

● Association of early puberty with disordered eating and anxiety

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From the original article:

-“Humans exhibit substantial variability in the timing of pubertal maturation, and deviations in normal pubertal timing are associated with various mental health problems. Examples range from negative body self-image to increased incidence of anxiety, symptoms of disordered eating, conduct disorder and increased alcohol and tobacco. Many of the psychological outcomes of pubertal timing have been demonstrated to persist into young adulthood.”

-“Specifically, particular experiences occurring during adolescence (e.g. the presence or absence of testosterone) may organize circuits and render them resistant to further modification or change. For example, patterns of synaptic connectivity change across adolescence within the hamster medial amygdala, concomitant with the pubertal rise in gonadal hormones. These decreases in dendrites, spine densities, and spinophilin protein may reflect organizational changes induced by testosterone during the adolescent sensitive period, ultimately limiting the capacity for further steroid-dependent organization”

Background information:

- The incidence of disordered eating increases dramatically at puberty and rarely occurs in prepubertal individuals. In addition, puberty onset marks a developmental shift in the relationship between biological and environmental influences on disordered eating. And both disordered eating and anxiety disorders, which are frequently presented simultaneously with disordered eating, are more common in females than in males.
- These prevalence patterns 12 year-old girls symptomatic for eating disorders have greater breast and pubic hair development than do nonsymptomatic girls of the same age, and postpubertal adolescent girls report higher levels of disordered eating than their prepubertal same-aged peers. Furthermore, both adolescent girls and boys who mature earlier than their peers have a higher incidence of bulimic behavior compared to girls and boys who mature on time or later. Also, similar to disordered eating behavior, adolescent girls who are more physically developed show a higher incidence of panic attack.

○ Hypothesis:

- To test whether the timing of puberty influences disordered eating and anxiety in young adults, consistent with an organizational effect of steroids. Finding no association between pubertal timing and psychological traits in young adulthood would suggest that gonadal hormones do not have organizational effects, while a significant association between pubertal timing and psychological measures in young adulthood would be consistent with the hypothesis that gonadal hormones have organizational effects on these symptoms during adolescence.

○ Participants:

- The initial sample included 750 female (age range = 17–36 years, $M = 19.35$, $SD = 1.60$) and 750 male (age range = 18 – 32 years, $M = 19.77$, $SD = 1.75$) undergraduate students at a large Midwestern university. Due to some missing data, the final sample of participants included 717 women and 643 men who responded to measures of pubertal development.
- Participants were recruited from introductory psychology courses and received course credit for their participation. The majority (81.5%) of all participants reported a Caucasian ethnic background. Socioeconomic status (SES), assessed by parental income, was largely in the middle-to-upper level income classes.
- Participants completed all measures electronically as part of the university's on-line volunteer research pool. Questionnaires obtained demographic information as well as information on pubertal development, disordered eating, anxiety, personality, sensation seeking, and alcohol use.

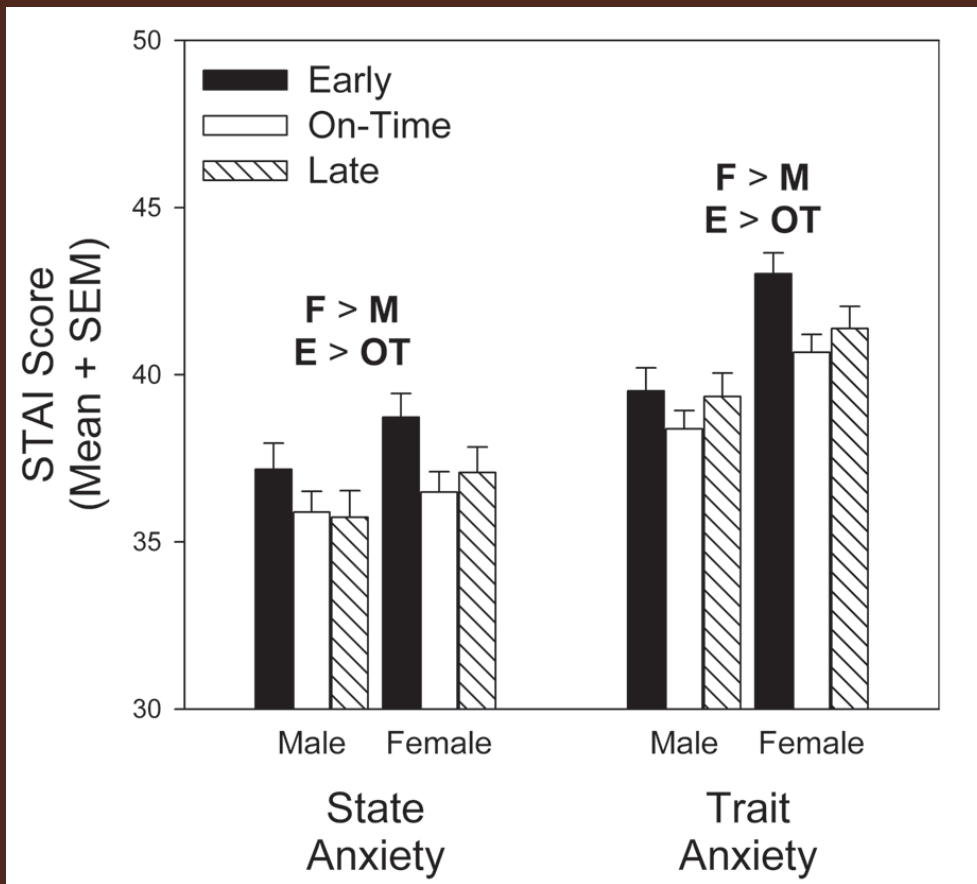
Methods:

- 1. In this study, young adult participants were asked to report whether pubertal milestones, such as breast development in women or facial hair growth in men, were achieved earlier than, at a time similar to, or later than their peers. Early, on-time, and later maturing post-pubertal women and men were then compared to determine whether pubertal timing was associated with a variety of psychological traits in young adulthood, including disordered eating, anxiety, personality, sensation seeking, and alcohol use. These were chosen to include measures that are linked to pubertal development (disordered eating, anxiety) or adolescent behavior (sensation seeking, alcohol use) and measures that are not linked to puberty (personality).
- 2. With a modified version of the PDS to retrospectively assess timing of pubertal development in post-pubertal adults. Participants reported whether their pubertal development occurred much earlier than others
- 3. Two questionnaires were used to assess disordered eating: the Eating Disorder Examination Questionnaire (EDE-Q) and the Binge Eating Scale (BES). Also, Body Mass Index (BMI), anxiety, personality characteristics, alcohol use and statistical analysis were measured by questionnaires as well. So in total, there were a 6 different areas of questionnaires.

Results:

Note:

- females (F); males (M); early (E); on-time (OT), and late (L) maturers
- STAI: State trait anxiety inventory



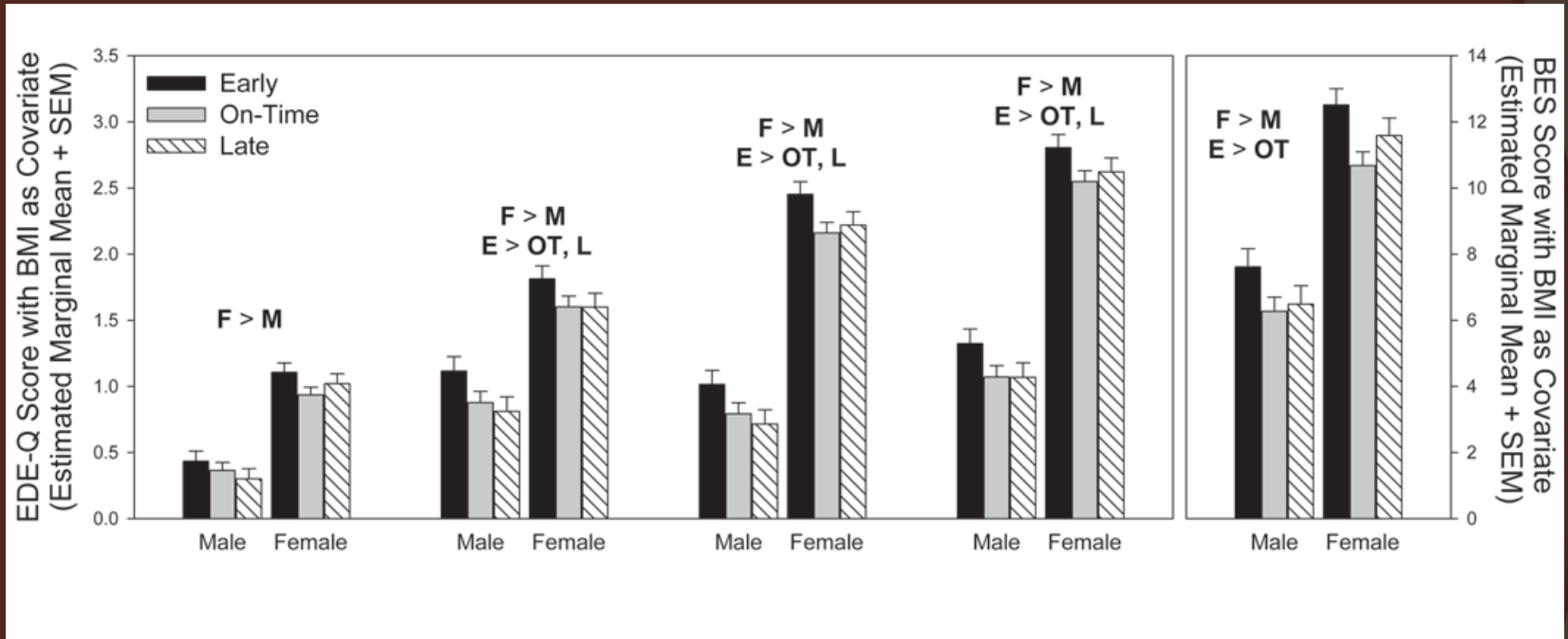
Varied with both sex and timing of pubertal onset. Females have higher score than males on both state and trait subscales.

More results:

Note:

EDE-Q: eating disorder examination Questionnaire

females (F); males (M); early (E); on-time (OT), and late (L) maturers



Females have higher scores than males, once again.

Limitations:

- Because subjects in these studies vary in degree of pubertal development, these studies can't distinguish between transient activational effects of steroids on disordered eating and anxiety symptoms and longterm organizational effects of pubertal steroids on psychological development.
- Online Questionnaires
- Have to recall their memories and rely on it even though many years have passed

Related article:

- Adolescent rodents show differential responsiveness to anxiogenic situations, which is directly related to different effects of neurosteroids on cell excitability in adolescents and adults (Shen H, Gong QH, Aoki C, Yuan M, Ruderman Y, Dattilo M, Williams K, Smith SS. *Nat Neurosci* 2007;10(4):469–77. [PubMed: 17351635]).
- Recent prospective studies show that adult BMI is explained solely by prepubertal body mass rather than by early menarche (Must A, Naumova EN, Phillips SM, Blum M, Dawson-Hughes B, Rand WM. *Pediatrics* 2005;116(3):620–7. [PubMed: 16099850]).

● Conclusions/Take home message:

- This study suggests that early puberty is associated with long-term risk for disordered eating and anxiety. Specifically, young adults who characterized themselves as maturing early relative to their peers had significantly higher scores on measures of disordered eating and trait anxiety than did individuals who characterized themselves as maturing on-time or late. Pubertal timing did not relate to measures of alcohol use, personality, or sensation seeking in young adults. Thus, the relationships of pubertal timing were specific to disordered eating and anxiety rather than generalized to sexually dimorphic psychological traits.
- Adolescent girls in a more advanced pubertal stage, with higher levels of reproductive hormones, have higher levels of disordered eating than adolescent girls in a less advanced pubertal stage
- More detail information can be found in the following article:
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2080669/pdf/nihms32857.pdf>

● Any questions?

- **Extra notes on each section (my side notes):**

- **Methods**

- **2. such as: (1), somewhat earlier (2), about the same time (3), somewhat later (4), much later (5), or they did not know. For female participants, six aspects of pubertal development were assessed, including onset of menses, breast development, growth spurt, appearance of body hair (axial and pubic), skin changes (e.g., acne), and overall development (i.e., “In general, do you think your development was any earlier or later than most other girls?”). For male participants, seven aspects of pubertal development were assessed: appearance of facial hair, voice changes, growth spurt, appearance of body hair (axial and pubic), skin changes including acne, spontaneous erections, nocturnal emissions and overall development.**

- **3. The EDE-Q contains four subscales that examine Eating Concerns (i.e., preoccupation with food, eating in secret, and guilt about eating), Restraint (i.e., restraint over eating, avoidance of eating), Shape Concerns (i.e., desire for a flat stomach, importance of body shape, and fear of gaining weight), or Weight Concern (i.e., importance placed on weight, dissatisfaction with weight, and desire to lose weight).**

- **Measured Body Mass Index (BMI) but was not a dependent variable of interest, BMI was included as a covariate in analyses of disordered eating.**

- ◎ **Note on Figure 1.** Scores on the State-Trait Anxiety Inventory (STAI) varied with both sex and timing of pubertal onset. On both state and trait subscales, females had higher scores than did males. In addition, early-maturing individuals, whether male or female, scored highest on anxiety measures. Significant differences between females (F) and males (M) and between early (E), on-time (OT), and late (L) maturers are indicated in the figure. Analyses are based on 180/179 (State/ Trait) early maturing men, 288 on-time maturing men, 172 late maturing men, 217 early maturing women, 300/301 on-time maturing women, and 193 late maturing women.
- ◎ **Figure 2.** A high score on the BES scale suggests more severe binge eating problems. Scores on the Eating Disorder Examination Questionnaire (EDE-Q) and Binge Eating Scale (BES) varied with both sex and timing of pubertal onset. Across EDE-Q subscales and the BES, females had higher scores than did males. Furthermore, early-maturing individuals, whether male or female, scored highest on all measures of disordered eating. No measures had a significant interaction between pubertal timing and sex, and all measures used body mass index (BMI) as a covariate in the analysis. Significant differences between females (F) and males (M) and between early (E), on-time (OT), and late (L) maturers are indicated in the figure. Analyses are based on 171–173 early maturing men, 278–284 on-time maturing men, 165–169 late maturing men, 208–212 early maturing women, 293–299 on-time maturing women, and 187–190 late maturing women.

○ Results:

- Measures of disordered eating differed across both pubertal timing and sex. In general, individuals who matured early had higher scores than did individuals who matured on-time or late. Specifically, early maturing individuals had significantly higher levels of EDEQ dietary restraint, more shape concerns, and more weight concerns as well as a trend towards significantly more eating concerns than on-time or late maturing individuals (Figure 2). Furthermore, females had significantly higher scores than males across all EDE-Q measures, indicating more eating concern, more dietary restraint, more shape concern, and more weight concern. None of the EDE-Q subscales showed an interaction of pubertal timing and sex. Scores on the BES questionnaire showed a remarkably similar pattern of results (Figure 2). Early maturing individuals had significantly higher BES scores than on-time individuals (Tukey HSD, $p < 0.05$) as well as a trend towards significantly higher scores than late individuals (Tukey HSD, $p = 0.06$), and females had significantly higher BES scores than did males. Measures of anxiety also varied with both pubertal timing and sex. Participants who matured early had significantly higher scores on measures of both state anxiety and trait anxiety than did participants who matured on-time (Figure 1). In addition, females scored significantly higher than males in measures of both state and trait anxiety (Figure 1). Measures of personality, sensation seeking, and alcohol use showed expected sex differences, but did not vary based on pubertal timing. Scores on IPIP extroversion, agreeableness, and conscientiousness items were significantly higher in females than in males. Scores on IPIP emotional stability, characterized as the opposite of neuroticism, and intellect items were significantly higher in males than in females. Across all sensation seeking measures, males had significantly higher scores than did females. Scores on the AUDIT, a survey designed to assess alcohol use, were also significantly higher in males than in females.