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Sex Differences in Eating Related Behaviors and Psychopathology among Adolescent Military Dependents at Risk for Adult Obesity and Eating Disorders

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Abstract

Stressors unique to military families may place dependents of military service members of both sexes at high-risk for disordered-eating. Yet, there are no data examining sex-related differences in eating pathology and distress among this population. Therefore, we examined disordered-eating attitudes and associated psychosocial characteristics in adolescent military dependents at high-risk for both eating disorders and adult obesity (i.e., BMI ≥ 85th percentile and elevated anxiety symptoms and/or loss-of-control eating). One-hundred-twenty-five (55.2% female) adolescent (12-17y) military dependents were studied prior to entry in an eating disorder and obesity prevention trial. Youth were administered the Eating Disorder Examination interview to determine disordered-eating attitudes, and completed questionnaires to assess self-esteem, social functioning, and depression. Girls and boys did not differ in BMI_Z ($p=.66$) or race/ethnicity ($p=.997/p=.55$).

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Adjusting for relevant covariates, girls and boys did not differ significantly with regard to disordered-eating global scores ($p=.38$), self-esteem ($p=.23$), or social functioning ($p=.19$). By contrast, girls reported significantly more symptoms of depression ($p=.001$). Adolescent male and female dependents at high-risk for eating disorders and adult obesity reported comparable levels of eating-related and psychosocial stress. Data are needed to elucidate how adolescent military dependents respond to intervention and whether sex moderates outcome.

Keywords

sex; disordered-eating; psychosocial functioning; adolescent military dependents

1. Introduction

Military personnel may present with higher rates of disordered-eating than the general population.¹⁻³ Service-members encounter unique challenges, namely fitness tests, military appearance standards, trauma exposure, relocation, and deployment that have been linked to unhealthy eating behaviors.^{1,4,5} Such experiences are likely to permeate and influence military families. Limited data suggest that the adolescent children of military personnel may be more vulnerable to disordered-eating behaviors, attitudes, and associated comorbidities than their civilian peers.^{6,7} In addition to exposure to their parents' eating- and weight-related behaviors and stress, aspects of being a military dependent may impact well-being⁸ and vulnerability to disordered-eating.^{6,7} Although data are mixed on the impact of frequent relocation on military dependents,⁹⁻¹¹ parental deployment has been associated with emotional and behavioral problems in military children.^{12,13} No study has directly compared military adolescents to their civilian counterparts with regard to the prevalence of disordered-eating. However, one study found that among female adolescent military dependents, disordered-eating behaviors and attitudes were reported by 21% of the sample.⁷ In another study that compared female adolescent military dependents with overweight and obesity to their matched civilian counterparts, military dependents reported higher rates of disordered-eating behaviors and attitudes, as well as depression.⁶ Therefore, adolescent military dependents may be at high-risk for eating and weight problems and associated psychosocial characteristics, and for a more exacerbated presentation compared to civilians.

In contrast to consistent data among civilian samples showing that females are at higher risk for disordered-eating than males,^{14,15} in active duty military samples, men may be at equal or greater risk than women.^{1,16} Studies comparing civilian men and women with binge-eating disorder show few differences in symptom or comorbidity severity.¹⁷⁻¹⁹ However, limited research suggests that civilian women with anorexia nervosa and bulimia nervosa present with heightened eating pathology in comparison to their male counterparts.²⁰ While among civilians, girls are at higher risk for disordered-eating than their male peers,^{14,21,22} the data are mixed on whether there are sex differences in the presentation of disordered-eating among youth with eating and weight problems.²³⁻²⁵ Some data suggest similar rates of symptom severity,^{24,25} while other research indicate that girls present with heightened disordered-eating pathology in comparison to boys.²³ Given that most measures of disordered-eating have been developed for females, lower levels of disordered-eating

reported among males compared to females, may be reflective of instrument development. Considering the lack of studies investigating disordered-eating attitudes not only among males, but also among military dependents of both sexes, understanding similarities and differences in presentation by sex warrants investigation.

We therefore examined disordered-eating attitudes and associated psychosocial characteristics, including depressive symptoms and difficulties with self-esteem and social functioning, that have been linked to eating disorders²⁶⁻²⁸ and obesity²⁹⁻³¹ in a sample of male and female adolescent military dependents at high-risk for both outcomes. We hypothesized that despite common stressors in male and female adolescent military dependents, similar to the civilian population,³²⁻³⁴ girls would present with higher disordered-eating attitudes and associated distress than their male counterparts.

2. Material and methods

2.1. Participants

One-hundred-twenty-five male and female adolescent military dependents were studied. All were eligible for the Military Health System (TRICARE) due to a parent's current or prior service, at high-risk for both eating disorders and adult obesity and were studied at a baseline visit prior to entry or randomization in an eating disorder and excess weight gain prevention trial ([ClinicalTrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT02671292) ID#: NCT02671292). Potential participants were identified as high-risk based on a body mass index (BMI, kg/m²) 85th percentile³⁵ and the endorsement of at least one episode of loss-of-control eating³⁶ and/or elevated anxiety (≥ 32 on the State-Trait Anxiety Inventory for Children).³⁷ Interested participants were screened over the phone to determine initial eligibility.

Recruitment efforts included referrals from physicians, flyer postings at various military hospitals and base facilities, local email listservs, online advertisements, base or local periodicals, in-person recruitment with kiosks/tables, and mailings to TRICARE-eligible families.

Due to the impact on eating and weight outcomes of the intervention trial, individuals were excluded if they had a chronic major medical illness, obesity-related medical complication, major psychiatric disorder (other than binge-eating disorder) that required treatment, weight loss during the past 3 months that exceeded 3% of body weight, or current use or recent discontinuation (within 3 months) of a medication that affected body weight or appetite. Youth taking medications (e.g., selective serotonin reuptake inhibitors (SSRIs), stimulants) were considered for inclusion if their dosage and weight had been stable for 3 months. Girls taking oral contraceptives were eligible if they had been taking the medication for at least 2 months and were weight stable. Adolescents were not included if they were involved in current psychotherapy or a structured weight loss program. Girls were excluded if breastfeeding or if currently or recently pregnant. Participants were compensated for their time and completion of study procedures. This study received approval from the Uniformed Services University of the Health Sciences and Fort Belvoir Community Hospital Institutional Review Boards.

2.2. Procedures

A baseline screening appointment was completed at either the Uniformed Services University of the Health Sciences/Walter Reed National Military Medical Center or Fort Belvoir Community Hospital, which are both located in the greater Washington DC metropolitan area. Written informed consent and assent for parents and adolescents, respectively, were obtained prior to initiation of study procedures. Adolescents underwent the following assessments:

2.2.1. Body Mass Index (BMI kg/m²)—Participants' height (cm) and fasting weight (kg) were measured to calculate BMI. BMI-z score, accounting for age and sex, was calculated based on the Centers for Disease Control and Prevention standards of growth.³⁸

2.2.2. Disordered-eating—The Eating Disorder Examination version 14,³⁹ a semi-structured interview, was administered by trained research coordinators and graduate students to assess the presence of loss-of-control eating episodes in the past 3 months and disordered-eating attitudes. Disordered-eating attitudes were determined by the global score. Loss-of-control eating status was quantified by the presence of at least one episode in the past 3 months. Loss-of-control eating was considered as a covariate and the disordered-eating global score served as a dependent variable. The Eating Disorder Examination has shown good reliability and validity among youth.^{40,41} Cronbach's alphas were: total sample (0.87), girls (.88), and boys (.86). Interrater reliability, assessed with ten (8%) randomly selected interviews revealed a Cohen's kappa (for presence vs. absence of loss-of-control eating) of 1.00 ($p < .01$).

2.2.3. Psychological Functioning

2.2.3.1. Anxiety: The State-Trait Anxiety Inventory for Children – A Trait Scale, a 20-item self-report scale, was used to determine anxiety symptoms.⁴² Scores range from 20-60, with higher scores indicating increased anxiety. Based on prior research,⁴³ a score of 32 was used to determine elevated anxiety symptoms. This scale has shown good reliability and validity among adolescents.⁴⁴ Cronbach's alphas were: total sample (0.77), girls (.81), and boys (.66).

2.2.3.2. Self-Esteem: The Rosenberg Self-Esteem Scale,⁴⁵ a 10-item self-report scale, was used to measure participants' self-esteem. Items are scored on a 4-point Likert-scale ranging from strongly agree [1] to strongly disagree [4], with lower scores indicating lower self-esteem. Scores range from 10-40. This scale has demonstrated strong reliability and validity.⁴⁶ Cronbach's alphas were: total sample (0.90), girls (.91), and boys (.86).

2.2.3.3. Social Adjustment: The Social Adjustment Scale–Self Report,⁴⁷ a 23-item scale, was utilized to assess social functioning in the following domains: school, friends, family, and dating, over the past two weeks. In line with prior studies,^{43,48} the dating subscale was excluded and a total score was used. Subscales range from 1-5, and higher scores reflected more social difficulties. This questionnaire has demonstrated good reliability and validity.⁴⁹ Cronbach's alphas were: total sample (0.83), girls (.78), and boys (.86).

2.2.3.4. Depressive Symptoms: The Beck Depression Inventory-II,⁵⁰ a 21-item self-report scale, was administered to assess depressive symptoms in the past 2 weeks. Scores range from 0-63, and higher scores indicated greater depressive symptoms. This measure has shown strong reliability and validity.⁵¹ Cronbach's alphas were: total sample (0.85), girls (.86), and boys (.79).

2.3. Statistical Analysis

All analyses were completed with IBM SPSS Statistics 24.⁵² Data were screened for outliers and normality. As less than 10% of data were missing for any variable, and data were found to be missing completely at random, missing data were handled using case-wise deletion. Group differences were measured using analyses of covariance (ANCOVAs). Disordered-eating attitudes, self-esteem, social functioning, and depressive symptoms (average score) were compared by sex. Age, race (Non-White vs. White), ethnicity (Non-Hispanic vs. Hispanic), BMI-z score, loss-of-control eating presence, and anxiety were considered as covariates. For the four dependent variables, estimated marginal means and standard errors are provided. Differences were considered significant when p -values were ≤ 0.05 , and all tests were two-tailed.

3. Results

Girls and boys did not differ significantly in race, ethnicity, BMI-z score, or loss-of-control eating presence. However, girls were significantly older and reported higher anxiety symptoms than boys. Therefore, only age and anxiety were included as covariates in all ANCOVA models. Descriptive characteristics are included in Table 1.

Adjusting for age and anxiety, girls and boys did not differ significantly on the Eating Disorder Examination global score, self-esteem, or social functioning (see Table 2). By contrast, girls reported significantly higher depressive symptoms than boys, such that 5.6% of the variance in depressive symptoms was attributable to sex.

4. Discussion

This study examined sex differences in disordered-eating attitudes and related psychosocial factors in adolescent military dependents at high-risk for eating disorders, particularly binge-eating disorder, and obesity. Male and female adolescent military dependents reported comparable levels of disordered-eating, similar to adults with binge-eating disorder and overweight or obesity,¹⁷⁻¹⁹ and there were no significant sex differences in social functioning and self-esteem. Girls, however, reported significantly higher levels of depression, even after accounting for anxiety.

Our finding of similar disordered-eating attitudes among girls and boys is consistent with some,^{24,25} but not all,²³ samples of adolescent civilians. It is possible that unique military stressors, including exposure to their parents' attitudes and behaviors in response to weight and shape requirements and other factors associated with their parents' careers, may impact boys and girls equivalently. Given that males typically report lower disordered-eating than females,^{14,15} our findings may suggest that the males in our sample may be at higher risk for

elevated disordered-eating attitudes in comparison to civilian boys. It should be underscored that while Eating Disorder Examination global scores were comparable to male and female youth with overweight or obesity who have experienced loss-of-control eating,⁵³ they were below those of adults with eating disorders.⁵⁴ This finding could be due to sample inclusion characteristics; youth were eligible due to reports of loss-of-control eating and/or elevated anxiety. Future research is required to elucidate whether boys and girls who are military dependents are at equal risk for exacerbated disordered-eating and increased weight trajectories.

The distinction of higher depressive symptoms among female military dependents may be explained by normative sex differences that occur during puberty. Among civilian samples, adolescent girls consistently report higher levels of depressive symptoms compared with boys.³² Hormonal differences between adolescent males and females that are linked to higher depression in girls⁵⁵ may be more potent than cultural factors associated with being a military dependent at high-risk for eating and weight disorders. Furthermore, beginning at an early age, girls are socialized to experience, and likely report, more internalizing behaviors that are consistent with symptoms of depression.^{56,57} Interestingly, while similarities for social functioning between females and males in our sample are consistent with civilian youth,⁵⁸ civilian adolescent boys generally report higher self-esteem compared to girls.³³ Compared to published norms of healthy youth,³³ boys in our sample reported slightly lower levels of self-esteem and girls reported somewhat higher scores. As there are no data examining sex differences in self-esteem among civilian youth at high-risk for disordered-eating and obesity, future study is needed to determine if this finding is specific to adolescent military dependents.

Study strengths include the use of measured height and weight, a relatively large and racially diverse sample of understudied military dependent girls and boys, and the use of a structured interview to assess disordered-eating attitudes. Given that our study examined sex differences in disordered-eating attitudes, it would have been beneficial to utilize a measure that was not primarily designed for females. However, the global Eating Disorder Examination score alpha for boys was comparable to girls, suggesting that the measure had good internal consistency for both sexes. Further, since loss-of-control eating was used as one inclusion criteria, this may have influenced the lack of sex differences in disordered-eating attitudes reported in our sample. Our sample was comprised of adolescent military dependents studied prior to an eating disorders and adult obesity prevention trial that involved exclusionary criteria that could influence intervention outcomes, thus, limiting generalizability of findings. Other limitations include the use of self-report measures of psychosocial variables and the lack of a healthy military dependent control group or a matched civilian adolescent sample. Future research should include these groups.

5. Conclusions

Both male and female adolescent military dependents at high-risk for eating disorders and adult obesity may present with similar levels of disordered-eating attitudes and associated psychosocial factors. Future studies should expand on these findings to discern military-

specific factors that contribute to eating pathology and associated distress. Further, prospective data are needed to inform early intervention efforts.

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Highlights:

- Adolescent military dependents at high risk for adult obesity and eating disorders report similar levels of disordered eating attitudes.
- Adolescent dependents at high risk for adult obesity and eating disorders report similar levels of social adjustment and self-esteem.
- Female adolescent military dependents report higher symptoms of depression compared to their male counterparts.

Table 1

Sample Characteristics by Sex

	Total (N = 125)	Girls (n = 69)	Boys (n = 56)	p
[†] Age, y	14.46 (1.55)	14.77 (1.56)	14.07 (1.46)	.01
Race, %				.997
White	56.1	57.1	54.9	
Black	24.6	23.8	25.5	
More than one race	12.3	12.7	11.8	
Asian	3.5	3.2	3.9	
Other	3.5	3.2	3.9	
Ethnicity, %				.55
Hispanic	19.1	17.2	21.6	
BMI-z	1.98 (0.43)	2.00 (0.39)	1.96 (0.48)	.66
Anxiety Symptoms	38.61 (5.92)	39.71 (6.31)	37.29 (5.15)	.023
Entry criteria presence, %				.366
Anxiety (only)	41.9	42.5	37.9	.083
Loss-of-control eating (only)	6.5	4.1	10.3	.157
Anxiety and loss-of-control eating	51.6	53.4	51.7	.442

Note. BMIz = Body mass index z-score;

[†]Mean (Standard Deviation); p-value represents sex comparison. P values are reflective of sex comparisons based on t-tests for continuous variables and Fisher's Exact tests for categorical variables.

Table 2

Eating and General Psychopathology by Sex

[†] Dependent Variable	<i>N</i>	Females (<i>M</i> , <i>SE</i>)	Males (<i>M</i> , <i>SE</i>)	F	<i>df</i>	<i>p</i>	η_p^2
Disordered-Eating	124	1.32 (0.10)	1.18 (0.11)	0.79	1, 120	.38	.007
Self-Esteem	113	28.41 (0.70)	29.70 (0.79)	1.43	1, 109	.23	.013
Social Functioning	113	2.08 (0.06)	1.97 (0.07)	1.72	1, 109	.19	.015
Depression ^{††}	124	0.69 (0.04)	0.49 (0.04)	10.89	1, 120	.001	.083

Note. Adjusted for age and anxiety;

[†]Estimated Marginal Means (Standard Errors);

^{††}Average score