GROWTH, ENERGY INTAKE, AND MEAL PATTERN IN FIVE-YEAR-OLD CHILDREN CONSIDERED AS POOR EATERS

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Objective To investigate whether 5-year-old children considered poor eaters differ from their peers regarding growth, intake of energy and nutrients, or meal pattern.

Study design Parental evaluations of children’s (n = 494) eating at age 5 years were collected using questionnaires, and energy and nutrient intakes and meal pattern of the children were assessed using 4-day food records. Weight and height were measured at birth and at ages 7 and 13 months, and 2, 3, 4, and 5 years. Of the children 30.2% (149) were poor eaters according to the parents. The rest of the sample (n = 345) formed the comparison group.

Results Poor eaters were on average lighter and shorter at birth (P = .026 and P = .020, respectively), and at age 5 years (P < .001 for both weight and height) than the comparison children. At age 5 years the poor eaters on average received less of their daily total energy from warm meals (P = .044) and more from snacks (P = .013) than the comparison group, but the mean daily weight-adjusted intake of energy showed no difference between the groups (P = .153).

Conclusions There appears not to be reason for serious concern about growth and diet of preschool-aged children considered as poor eaters by parents. (J Pediatr 2004;144:363-7)

Poor eating in young children is typical of the feeding difficulties that pediatricians see, and is a common complaint of parents. When parents of children 2 to 6 years of age were interviewed about their child’s eating behavior, different aspects of undereating—fussiness, slowness in eating, eating too little at meals, and being easily put off eating—were most often brought up by the parents. Jacobi et al found that 21% of 4- to 5-year-old children were reported to be picky eaters by parents. In the current study the concept of poor eating refers broadly to eating little, including both eating a limited range of foods (selective eating), and eating a limited quantity of food (“poor appetite”).

The age of 5 years is particularly interesting regarding poor eating. Usually by this time children are consuming many of the foods of the adult diet. Between 1 and 5 years of age the diet gets more varied, and appetite changes from being relatively stable to becoming more erratic and unpredictable. Children also begin to develop stronger preferences and aversions, as they mature in the capacity for independent eating, and family mealtimes often get more complicated during these years. In a 5-year follow-up study, the risk for the emergence of eating problems in children reported by mothers increased annually through the first 5 years of life. In Finland, children start preschool at the age of 6 years and school at the age of 7 years. Thus at the age of 5 years, child behavior, or parental views of it, is not yet influenced by the transition to formal schooling, which marks a major developmental shift in independence and adult expectations.

Although parental concerns of poor eating in the offspring are common, research on children who are perceived to be poor eaters has been meager. Our objective was to discover whether the 5-year-old children described by their poor eaters differed from their age-matched controls whose parents voiced no such concerns regarding growth, the
intakes of energy, the energy nutrients, fiber, vitamin C, folic acid, iron, calcium, or meal pattern.

METHODS

Subjects

In the current study, data collected in the Special Turku Coronary Risk Factor Intervention Project for Children (STRIP) were used, as the long-term trial provided a vast amount of data about children's well-being, growth, and food consumption. As previously described, STRIP is a prospective, randomized trial designed to test whether the risk of atherosclerosis can be safely altered with an intervention beginning in infancy. In brief, voluntary families of 1062 6-month-old children (56.5% of the eligible age cohort) were recruited in 1990 through 1992 and randomized either to regularly receive individualized health education and dietary advice (the intervention group, n = 540) or to be given the standard health recommendations given to all Finnish families at the well-baby clinics (control group, n = 522). The children's diet, growth, and serum lipid concentrations were closely followed. The STRIP study was approved by the Joint Commission on Ethics of Turku University and Turku University Central Hospital. Informed consent was obtained from the parents.

The sample of the current study comprised 494 children (with 3 pairs of twins; 237 [48.0%] were girls) and their parents participating in the STRIP trial. The children, for whom the following data were available, were included: (1) evaluations of whether the child ate too little, given in questionnaires by both parents when the child was 5 years old; (2) weight and height of the child at age 5 years; and (3) dietary intake data collected with 4-day food records close to the fifth birthday of the child. Originally, 498 children met the criteria, but four were excluded because of conditions that may markedly restrict one's diet (3 boys with significant food allergies and 1 girl with diabetes). None of the children were known to have any somatic disease affecting nutrient absorption or growth. The sample represented 64.5% of the total sample of 5-year-old STRIP participants (n = 766). The mean values of weight and height at age 5 years were similar between those included in the sample and the rest of the children; 49% (242) belonged to the STRIP intervention group and 51.0% (252) to the STRIP control group.

Of the mothers (n = 491) and the fathers (n = 491), 8% and 12%, respectively, had only completed comprehensive school (< 10 years of education), 34% and 40% had vocational education (10-12 years), 27% and 19% had a college degree (13-15 years), and 26% and 21% had a university degree, respectively. Educational data of 5% (25) of mothers and 8% (39) of fathers was missing or incomplete for classification.

Procedure

Parental evaluations of the child's eating were collected using questionnaires mailed to the parents just before the child's fifth birthday. Each parent answered the statement "the child eats too little" on a 5-point scale from "never" (1) to "often" (5).

Weight and height of the child were measured at ages 7 months, 13 months, 2 years, 3 years, 4 years, and 5 years. At ages 7 months and 13 months, weight (to the nearest 0.01 kg) was measured using an infant scale, and thereafter (to the nearest 0.1 kg) with an electronic scale. Length (to the nearest mm) was at first measured using an infant board, and from the age of 2 years onward, standing height was measured with a stadiometer. Relative weight, ie, the deviation of weight in percentage from the mean weight of healthy children of the same height and sex, and relative height, ie, the deviation of height in SD units from the mean height of healthy children of the same age and sex were calculated from growth curves for Finnish children. Birth weight, birth length, and gestational age of the child were obtained from hospital records (or, when lacking, from the well-baby clinics).

Food consumption of the child was recorded by a parent (usually the mother), and/or other adults responsible for the child's day care, on four consecutive days close to the child's fifth birthday. Respondents recorded detailed information about brand names, ingredients of mixed dishes, food preparation methods, and amounts of the foods and beverages consumed by the child. Also the times of each eating occasion were recorded. Nutrient intakes were analyzed with the Micro NUTRICA computer program. It was developed at the Social Insurance Institution, Turku, Finland (1989) and updated frequently. Intake of nutrients from vitamin and mineral supplements was not included in the calculations. Each meal was based on the time it was eaten and classified as "breakfast" (before 10 AM), "lunch" (between 10 AM and 3 PM), "dinner" (between 4 and 8 PM), and "bedtime snack" (after 6 PM). In addition, to be classified as a warm meal (lunch or dinner), a meal had to include meat, fish or vegetables with rice, pasta, or potatoes, or to be in the form of soup or casserole. Eating occasions that did not fit into any of these categories were classified as "snacks."

BACKGROUND VARIABLES. When the child was 5 years old, age, education, occupation, and employment situation of the parents and number of children in the family were evaluated by questionnaires. Weight and height of the parents were measured to calculate body mass index scores (BMI [kg/m²]).

DEFINING THE POOR EATERS. A child was classified as a poor eater if he or she ate too little either often or sometimes according to the mother, and also often or sometimes according to the father. The parents clearly agreed on their evaluations (r = 0.66, P < .0001). Of the children, 149 (30.2%) met the criteria of being a poor eater. The rest of the sample (n = 345) formed the comparison group.

Statistical Analyses

Of the children perceived to be poor eaters by parents and of the comparison children, 48.3% and 49.3%, respectively, belonged to the STRIP intervention group. As the study group of STRIP (intervention/control) appeared thus to not be
associated with poor eating, it was ignored in the analyses. Similarly, the sex distributions were alike between poor eaters (51.7% were girls) and the comparison children (46.4% were girls), and the sexes were therefore analyzed together. Parametric and nonparametric tests were used depending on whether the values of the analyzed variables were normally distributed on the basis of a graphic evaluation.

T tests were used to compare the mean values of weight (kg and weight %) and height (cm and height SD) at age 5 years between the children included in the sample and the rest of children participating in STRIP. To analyze whether the mothers and fathers agreed that the child ate too little, Spearman correlation coefficient was calculated. Between group differences in absolute and relative weight and height at age 5 years were assessed using t test, birth weights and lengths, and gestational ages using Wilcoxon 2-sample test. Using procedure MIXED in the SAS program, analysis of variance of repeated measurements with missing data were conducted to analyze differences between the groups for mean relative weights and heights at ages 7 months, 13 months, and 2, 3, 4, and 5 years. Fisher’s exact test was conducted to examine differences in the proportions of underweight, overweight, and normal weight children in the poor eaters versus the comparison children.

Comparisons of the daily intake of energy (kcal and kcal/kg) and of the relative energy intakes per meal (E%) between the 2 groups of children were done by means of Wilcoxon 2-sample test. Procedure MIXED, suitable for analyzing intercorrelated variables, was applied in testing the overall group difference in meal pattern (ie, group-meal interaction for absolute energy intake). Wilcoxon 2-sample test was used to test group differences regarding the energy-adjusted intakes of protein, fat, carbohydrates, and sucrose, and of fiber (g/1000 kcal), vitamin C, iron, calcium (mg/1000 kcal), and folic acid (µg/1000 kcal). These nutrients can be regarded as the basic indicators of the quality and variability of diet, and they were thus selected to be analyzed in the current study. For example, vitamin C intake can be considered as an indicator of fruit and vegetable consumption, iron intake of meat consumption, and calcium intake of consumption of milk products.

Wilcoxon 2-sample tests were used to compare ages and BMIs of the parents between the poor eaters and their peers. Parental education level was classified into four categories, and socioeconomic status (based on occupation and work situation) was classified into seven categories following the classification of Statistics Finland (1989).13 Level of education and socioeconomic status of the mothers and fathers, and the number of siblings were compared between the 2 groups of children by means of χ² tests. The statistical computations were performed with the SAS (system for Windows, release 8.2/2001).

RESULTS

On average, the children considered poor eaters by their parents were both absolutely and relatively lighter and shorter than their peers at the age of 5 years (Table I). The poor eaters

<table>
<thead>
<tr>
<th>Table I. Birth weight, birth length, and weight, relative weight, height, and relative height at age 5 years in poor eaters and the comparison group</th>
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<tbody>
<tr>
<td><strong>Poor eaters</strong> (n = 149)</td>
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<tr>
<td>Birth weight (g)</td>
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<tr>
<td>Birth length (cm)</td>
</tr>
<tr>
<td>Weight at age 5 y (kg)</td>
</tr>
<tr>
<td>Relative weight at age 5 y (weight-%)</td>
</tr>
<tr>
<td>Height at age 5 y (cm)</td>
</tr>
<tr>
<td>Relative height at age 5 y (height-SD)</td>
</tr>
</tbody>
</table>

Figures are means (SD).

*Relative weight is the deviation of weight in percentage from the mean weight of Finnish children of the same height and sex.

†Relative height is the deviation of height in SD units from the mean height of Finnish children of the same age and sex.

‡Wilcoxon 2-sample test (birth weight and length); t test (weight and height variables at age 5 years).

were lighter and shorter already at birth (Table I), although the mean gestational ages did not differ between the groups (P = .20). The mean relative weight of the poor eaters had been continually lower, when measured at the ages of 7 months, 13 months, and 2, 3, 4, and 5 years. The between group difference in mean relative weight increased with time (P = .014). Compared with their peers, mean relative weight of the poor eaters was 2.30 percentage points lower (95% CI, 0.77-3.82) at age 7 months and 4.18 percentage points lower (95% CI, 2.66-5.71) at age 5 years; mean relative height of the poor eaters was 0.29 SD units lower (95% CI, 0.11-0.48) at age 7 months and 0.35 SD units lower (95% CI, 0.16-0.54) at age 5 years. Growth with time on average did not differ significantly between the two groups (P = .575).

There were more underweight children (relative weight <15% or lower), 6 (4.0%) versus 3 (0.9%), and less overweight children (relative weight >20% or higher), 2 (1.3%) versus 13 (3.8%), among the poor eaters compared with their peers at the age of 5 years (P = .024). The majority of both the poor eaters and their peers were of normal weight.

Table II shows that, although the absolute energy intake of the poor eaters was on average lower than that of their peers, the mean intakes of energy adjusted for child’s weight showed no difference between the groups. The mean intakes of carbohydrates, protein, fat, and sucrose (as E%) or those of vitamin C, iron (in mg/1000 kcal), and folic acid (in µg/1000 kcal) did not differ between the groups either. Poor eaters had slightly lower mean intakes of fiber (in g/1000 kcal) and calcium (in mg/1000 kcal).

The meal pattern of poor eaters differed a bit from that of their peers (Table III). On average, poor eaters received a smaller proportion of their total daily energy from warm meals (lunches and dinners), and a larger proportion from snacks, than the comparison children.
Of the poor eaters and the comparison children, 15.4% and 10.7%, respectively, had no siblings (difference not significant). There were no differences between the two groups regarding mean age, BMI, or distributions of education level and socioeconomic status of the parents.

**DISCUSSION**

Our findings suggest that even though parental complaints of poor eating in children are very common, in general there appears to be no reason for serious concern about these children. Children with extremely limited energy intakes may have growth restriction, but in this sample of 5-year-old children, no alarming findings were obtained when comparing children considered as poor eaters with those who ate well.

Previous findings in older children suggest that body weight is not affected by poor eating. However, in this study, the poor eaters were on average continuously lighter and shorter already at birth, albeit there was no significant difference between the groups in fiber intake is more difficult to interpret, because for Scandinavian children, there are no strict, scientifically justified recommendations concerning fiber intake.

On average, poor eaters received a bit smaller proportion of their daily total energy from warm meals, and a bit larger proportion from snacks than the comparison children. The different meal pattern as such does not indicate that there should be cause for concern. It has been demonstrated that children show meal-to-meal adjustments in food intake, ie, they are able to compensate a meager meal by eating more at the following meal, and to eat less after a high-calorie course. Furthermore, caloric compensation produces relatively consistent 24-hour daily energy intake, no matter how erratic or displeasing to the parents the child's eating behavior may seem.

There are some limitations in the current study. We used data collected in the STRIP study, a trial aiming at early prevention of atherosclerosis. Voluntary participants in a project focusing on health promotion may not represent the average Finnish population. We previously observed, however, that nutritional counseling in STRIP did not seem to have complicated the eating behavior or the mealtime atmosphere in the participating families. Based on the analysis of nonparticipation in the beginning of the STRIP trial and later discontinuation, representativeness of the children in the trial appears to be quite good. Thus, although our sample was special instead of random, we think that the STRIP data, collected prospectively from hundreds of Finnish children, provided a unique opportunity to study poor eating.

**Table II. Daily intakes of energy and of the nutrients selected as indicators of dietary quality in poor eaters and the comparison group at age 5 years**

<table>
<thead>
<tr>
<th></th>
<th>Poor eaters (n = 149)</th>
<th>Comparison group (n = 345)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal)</td>
<td>1377 (259)</td>
<td>1447 (234)</td>
<td>.010</td>
</tr>
<tr>
<td>Energy, adjusted for weight (kcal/kg)</td>
<td>75.7 (14.3)</td>
<td>74.5 (13.6)</td>
<td>.153</td>
</tr>
<tr>
<td>Protein (E%)</td>
<td>16.0 (2.5)</td>
<td>16.2 (2.2)</td>
<td>.326</td>
</tr>
<tr>
<td>Fat (E%)</td>
<td>31.8 (4.1)</td>
<td>31.1 (4.6)</td>
<td>.188</td>
</tr>
<tr>
<td>Carbohydrate (E%)</td>
<td>52.2 (4.6)</td>
<td>52.7 (4.9)</td>
<td>.422</td>
</tr>
<tr>
<td>Sucrose (E%)</td>
<td>10.0 (3.1)</td>
<td>9.7 (3.0)</td>
<td>.247</td>
</tr>
<tr>
<td>Fiber (g/1000 kcal)</td>
<td>7.9 (2.1)</td>
<td>8.3 (1.9)</td>
<td>.048</td>
</tr>
<tr>
<td>Vitamin C (mg/1000 kcal)</td>
<td>50.8 (27.8)</td>
<td>51.2 (25.8)</td>
<td>.452</td>
</tr>
<tr>
<td>Folic acid (µg/1000 kcal)</td>
<td>124.5 (25.5)</td>
<td>126.5 (24.1)</td>
<td>.424</td>
</tr>
<tr>
<td>Iron (mg/1000 kcal)</td>
<td>5.9 (2.1)</td>
<td>5.9 (1.6)</td>
<td>.330</td>
</tr>
<tr>
<td>Calcium (mg/1000 kcal)</td>
<td>693.7 (275.3)</td>
<td>701.1 (148.3)</td>
<td>.045</td>
</tr>
</tbody>
</table>

Figures are means (SD) of 4-day average intakes.

**Table III. Intake of energy per meal* in percentage of the total daily intake of energy (E%) in poor eaters and the comparison group at age 5 years**

<table>
<thead>
<tr>
<th></th>
<th>Poor eaters (n = 149)</th>
<th>Comparison group (n = 345)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast (%)</td>
<td>14.9 (5.0)</td>
<td>15.4 (4.7)</td>
<td>.192</td>
</tr>
<tr>
<td>Snacks (%)</td>
<td>26.0 (9.1)</td>
<td>23.8 (8.7)</td>
<td>.013</td>
</tr>
<tr>
<td>Warm meals (%)</td>
<td>35.2 (10.3)</td>
<td>37.5 (9.4)</td>
<td>.044</td>
</tr>
<tr>
<td>Bedtime snack (%)</td>
<td>23.9 (7.9)</td>
<td>23.2 (7.4)</td>
<td>.297</td>
</tr>
</tbody>
</table>

Figures are means (SD) of 4-day average intakes.

*Wilcoxon 2-sample test. The overall group difference in meal pattern (intake of energy per meal) was significant at $P = .019$ (procedure MIXED).
In practice, measuring the diets of children is always imprecise, and food records are a subjective method with limitations. Food records are, however, widely used and appear to have reasonable validity compared with food frequency questionnaires. We used recordings of 4 days, which is a relatively short time, knowing that the validity of food records for measuring usual food intake improves with more days of recording. Furthermore, because the respondents in our study had regularly kept record of the child's eating habits since infancy in the STRIP trial, they were accustomed to, trained, and well-practiced in keeping food records. We thus believe to have achieved a reasonably accurate picture of the children's diet.

We found no indications that the different eating pattern of the poor eaters should be any worse, because they showed no prominent differences in weight-adjusted energy intake or quality of diet compared with other children. Though it is known that significant caloric restriction can be associated with poor growth, preschool children whose parents perceive them to be poor eaters do not appear to be at nutritional risk.

REFERENCES