



Published in final edited form as:

*J Adolesc Health*. 2017 April ; 60(4): 469–471. doi:10.1016/j.jadohealth.2016.10.019.

## Effect of a Prior History of Overweight on Return of Menses in Adolescents With Eating Disorders

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### Abstract

**Purpose**—The purpose of this study was to determine whether a history of overweight, weight suppression, and weight gain during treatment have an effect on return of menses (ROM) in adolescents with eating disorders (EDs).

**Methods**—Retrospective chart review of female adolescents presenting to an ED program from January 2007 to June 2009.

**Results**—One hundred sixty-three participants (mean age, 16.6 ± 2.1 years) met eligibility criteria. The mean median body mass index percent at ROM for those previously overweight was 106.1 ± 11.7 versus 94.2 ± 8.9 for those not previously overweight ( $p < .001$ ). Both groups needed to gain weight for ROM. Greater weight suppression (odds ratio, 0.90; 95% confidence interval, 0.84–0.98;  $p = .013$ ) was associated with lower likelihood of ROM, and greater weight gain during treatment (odds ratio, 1.20; 95% confidence interval, 1.07–1.36;  $p = .002$ ) was associated with higher likelihood of ROM in those not previously overweight.

**Conclusions**—Previously overweight amenorrheic patients with EDs needed to be at a higher median body mass index percent for ROM compared to those who were not previously overweight.

### Keywords

Adolescents; Amenorrhea; Eating disorders; Overweight; Return of menses

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Individuals with a history of overweight represent a substantial portion of adolescents presenting for evaluation of eating disorders (EDs) [1,2]. Their diagnosis often goes unrecognized because of higher or normal weight at presentation [3]; the proportion of such patients presenting to one tertiary care inpatient service increased fivefold over the past 5 years [4]. A common medical complication of weight loss in these patients is amenorrhea,

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**Conflicts of Interest:** The authors have no conflicts of interest to disclose.

which occurs by disruption of the hypothalamic-pituitary-ovarian axis secondary to an energy deficit. Prolonged amenorrhea is associated with reduced bone mineral density and increased fracture risk. Return of menses (ROM) usually accompanies weight restoration and is an important marker of healthy weight. Studies showed ROM occurred in approximately 68% of participants at about 95% median body mass index (mBMI) [5,6]. However, weight necessary for ROM may be different in those previously overweight. A recent study found those with higher premorbid BMIs were less likely to achieve ROM, despite getting to similar weight as those previously not overweight [7].

A potential factor affecting ROM, particularly in patients not previously overweight, is the degree of weight suppression (WS; difference between highest-ever and current weight). Research in adults suggests high levels of WS predict greater weight gain during treatment [8]. More recent research suggests WS may be related to ED symptom progression in anorexia nervosa [9]. Given that weight gain is thought to be essential for ROM in patients with EDs and WS appears to be related to weight gain during treatment, further exploration of the role of WS in ROM for adolescents is warranted.

The objective of this study was to analyze associations of history of overweight, WS, and weight gain on ROM in adolescents with EDs. We hypothesized that adolescents with EDs with history of overweight will need to be at a higher %mBMI for ROM than those not previously overweight.

## Methods

### Sample

Retrospective chart review was conducted of female adolescents (N = 427) presenting to an academic ED program from January 2007 to June 2009 who were subsequently followed in the outpatient ED program for medical management. Data were collected for 2 years after presentation or until the last clinic visit if <2 years. We excluded participants who were premenarchal (n = 31), age <12 years (n = 29), on contraceptives before or during the entire study (n = 41), had no loss of menses (n = 116), and had missing data (n = 47). ED diagnosis was assigned by a child psychiatrist using *Diagnostic and Statistical Manual of Mental Disorders, Fourth edition*, criteria. Secondary amenorrhea was defined as absence of menses for >3 months in girls who were previously menstruating. ROM was defined as self-report of 1 month of ROM. BMI at ROM was collected within 1 month of the time of ROM. Overweight was defined as 85th percentile BMI; not previously overweight was 85th percentile BMI, based on self-reported highest weight before presentation. Previous BMI was calculated using patient's recall of the past highest weight and height at presentation.

### Measures

Race/ethnicity, age, anthropometric measures (height, weight), and duration of illness were collected. mBMI was defined as 50th percentile BMI for age using Centers for Disease Control and Prevention growth curves. Percent mBMI (%mBMI) was defined as BMI/mBMI × 100. WS was calculated as maximum pretreatment weight minus weight at presentation [8]. BMI suppression was calculated as maximum pretreatment BMI minus

BMI at presentation [10]. The Stanford University Institutional Review Board approved the protocol.

## Analysis

Statistical analyses were conducted using SPSS 22.0.2 for Windows (SPSS Inc., Chicago, IL). The primary outcome measure was %mBMI at ROM. Analysis of variance with post hoc follow-up determined differences among groups. Multivariate logistic regression was performed to investigate relationships among WS, BMI suppression, and weight gain, with ROM as the binary dependent variable.

## Results

One hundred sixty-three participants met eligibility criteria ( $X_{\text{age}} = 16.6 \pm 2.1$  years; 71.8% Caucasian, 6.7% Hispanic, 9.2% Asian, 12.3% other). Average duration of illness was  $16.6 \pm 15.5$  months; duration of follow-up was  $7.6 \pm 9.5$  months; 33 (20.2%) were previously overweight and 130 (79.8%) were not. Mean %mBMI at presentation for those previously overweight was  $97.4 \pm 13.2$  compared to  $84.0 \pm 9.7$  for those not previously overweight ( $p < .001$ ; Table 1). Among those previously overweight, 42.5% ( $N = 14$ ) resumed menses within study period and 57.5% ( $N = 19$ ) had continued amenorrhea. Among those not previously overweight, 37% ( $N = 48$ ) resumed menses and 63% ( $N = 82$ ) had continued amenorrhea. At ROM, %mBMI for those previously overweight was  $106.1 \pm 11.7$  compared to  $94.2 \pm 8.9$  for those not previously overweight ( $p < .001$ ; Table 1). Both groups needed to gain weight to resume menses, and there were no significant differences in weight gain for ROM between those previously overweight ( $5.2 \pm 4.7$  kg) and those not ( $5.8 \pm 4.4$  kg;  $p = .06$ ; Table 1). For every 1-kg weight gain, odds of ROM increased 20% in those not previously overweight (odds ratio [OR], 1.20; 95% confidence interval [CI], 1.07–1.36;  $p = .002$ ; Table 2). For every 1-kg weight suppressed, odds of ROM decreased by 10% in those not previously overweight (OR, .90; 95% CI, .84–.98;  $p = .013$ ; Table 2). For every 1 kg/m<sup>2</sup> BMI suppressed, odds of ROM decreased by 1% in those not previously overweight (OR, .99; 95% CI, .98–.99;  $p = .002$ ; Table 2). Weight gain during treatment, WS, and BMI suppression at presentation did not reach significance in the previously overweight group in relation to ROM.

## Discussion

We found that the previously overweight group, who presented for treatment at a relatively normal %mBMI, not only needed to be at a higher %mBMI for ROM compared to those not previously overweight but required similar amounts of weight gain for ROM, compared to those not previously overweight. One previous study noted wide variability in weight at ROM with some patients needing to be between 75% and 115% of their median weight for age and height, corresponding to 80%–120% mBMI [5]. These findings are consistent with our results. Thus, clinicians may need to assign higher weight goals for some patients, based on weight history, for ROM.

Our findings should be considered in light of several limitations: relatively small sample size, retrospective recall of previous weight, use of height at presentation to determine

premorbid BMI, and limited length of follow-up secondary to attrition which limited ability to assess return of several months of menses. Despite these limitations, this is the first study examining effect of prior history of overweight and WS on ROM in adolescents with EDs.

Our findings indicate that pretreatment weight status influences weight required for ROM and is an important consideration when determining treatment goal weights in adolescents with EDs.

## Acknowledgments

The authors thank Dr. Elaine Isabel Allen and the UCSF CTSI (grant number UL1 TR000004) for their statistical assistance.

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**IMPLICATIONS AND CONTRIBUTION**

Findings from this study suggest that pretreatment weight status is an important indicator for return of menses in adolescents with eating disorders and should be considered in the determination of treatment goal weights.

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Table 1

Age, diagnosis, and weight characteristics based on prior weight status, N = 163

	Previously overweight; N = 33 (20.2%)		Not previously overweight; N = 130 (79.8%)		p value
	Menses returned (a) n = 14	Menses did not return (b) n = 19	Menses returned (c) n = 48	Menses did not return (d) n = 82	
Age (years)	15.7 ± 1.6	17.1 ± 2.2	16.3 ± 1.9	16.8 ± 2.3	.13
Duration of follow-up (months)	12.0 ± 6.6	7.0 ± 12.4	14.6 ± 9.7	3.1 ± 6.2	<.001
Weight suppression at presentation (kg)	29.0 ± 11.2	36.3 ± 17.7	17.1 ± 8.5	22.0 ± 7.1	<.001
Weight gain during treatment (kg)	5.2 ± 4.7	3.0 ± 5.5	5.8 ± 4.4	4.2 ± 3.3	.06
DSM-IV eating disorder diagnosis <sup>a</sup>					Chi-square across 4 groups
Anorexia nervosa	5 (35.7%)	10 (52.6%)	28 (58.3%)	63 (76.8%)	.53
Bulimia nervosa	1 (7.1%)	1 (5.3%)	6 (12.5%)	2 (2.4%)	.53
Eating disorder not otherwise specified	8 (57.1%)	8 (42.1%)	14 (29.2%)	17 (20.7%)	.50
Weight characteristics					ANOVA across four groups
Mean %mBMI at highest premenstrual weight	137.6 ± 17.9	137.9 ± 28.1	102.2 ± 9.8	101.5 ± 11.1	<.001
Mean %mBMI at presentation	97.4 ± 13.2	83.8 ± 17.9	84.0 ± 9.7	78.5 ± 9.5	<.001
Mean %mBMI at ROM <sup>b</sup>	106.1 ± 11.7	89.4 ± 19.0	94.2 ± 8.9	85.7 ± 8.6	<.001
Mean %mBMI change during treatment	8.6 ± 9.6	5.5 ± 9.4	10.1 ± 8.6	7.3 ± 6.1	.09

Bold values indicate a p value of &lt; .05.

ANOVA = analysis of variance; DSM-IV = *Diagnostic and Statistical Manual of Mental Disorders, Fourth edition*; ROM = return of menses; %mBMI = median body mass index percent.<sup>a</sup>Percentage reflects distribution within each column.<sup>b</sup>Last clinic visit if menses not resumed.

**Table 2**

Determinants of return of menses based on prior weight status

	<u>95% Confidence interval for odds ratio</u>			
	Odds ratio	Lower	Upper	<i>p</i> value
Previously overweight				
Weight gain during treatment	1.14	.94	1.39	.17
Weight suppression at presentation	.97	.93	1.02	.28
Body mass index (BMI) suppression at presentation	.99	.99	1.00	.13
Previously normal weight				
Weight gain during treatment	1.20	1.07	1.36	<b>.002</b>
Weight suppression at presentation	.90	.84	.98	<b>.013</b>
BMI suppression at presentation	.99	.98	.99	<b>.002</b>

Bold values indicate a *p* value of < .05.