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Diet quality, nutrient intake, weight status, and feeding environments of girls meeting or exceeding the American Academy of Pediatrics recommendations for total dietary fat

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Abstract

The American Academy of Pediatrics (AAP) recommends that children consume no more than 30% but no less than 20% of energy as dietary fat intake, and tills recommendation, is accompanied by suggestions that fat calories should be replaced by eating more grain products, fruits, vegetables, low fat datiy products, beans, lean meat, poultry, fish, and other protein rich foods. In comparing diets of girls meeting this AAP recommendation with girls who consumed diets higher in fat, we noted that girls meeting recommendations had diets that came closer to meeting other dietary recommendations for several food groups and had higher Intake of several key micronutrfents. Dietary fat was also associated with body fat and weight status. Children's fat Intake was also related to mothers' dietary fat intake, and nutrient Intake patterns were similar for mothers and daughters. Finally, mothers of girls consuming higher fat diets reported using more restriction and pressure to eat in feeding their daughters. These findings provide additional support for the AAP recommendation to limit total dietary fat Findings reveal that mothers' use of controlling feeding practices are not effective in fostering healthier diets among cluldren, and that mothers' own eating may be more influential than their attempts to control children's intake.

Keywords

Dietary fats; Nutrition assessment; Obesity; Child; Feeding behavior

As a part of a population-wide approach to affecting dietary change and reducing cholesterol levels among children and adolescents, the American Academy of Pediatrics (AAP) Committee on Nutrition has recently recommended that by five years of age, children consume diets with ≤30% of energy (but not <20% of energy) from fat, and <10% total calories from saturated fatty acids.[1] However, many children and adolescents in the US today consume diets that are substantially higher in dietary fat than these recommended levels, with current estimates ranging from 32 to 34% of energy from fat.[2] Not only do children's diets exceed recommended levels for fat and total energy, these diets also fail to meet minimum recommendations for all food groups,3 Diets high in fat and energy have been found to contribute to overweight and obesity.[4–7] Childhood overweight has tripled in the US in the past 30 years, with one in four children overweight or at risk for overweight.[8] This suggests that compliance with the AAP

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dietary recommendations to reduce fat intake could also contribute to reducing the prevalence of childhood overweight.

The AAP recommendations to reduce children's dietary fat intake are accompanied by suggestions that fat calories should be replaced by eating more grain products, fruits, vegetables, low fat dairy products, beans, lean meat, poultry, fish, and other protein rich foods. Children should meet the recommendation to lower fat intake by consuming a wide variety of foods from all the food groups, and consuming adequate energy to maintain healthy body weight. Lower fat diets may be attained via these substitutions across food groups; however, in some cases, children's diets that are lower in fat are of lower nutrient density, and higher in simple sugars rather than in complex carbohydrates,[9] raising the possibility that lower fat diets may not necessarily be healthier diets.

In this paper, the diet quality and weight status of girls consuming diets meeting the AAP recommendation for dietary fat will be compared with those of girls consuming >30% of energy from fat. The relationships between girls' dietary fat intake, mothers' nutrient intakes, and mothers' child feeding practices will also be investigated. We will review whether mothers of girls whose diets met the AAP guidelines were more likely to meet dietary recommendations themselves and whether they were more likely to report using child feeding strategies to foster healthy diets in their daughters than were mothers of girls whose diets did not meet the guidelines.

Girls' energy intake, fat intake and weight status

On average, reported mean energy intakes of US children aged 2 to 11 years were 91 to 119% of 1989 Recommended Dietary Allowances (RDAs).[2] However, this suggests the possibility that many US children are in positive energy balance, considering that the 1989 RDA for energy is set higher than children's actual energy needs fact that energy intakes are often underreported in dietary surveys.[10] In addition, US children and adolescents consume 32 to 34% of energy from fat, which is higher than AAP recommended levels.[2] Among US children, only 31% of them had fat intake at or below 30% of total energy intake, and only 21% of US children had saturated fatty acid intake below 10% of energy. Children's high fat intake has been a special concern in relation to cardiovascular disease and obesity. Although high levels of dietary fat intake have been associated with overweight and obesity, there has been controversy on this issue. Some researchers have argued that there is no conclusive evidence that dietary fat is a cause of the excessive body fat, and have questioned the effectiveness of fat reduction in treatment of obesity.[7] However, Bray and Popkin reviewed research from animal, clinical, epidemiological, and ecologic studies, and provided ample evidence that dietary fat contributes to the development of obesity.[7]

Several studies have provided evidence for the relationship of dietary fat and overweight in children. Nguyen *et at*.[4] reported that dietary fat intake contributes to obesity in boys but not in girls. In another study on preadolescent children by Gazzaniga and Burns,[6] overweight children were not consuming more energy than non-overweight children, after adjusting for body weight. Instead, the overweight children were consuming a greater proportion of their overall energy in the form of total dietary fat, and less in the form of carbohydrate, than the non-overweight children, independent of total energy intake, resting energy expenditure, and physical activity. Fisher and Birch 5 reported that children's fat preferences were related to measures of body fat, including triceps skinfold ($r=0.61$; $p<0.01$).

In the present research, we studied fat intake of 5-year-old, non-Hispanic white girls in Central Pennsylvania, and divided girls into two groups, based on their fat intake, using data from 3-day diet recalls.[13] The low fat intake group (LF) included girls who consumed ≤30% of energy from fat (84 girls), and high fat intake group (HF) was defined as girls who consumed >30%

of energy from fat (108 girls). As shown in Table I, girls on HF and LF diets did not differ in BMI at either age 5 or 7, However, change in BMI from age 5 to 7 was significantly greater for girls on HF diets, and the same result was obtained when controlling for BMI at age 5. Change in the sum of skinfold thickness (sum of triceps and subscapular) was also significantly higher in the HF group than in the LF group; girls who consumed relatively more energy from fat at age 5 gained more subcutaneous fat from age 5 to 7. In the correlation analysis, percentage of energy intake from fat was positively correlated with change in BMI from 5 to 7 years ($r=0.14$, $p<0.05$), while percentage of energy from carbohydrate was negatively related to change in BMI from 5 to 7 years ($r=-0.19$, $p<0.01$). These findings indicate that total dietary fat Intake may be an important factor in the development of overweight during childhood.

Girls' food group and nutrient intake by fat intake level

There has also been controversy on the safety of low fat diets for children. There has been concern that low fat intakes may have deleterious effects on growth and development, and may be deficient in total calories and essential nutrients.9-14.15 Considering these risks, the AAP recommended beginning to reduce fat intake from age 2 to reach the goal gradually (<30% of energy from fat) by five years of age. Diets with less than 20% of energy from fat are not recommended by the AAP.[1]

When diets of girls meeting the AAP recommendation for dietary fat intake were compared with diets of girls exceeding 30% of energy from fat, excluding the girls with less than 20% of fat intake, several differences were apparent (Table II).[13] Girls meeting the recommendation (consuming 20 to 30% of total energy from fat) had diets that were higher in fruit, and lower in fats and sweets. The mean number of servings of fruit consumed by the LF group was close to the recommended 2 servings a day, while the HF group consumed only 1.26 servings. There were no significant differences in vegetable intake, probably because both groups had only about half die number of recommended servings of vegetables. Girls on LF fat diets also had higher quality diets, as indicated by Healthy Eating Index scores (HEI).[16] The LF group had significantly higher total HEI scores than the HF group. Because the groups were defined based on the fat intake, we also compared girls' scores on die HEI excluding the three fat related subscales. Even when excluding 3 fat sub-scales, girls on LF diets had significantly higher scores than the girls on HF diets (Table II).

Energy and nutrient intakes for girls on HF and LF diets appear in Table III. Girls on LF diets consumed more fiber than girls on HF diets. With respect to micronutrients, the LF group had higher intakes of several vitamins: A, C, thiamin, B_6, folate, and niacin, and the LF group also had higher iron and magnesium intakes. Girls on HF diets consumed more sodium than girls on LF diets. These findings fail to provide support for concerns that children's diets with ≤30% of energy from fat may compromise nutrient intake and dietary quality.[14,15,17]

Girls with LF diets had slightly but not significantly lower energy intakes than girls on HF diets; in contrast, Nicklas *et al.*[9] reported that children consuming diets lower in total fat were eating 25% fewer calories than children on the high fat diets. In our study, the LF group consumed significantly more carbohydrate, but not more sucrose than the HF group. These findings also differed from those reported by Nicklas *et al.*,[9] where children on the lowest fat diets consumed 20% more sucrose. But, as we mentioned above, we cannot compare our result directly with the study of Nicklas *et al.,* because children with less than 20% of energy from fat were included in their study, and because race, income, and education also differed across the two samples.

Our findings are consistent with those reported from intervention studies showing that the nutrient intake of most vitamins and minerals is higher when mean fat intake is lower.[18–20] These studies revealed that children's fat intake could be safely reduced through intervention,

and that fat reduction may also increase nutrient adequacy. Al-through a decrease in total dairy food or calcium intake may occur with reduction of fat intake,[19] Dixon *et al.*[21] reported that young children who reduced their fat intake accomplished this by replacing high-fat foods with lower-fat foods, particularly within the dairy group, Peterson and Sigman-Grant [22] also showed this to be a highly effective strategy for reducing children's fat intake. Although some studies report the potential negative effects of "unsupervised" low fat intakes in children, such as increased sugar intake and reduced micronutrient intake,[9] our findings and other previous intervention studies highlight the benefits of diets meeting the AAP recommendation for fat intake on overall nutrient adequacy of children's diets.

Mothers' nutrient intakes and feeding practices for girls on HF and LF diets

In a report from the Framingham Children's Study, Oliveria *et al.*[23] showed parent-child relationships in nutrient intake. They found significant correlations between parents' and children's intakes for most nutrients. Mothers' and children's intakes were more strongly related than were fathers' and children's intakes. The correlation coefficient for fat intake between mothers and children was 0.46, and was higher than the correlation of other nutrients. In their study on the role of fat on childhood obesity, Nguyen *et al.*[4] also suggested that mothers might contribute to the development of obesity in children by influencing their dietary fat intake. Also, in the study on the fat preference of children, Fisher and Birch[5] showed that children with the strong preferences for high-fat foods ($r=0.75$, $p<0.01$) and the high total % fat intakes had heavier parents ($r=0.67$, $p<0.01$) than did children with low preferences or low intake of dietary fat, which also provides indirect support for the influence of mothers on children's fat intake.

In our study, correlation analyses revealed that mothers' and daughters' fat intakes (% of total energy intake) were significantly correlated ($r=0.31$, $p=0.0001$), and that fat intakes were more highly correlated than mothers' and daughters' energy intake ($r=0.15$, $p=0.03$) or carbohydrate intake ($r=0.21$, $p=0.003$). Also, mothers of girls consuming HF diets had higher fat intakes and lower carbohydrate intake than mothers of girls consuming LF diets. Mothers' energy and protein intakes did not show significant differences between the LF and HF groups, but LF mothers had greater fiber intakes (Table IV). Table IV also indicates that mothers of girls consuming LF diets had higher intakes of vitamins A, C, riboflavin, folate, calcium. In summary, similar nutrient intake patterns were obtained for mothers and daughters (Table III and Table IV). These findings are consistent with mothers serving as models for their daughters, or alternatively, mothers and daughters may select diets from the same array of foods available in the home and the broader food environment.

In addition to mothers' modeling, child feeding practices [24] may also be a key to understanding how to achieve the AAP guideline to reduce dietary fat intake. When the relationship between mothers' feeding practices and girls' macronutrient intake was assessed, controlling for girls' BMI, both maternal restriction and pressure to eat were positively related to girls' percent of total energy from fat ($r=0.17$, $p=0.01$, and $r=0.16$, $p=0.02$, respectively), while carbohydrate and protein intake were not correlated with maternal feeding practices. No significant relationship was found between mothers' feeding practices and girls' total energy intake.[13] Also, mothers of girls whose fat intake exceeded the AAP recommendation reported using greater dietary restriction and greater pressure to eat with their daughters than did mothers of girls on LF diets (Table V). Parental use of restriction and pressure to eat are in part a response to the child's weight status, with heavier children eliciting more restriction, and thinner children more pressure to eat. It is also possible that mothers who take responsibility for controlling their children's intake may employ both practices, regardless of the child's weight status; restriction is used to curb the child's intake of snacks or "junk" foods, while pressure to eat tends to be used at mealtime to increase children's intake of "healthy" foods. Our findings

suggest that the use of restriction and pressure in child feeding is ineffective and counterproductive in bringing children's diets into line with current recommendations. When taken together with results showing dietary similarity between mothers and daughters, these findings suggest that daughters' intake was more closely related to what mothers were eating than to mothers' feeding practices. Casey and Rozin [25] reported that parents believed that pressuring children to eat was an effective way to induce children to accept and like foods, and that restriction can be effective in limiting children's liking and intake of preferred foods. However, experimental research reveals that restriction can foster heightened interest in restricted foods, and over consumption of those foods when they are available,[26] and pressuring children to eat fosters dislikes for those foods.[27]

Conclusions

In comparing diets of girls meeting the AAP recommendation for a diet with between 20 and 30% of total energy from fat with girls who consumed diets higher in fat, we noted that girls meeting recommendations had diets that came closer to meeting other dietary recommendations for several foods groups and for several key nutrients. In addition, girls who consumed dietary fat in excess of the AAP recommendation showed greater increases in BMI and skinfolds from 5 to 7 than did girls consuming LF diets. This finding suggests that successful implementation of the AAP recommendation could have an impact on slowing or reducing childhood overweight, and have a positive impact on children's diet quality. With respect to anticipatory guidance for parents, the similarities noted between mothers' and daughters' diets suggest an effective way for mothers to influence girls' diets in ways consistent with the AAP dietaiy recommendations: mothers who consume diets consistent with recommendations will have daughters who are more likely to do so as well. These findings also provide an additional rationale for mothers to consume healthier diets: in addition to having positive effects on their own health, these patterns may prove beneficial to daughters as well. With respect to the means for achieving the AAP recommendation, the results indicate that while modeling healthy patterns of food intake may be effective, the use of controlling child feeding practices that restrict children's intake of snack and pressure children to eat healthy foods are not associated with healthier diets in children.

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Table I

Weight status of girls consuming high fat (>30%) and low fat C≤30%) diets.[13]

Weight status	Low fat intake group* (n = 84)	High fat intake group* (n = 108)
BMI at age 5	15.8±0.2[a]	16.0±0.2[a]
BMI at age 7	16.4±0.2[a]	16.9±0.3[a]
Change score of BMI	0.6±0.1[a]	1.0±0.2[b]
Change score of skinfold thickness	0.9±0.4[a]	2.1±0.5[b]

*Low fat intake group; >20% but ≤30% of energy from fat. High fat intake group, >30% of energy from fat;

*a, b*Values with the same letter are not significantly different between the groups at p<0.05.

Table II

Number of servings by food groups for girls consuming high fat (>30%) and low fat (≤30%) diets.[13]

Food groups	Low fat intake group * (n = 84)	High fat intake group * (n = 108)	Recommended No. of serving
Grains (# servings)	5.0±0.2[a]	4.7±0,1[a]	6
Vegetables (# servings)	1.7±0.1[a]	1.5±0.1[a]	3
Fruits (# servings)	1.8±0.1[a]	1.3±0.1[b]	2
Dairy (# servings)	2.7±0.1[a]	2.9±0.2[a]	2
Meat (# servings)	1.1±0.1[a]	1.3±0.1[b]	2
Fats and sweets (# servings)	4.6±0.2[a]	5.3±0.3[b]	NA
Total healthy eating index	78.4±0.8[a]	69.6±0.8[b]	100 (max. score)
Total healthy eating index excluding fat items	50.1±0.8[a]	48.4±0.6[b]	70 (max. score)

* Low fat intake group; >20% but ≤30% of energy from flat. High fat intake group; >30% of energy from fat.

a, b Values with the same letter are not significantly different between the groups at $p<0.05$.

Table III

Energy and nutrient intake for girls consuming high fat (>30%) and low fat (≤30%) diets controlling for the energy intake.[13]

Nutrients	Low fat intake group* (n = 84)	High fat intake group* (n = 108)	Recommendation
Energy (kcal)	1491±32[a]	1563±33[a]	1800
Carbohydrate Cg)	233±1.6[a]	205±1.4[b]	NA
Fat(g)	46±0.5[a]	58±0.5[b]	NA
Protein (g)	53±1.0[a]	53±0.9[a]	24
Sucrose (mg)	48.7±1.5[a]	45.6±1.3[a]	NA
Fiber (g)	11.8±0.3[a]	10.1±0.3[b]	NA
Vitamin A (R.E.)	872±50[a]	751±44[b]	500
Vitamin C (mg)	96.5±4.9[a]	71.5±4.3[b]	45
Thiamin (mg)	1.5±0.03[a]	1.3±0.03[b]	0.9
Riboflavin (mg)	1.8±0.04[a]	1.7±0.04[a]	1.1
Niacin(mg)	15.9±0.4[a]	15.0±4[b]	12
Vitamin B_6 (mg)	1.3±0.04[a]	1.2±03[b]	1.1
Folate (mcg)	221.6±7.4[a]	181.5±6.5[b]	75
Calcium (mg)	853±30[a]	814±26[a]	800
Iron (nig)	11.1±0.3[a]	10.0±0.3[b]	10
Sodium (mg)	2190±55[a]	2316±48[b]	NA
Magnesium (mg)	199.9±3.9[a]	189.1 ±3.5[b]	120
Zinc (mg)	7.3±0.2[a]	7.2±0.2[a]	10

Adjusted mean ± standard error (energy: mean ± standard error). Low fat intake group; >20% but ≤30% of energy from fat. High fat Intake group; > 30% of energy from fat.

a, b Values with the same letter are not significantly different between the groups at $p<0.05$.

Table IV

Mothers' energy and nutrient intake by girls' fat intake level controlling for the energy intake.[13]

Nutrients	Low fat intake group * (n = 84)	High fat intake group* (n = 108)	Recommendation
Energy (kcal)	1838±81[a]	1797±63[a]	2200
Carbohydrate (g)	227±4.0[a]	216±3.5[b]	NA
Fat (g)	70±1.5[a]	75±1.3[b]	NA
Protein (g)	72±1.6[a]	71±1.3[a]	50
Sucrose (mg)	42.2±1.7[a]	40.1±1.4[a]	NA
Fiber (g)	16.3±0.6[a]	14.4±0.5[b]	NA
Vitamin A (R.E.)	1202±67[a]	1021±58[b]	800
Vitamin C (mg)	124.2±6.5[a]	102.4±5.6[b]	60
Thiamin (mg)	1.5±0.04[a]	1.4±0.03[a]	1.1
Riboflavin (mg)	1.9±0.05[a]	1.7±0.05[b]	1.3
Niacin (mg)	18.0±0.5[a]	18.8±0.5[a]	15
Vitamin B_6 (mg)	1.6±0.05[a]	1.6±0.04[a]	1.6
Folate (mcg)	278.5±10.4[a]	247.4±9.0[b]	180
Calcium (rag)	932±30[a]	834±26[b]	800
Iron (mg)	13.8±0.6[a]	13.0±0.5[a]	15
Sodium (mg)	3055±56[a]	2973±48[a]	NA
Magnesium (mg)	272.9±6.5[a]	256.5±5.6[b]	280
Zinc (mg)	11.3±0.4[a]	10.9±0.3[a]	12

Adjusted mean ± standard error (energy: mean ± standard error). Low fat intake group; >20% but ≤30% of energy from fat. High fat intake group; > 30% of energy from fat.

a, b Values with the same letter are not significantly different between the groups at $p<0.05$.

Table V

Mothers' child feeding practices of girls consuming high fat (>30%) and low fat (≤30%) diets.[13]

Nutrients	Low fat intake group* (n = 84)	High fat intake group* (n = 108)
Mother's restriction	2.8±0.1[a]	3.1±0.1[b]
Mother's pressure to eat	2.1±0.1[a]	2.5±0.1[b]
Mother's monitoring	3.7±0.1[a]	3.7±0.1[a]

*Low fat intake group; >20% but ≤30% of energy from fat.

[a, b]Values with the same letter are not significantly different between the groups at $p<0.05$.