. A copy of this chapter may be downloaded from http://www.ellynsatter.com/Pages/Book%20Contents%20and%20Reviews.htm

Satter EM. A moderate view on fat restriction for young children. *Journal of the American Dietetic Association* . 2000(100):32-36.
Notes: At a given meal, include foods of a variety of caloric—and fat—densities. If fat-reduction strategies are used, limit them to one at any given meal. To support children's abilities with food regulation, offer some foods that are low in fat (like vegetables and fruit), some moderate (meat, chicken and fish prepared with added fat or fat-containing casseroles) and some high (salad dressings, table spreads and/or whole milk). Then allow children to pick and choose from the foods available, eating as much or as little as they want. This approach will allow children to apply their considerable abilities with food selection and regulation to eating what they need at any given time to maintain nutritional status and energy balance. Children are good regulators, and they eat more or less of all foods—including high-fat food—depending on their energy needs.

Serdula MK, Ivery D, Coates RJ, Freedman DS, Williamson DF, Byers T. Do obese children become obese adults? A review of the literature. *Preventive Medicine.* 1993;22:167-177.
Notes: A meta-analysis of epidemiologic studies found obese children to be at higher risk for obesity as adults, but most obese adults were not obese as children. Obesity was defined by skinfold measurement, densitometry, or various calculations of W/H. Among obese infants and toddlers, less than 25% were found to be obese as young adults. Among obese preschool children, 26-41% were found to be obese as adults and among obese school-age children, 42-63% were obese as adults. The proportion of adults who were obese as children ranged from 5 to 20%. (The one outlier statistic was from France and showed that 44% of obese 18 -25 years olds had been obese as preschoolers.) This is

a meta-analysis of epidemiological studies conducted in either the United States or Europe between 1970 and 1992. To be included studies had to have anthropometric measurements of participants both as children who were less than 18 years of age and as adults who were 18 years and older. The literature search identified 17 published reports from 15 study populations. The age at initial obesity assessment varied between 6 months and 16 years and the age at final obesity assessment range from 18 years to 53 years. The interval between initial and final assessment ranged from 2 years to 45 years. The risk for adult obesity was greater among children who were at more extreme levels of obesity and for children who were obese at older ages.
ES Note: When evaluating this article it is important to remember the laws of conservation of growth. Children's growth tends to track--to follow a consistent growth channel. An older infant or toddler who stabilizes at the 25th percentile or the 95th percentile is likely to remain in that percentile throughout life. As a consequence it would be valid to expect a correlation between "obesity" (or any W/H category) in children and in adults of 100%. In contrast, this article found correlations of only about 5 to 63% between obesity in childhood and obesity in adulthood. *While authors emphasized the risk of retaining obesity into adult life, in reality, this meta-analysis shows that the tendency is to slimming.*

Sigman-Grant M, Zimmerman S, Kris-Etherton PM. Dietary approaches for reducing fat intake of preschool-aged children. *Pediatrics* . 1993;91:955-960.
Notes: Computer modeling led to the conclusion that use of more than one fat-reduction strategy can cause dietary deficiency for 4 to 5 years olds. Use of even one strategy can impair dietary quality for 2 to 3 year olds. Strategies applied were replacing high-fat meat exchanges with lean meat exchanges (+three high-fat meat exchanges per week), replacing higher fat milks with skim milks, replacing high-fat meat exchanges with medium-fat meat exchanges, using low-fat preparation techniques, and avoiding added fat. When multiple strategies were used to lower fat in children's diets, some diets were very low in fat (<20% of calories) and potentially inadequate in energy and nutrients. Use of skim milk is the simplest strategy to use for the 4- and 5-year-old children, although other single strategies are effective.

Sinaiko AR, Donahue RP, Jacobs DR Jr, Prineas RJ. Relation of weight and rate of increase in weight during childhood and adolescence to body size, blood pressure, fasting insulin, and lipids in young adults. The Minneapolis Children's Blood Pressure Study. *Circulation.* 1999;99:1471-6.
Notes: This study followed a cohort of 679 individuals (predominantly white children 66%) aged 7.7 years through 23.6 years to examine the relationship between BMI and insulin levels, lipid and lipoproteins concentrations, and blood pressure. By author definition, 64 children were at risk of overweight (85^{th} to 95^{th} percentile), 50 children were obese ($>95^{th}$ percentile, 7.3% of total sample). Initial childhood weight and BMI were highly correlated with young adult weight and BMI. “The relation between fasting insulin and initial childhood weight was not significant, whereas the relationship to both childhood and adolescent *rates of weight gain* were highly significant. ES note: These results support the premise that weight *acceleration*, not high weight per se, is a legitimate basis for the diagnosis of childhood obesity and likely correlated with health parameters.

Skinner JD, Carruth BR, Houck K, et al. Mealtime communication patterns of infants from 2 to 24 months of age. *Journal of Nutrition Education.* 1998;30:8-16.
Notes: Documented mealtime communication behaviors used by 98 Caucasian infants who were studied longitudinally from 2 to 24 months of age. Lists age-related food-acceptance and food-refusal behavior of infants. Mothers' responses to food rejection, which fell into 3 categories: "don't worry," "offers alternative" and "tries force or bribery." Percentage of related responses to each of the three categories were 16 months: 25, 70 and 5; 20 months: 30, 60 and 10; 24 months: 40, 45 and 10. ES note: The norm in feeding appears to be short order cooking. Mothers plan meals based on what they think their child will eat, then make alternatives if the child refuses the offering.

Stanek K, Abbott D, Cramer S. Diet quality and the eating environment of preschool children. *Journal of the American Dietetic Association.* 1990;90:1582-1584.
Notes: When rating their child's appetite, 17% of surveyed parents of preschool aged children described their child as a "picky eater"; 31% described their child's appetite as fair, 34% as good, and

19% as excellent with vegetable and meat items most frequently reported as disliked by the children. Parents were primarily concerned that their children ate too little, ate too many sweets, ate a limited number of foods, or drank too little milk. Children who had had a positive home environment did better nutritionally, as did children who had companionship at mealtime, whether they ate with parents (32%), with siblings (7%), or with both parents and siblings (42%). Other behaviors that improved significantly children's food consumption included allowing the child enough time to eat, involving the child with prepare foods or setting the table, allowing the child to make decisions about the type of food eaten and giving small portions when introducing a new food. 67% had 4+ breads & cereals; 78% 2+ meat group; 62% 4+ fruits & vegetables and 57% 3+ milk. Typical negative food-related behaviors of parents with 2 to 5 year old children include bargaining, bribing, and forcing; promising a special food, such as dessert, for eating a meal; withholding food as punishment; rewarding good behavior with food; persuading children to eat; playing a game to get children to eat; taking over and feeding children who refuse to eat; threatening punishment for not eating; and making children clean their plates

Stunkard AJ, Harris JR, Pedersen NL, McClearn GE. The body-mass of twins who have been reared apart. *New England Journal of Medicine.* 1990;322:1483-1487.
Notes: This Swedish twin adoption study indicates that identical twins reared apart had a weight correlation of 0.70 for men and 0.66 for women. This article also reviews other twin studies that have similar findings.

Stunkard AJ, Sorenson TIA, Hanis C, et al. An adoption study of human obesity. *New England Journal of Medicine.* 1986;314(4):193-198.
Notes: Adult Danish adoptees resembled their biologic parents but not their adoptive parents across the range of body fatness: Thin, median weight, overweight and obese.

Tanner JM, Goldstein H, Whitehouse RH. Standards for children's height at ages 2 to 9 years allowing for height of parents. *Archives of Disease in Childhood.* 1970;45:755-762.
Notes: Charts are presented which give centile standards for boys' and girls' heights at ages 2 to 9 when parents' height is allowed for. Mid-parent height is used (i.e. the average of father's and mother's height). Tanner-Whitehouse chart: To use the chart, first find the child's height and then follow the curve until you reach the child's age. Next, place a ruler from this point along the horizontal line across the middle of the chart to the right side of the chart. Note the point where this line crosses the vertical line of the mean parental height and record the percentile of the child's height, given mean parental height. (Instructions from 2910.)

Troiano RP, Flegal KM. Overweight children and adolescents: description, epidemiology, and demographics. 1998;101 (Supplement 3):497-504.
Notes: Derivative graph in Healthy People 2110. Cycles II (1963 to 1965) and III (1966 to 1970) of the National Health Examination Survey (NHES) and the National Health and Nutrition Examination Surveys (NHANES 1, 1971 to 1974; NHANES II, 1976 to 1980; and NHANES III, 1988 to 1994). Overweight was defined by the age-and-sex-spcific 95th percentile of body mass index (BMI). from NHES II and III. Approximately 11% of children and adolescents were overweight in 1988 to 1994, and an additional 14% had a BMI between the 85th and 95th percentiles. The prevalence of overweight did not vary systematically with race-ethnicity, income, or education. Overweight prevalence increased over time, with the largest increase between NHANES II and NHANES III. Examination of the entire BMI distribution showed that heaviest children were markedly heavier in NHANES III than in NHES, but the rest of the distribution of BMI showed little change.

Troiano RP, Frongillo EAJr, Sobal J, Levitsky DA. The relationship between body weight and mortality: a quantitative analysis of combined information from existing studies. *International Journal of Obesity.* 1995;20:63-75.
Notes: Most studies have shown a U-shaped relationship between BMI and mortality, with both low and high body weights associated with increased risk of death. For this meta-analysis, over 1000 weight/mortality studies were reviewed and only 19 met criteria for required information and data on cumulative incidence of mortality. A U-shaped relationship between BMI and mortality was

demonstrated for 50-year-old men followed 30 years. The minimum mortality BMI was between 23 and 28 and risk increased with low and high BMI outside those ranges. With 10 years of follow-up, detecticable differences in mortality were evident with BMI below 22 and above 30. With 30 years of follow-up, increased risk was seen at BMI of below 23 and above 28. For the much smaller number of 50 y/o women, who were followed for only 10 years, all mortality points were low with a slight elevation in mortality at 34-38 BMI. The male sample was 235 BMI groups from 17 studies representing 356,747 men and 38, 032 deaths. The female sample was 73 BMI groups from 6 studies representing 248,501 women and 13,707 deaths.

Zack PM, Harlan WR, Leaverton PE, Cornoni-Huntley J. A longitudinal study of body fatness in childhood and adolescence. *Journal of Pediatrics.* 1979;95:126-130.
Notes: HANES (National Health and Nutrition Examination Survey) data showed children had a strong tendency to maintain their relative ranking in skin-fold thickness. 68-77% of children classified as obese in childhood were similarly classified in adolescence. 39 to 52% of lean children remained in that category in adolescence. Tracking for skinfold thickness was strongly correlated with tracking for height. ES note: The logic of this article is complicated by the authors' very common assumption that "obesity" (generally identified as W/H or BMI above the 95 percentile) is an abnormal condition. This article strongly supports children's ability to track and, indeed, indicates a tendency to slimming.