Higher Diet Quality in Adolescence and Dietary Improvements Are Related to Less Weight Gain During the Transition From Adolescence to Adulthood

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Objectives To examine the previously validated A Priori Diet Quality Score (APDQS), and weight change among adolescents transitioning into young adulthood.

Study design Young people were recruited in middle/high schools and followed for 10 years. Participants reported diet and weight in 1999 (mean age, 15 years), 2004 (20 years), and 2009 (25 years). The analytic sample (n = 2656) had dietary intake assessments in 1999 and at least one other assessment. The APDQS (without alcoholic items) was based on 13 beneficial food groups, 12 adverse food groups, and 9 neutral food groups to capture aspects of Mediterranean/prudent diets, focusing on foods that are varied, based on nutritionally rich plants, and less processed.

Results From mean age 15 to 25 years, mean (SD) weight increased from 61.0 (14.7) kg to 76.1 (18.8) kg, and APDQS increased from 43.1 (11.1) points to 45.6 (10.7) points. Within-person tracking correlation of the APDQS was 0.35 at mean age 15-20 years, increasing to 0.49 at 20-25 years. Independent of lifestyle factors and energy intake, a 15-point (IQR) higher APDQS in 1999 was associated with 1.5 kg (95% CI, 0.7-2.3 kg) less weight gain over 10 years, The increase in APDQS over time was similarly associated with less concurrent weight gain. Findings were stronger for models of excess weight gain.

Conclusion Higher diet quality, based on an assessment of dietary patterns in and after adolescence, was associated with reduced weight gain during the next 10 years. Establishment of high-quality dietary patterns in adolescence may help mitigate excess weight gain by young adulthood. *(J Pediatr 2016;178:188-93).*

Currently, the prevalence of obesity in Americans aged 2-19 years and aged 19-40 years is double what it was 2-3 decades ago, suggesting significant weight gain occurring during childhood/adolescence and young adulthood.[1,2] Weight gain during adolescence and young adulthood is associated with elevated metabolic risk factors later in life.[3,4] Adolescence and young adulthood are critical periods during which dietary patterns may be established that persist through adulthood, impacting weight status and health risk throughout adulthood.[5,6] Greater understanding of the contributors to weight gain during this critical period is needed.

Although dietary modification with a single diet focus (eg, calorie or fat restriction) has been effective for moderate weight loss in middle age, such a strategy has been ineffective thus far in youth.[7-9] Given the possible combined or synergistic effects of dietary compounds in foods, examination of diet as a whole may carry added information about weight gain over time and potentially promote effective interventions.[10] The A Priori Diet Quality Score (APDQS) is food-based, reflects overall diet quality, and captures aspects of Mediterranean/prudent diets. It emphasizes reducing the consumption of processed foods, red meat, sweet/salty foods, and whole-fat dairy foods while increasing consumption of seeds, white meat, plants, and low-fat dairy foods, in the context of maintaining energy balance over the long run.[11,12] The APDQS has limited within-person variation, tracking strongly over time.[12-15]

This score has been related to weight change in young adulthood and middle age independent of energy intake and physical activity[11,13,15]; nonetheless, little is known about the APDQS in relation to weight gain during the transition from adolescence to young adulthood. Learning more about how the quality of dietary intake and dietary patterns in adolescence predict weight gain through young adulthood is important for designing interventions aimed at preventing excessive weight

APDQS	A Priori Diet Quality Score
BMI	Body mass index
EAT	Eating and Activity in Teens and Young Adults
FFQ	Food Frequency Questionnaire
SES	Socioeconomic status
YAQ	Youth and Adolescent Food Frequency Questionnaire

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gain for children, adolescents, and families. We hypothesized that the APDQS tracks through late adolescence into young adulthood, and that improved diet quality, as assessed by the APDQS, is associated with less weight gain among a large, diverse group of adolescents transitioning into young adulthood.

Methods

Project EAT (Eating and Activity in Teens and Young Adults) is a longitudinal study examining lifestyle and weight in adolescents followed for 10 years.[16,17] In 1998-1999 (EAT-I; mean age 15 years), adolescents from 31 public middle/high schools from urban and suburban school districts in the Minneapolis–St Paul metropolitan area of Minnesota were studied. Among these students, those who were absent from school on the days of survey administration or who did not read English were excluded. Participants completed surveys and anthropometric measures at baseline, and completed follow-up surveys in 2004 (EAT-II; mean age 20 years) and 2009 (EAT-III; mean age 25 years). All study protocols used in Projects EAT-I, II, and III were approved by the University of Minnesota's Institutional Review Board, Human Subjects Committee. In 1999, consent procedures were done in accordance with the requests of the participating school districts; passive consent procedures were used in some schools, and active consent procedures were required in others. For follow-up exams, consent was implied by returning the survey by mail or submitting it online.

Weight and height were self-reported in Projects EAT-I, II, and III. In a subset of EAT-I, self-reports were highly correlated with measured weight and body mass index (BMI; reported as kg/m^2) among 1936 boys and 1861 girls (weight: $r = 0.96$ for boys and $r = 0.94$ for girls; BMI: $r = 0.89$ for boys and $r = 0.85$ for girls).[18] In EAT-III, high correlations between self-reported and measured BMI were also found in a validation subsample of 63 and 62 young adult men and women ($r = 0.95$ for men and $r = 0.98$ for women).

Dietary intake was self-reported in EAT-I and II using the 152-item Youth and Adolescent Food Frequency Questionnaire (YAQ), which is based on the Willett Food Frequency Questionnaire (FFQ), with modifications to include foods commonly consumed by children/adolescents.[19,20] One-year reproducibility coefficients for energy-adjusted nutrient intake had a mean of 0.41, and the average correlation coefficient between energy-adjusted nutrient intake determined from the 24-hour dietary recalls and the average of the 2 YAQs was 0.45.[19,20] Dietary intake was assessed in EAT-III using the 151-item 2007 grid form of the Willett FFQ.[21] One-year reproducibility coefficients for unadjusted nutrient intake ranged from 0.47 to 0.80.[22] The average correlation coefficient between energy-adjusted nutrient intake determined from the 24-hour dietary recalls and the FFQ was 0.59.[22]

The APDQS was derived from YAQ food groups at mean ages 15 and 20 years and from the FFQ at mean age 25 years.[14] Following the food grouping structure used in the Coronary Artery Risk Development in Young Adults Study (except for omitting alcohol items in view of the pediatric age range of EAT-I and some EAT-II participants), we considered 34 food groups encompassing most aspects of diet, among which 13 were rated beneficial, 9 rated neutral, and 12 rated adverse[14] (**Table I**; available at www.jpeds.com). A higher score indicates a diet with better quality. The APDQS at EAT-III was calculated as the sum of quintile scores 0-4 for beneficial foods plus scores in the reverse order (4-0) for adverse foods. (Neutral foods affect the score indirectly by affecting the amounts of beneficial and adverse foods while maintaining energy balance.) In foods with a large subset of nonconsumers, the nonconsumer group was scored 0 and quartiles among consumers were scored 1-4. One APDQS point reflects a one-category change in one food group. To enhance the comparability between scores over time, the APDQS at EAT-I and II used cutoff points based on the distribution of APDQS in EAT-III for scoring.

Daily intake of energy and nutrients was determined based on the US Department of Agriculture's Nutrient Database for Standard Reference (release 19). Among 34 food groups in common between the YAQ and the FFQ, 14 were virtually identical and 20 were based on comparable questions. In a validation study of our participants who completed both the YAQ and the FFQ at EAT III (n = 194), correlation coefficients between YAQ and FFQ intake estimates of energy and food groups ranged from 0.49 to 0.62, and the percentage of individuals classified into the same quartile rank category based on their responses to the YAQ and the FFQ were >50% for major food groups.[23]

Covariates

Baseline family socioeconomic status (SES) was rated on a 5-point scale based primarily on parental education level, emphasizing the higher level of either parent.[24] In each EAT exam, unhealthful weight control behaviors during the past year aimed at losing weight or keeping from gaining weight included "fasted," "ate very little food," "used a food substitute (powder or special drink)," "skipped meals," "smoked more cigarettes," "took diet pills," "made myself vomit," "used laxatives," and "used diuretics" (test-retest agreement, 83%).[25] Smoking frequency during the past year was categorized as "never," "a few times," "monthly," "weekly," or "daily" (test-retest $r = 0.91$). Total hours of physical activity included hours spent on strenuous, moderate, and mild exercise (test-retest $r = 0.80$).

Statistical Analyses

At baseline, 4746 students were enrolled, and 2901 participated in at least one follow-up exam. Of these 2901 participants, data from 245 were excluded because they either lacked or provided inadequate or implausible data on dietary intake (>7000 kcal/day or <400 kcal/day). After these exclusions, data from 2656 participants (1226 males, 1633 whites) were included in our analysis. Mean weight and age did not differ significantly between those included in the analysis and those excluded.

We assessed APDQS per 15 units in this analysis, because the IQR of baseline APDQS was 13 and the IQR of change in