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Prospective Associations between Driven Exercise and other Eating Disorder Behaviors in Adolescence: A Longitudinal Cohort Study

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Abstract

Purpose: Dysfunctional exercise is a common, debilitating symptom across eating disorders (ED). We examined the cross-sectional and longitudinal associations between experiences of exercise and ED behaviors and cognitions in an adolescent, population-based sample.

Methods: Adolescents (n = 4,054) self-reported whether they exercised to control shape and weight (exercise for weight loss; EWL), and, if so, whether they exercised even when or injured, and whether exercise interfered with life functioning (driven exercise) at age 14 years, allowing delineation of three exercise-based groups: No-EWL, EWL, and driven exercise. Participants also reported ED cognitions at age 14 years along with other ED behaviors (fasting, purging, binge eating) at ages 14 and 16 years. Sex-stratified regression approaches were employed to examine relationships between these exercise categories at age 14 and ED behaviors and cognitions at ages 14 and 16.

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Conflicts of Interest

The authors have no conflicts to declare

Results: Cross-sectionally, those in the driven exercise group, as compared to the no-EWL group, consistently reported higher levels of ED cognitions and behaviors, with those in the EWL group also reporting higher levels of some ED cognitions and behaviors relative to the no-EWL group. Those in the EWL and driven exercise groups at age 14 also demonstrated a higher prospective likelihood of fasting (boys and girls) and purging (girls only) at age 16, relative to those in the no-EWL group at age 14.

Conclusions: Results inform our understanding of EWL and driven exercise and the developmental timing of ED behaviors in adolescence and point towards the potential utility of targeted prevention for young people who report EWL.

Keywords

Eating Disorders; Driven Exercise; Epidemiology; ALSPAC

Eating disorders (EDs) are severe psychiatric disorders characterized by abnormal patterns of eating, often accompanied by a distorted body image and, in many cases, unusual patterns of exercise and maladaptive exercise-related cognitions. [1], EDs are associated with both high morbidity and mortality [2, 3]; and EDs for which dysfunctional exercise patterns are a common feature are known to most commonly onset in adolescence (i.e. between 15–19 years old) [4, 5]. Exercise that is driven and/or compulsive with intention to manage weight and shape (driven exercise) is common across many eating disorder presentations (e.g. up to 40% of individuals with bulimia nervosa and 80% of those with anorexia nervosa) [6–8]. Recent definitions of dysfunctional exercise in EDs include psychological components such as feeling ‘driven’ to preform exercise, having exercise obsessions, and using exercise to reduce distress (e.g. guilt, anxiety) or prevent negative consequences (e.g. weight gain) as well as significant burden resulting in functional impairment (e.g. time-consuming, interference with occupational or social functioning, risk for injury) [9, 10]. While researchers agree that dysfunctional exercise is unhealthy [11, 12] there remains ambiguity regarding which specific aspects of exercise impact onset and exacerbation of eating pathology.

Dysfunctional exercise demonstrates consistent associations with ED behaviors and cognitions in both adults [13] and adolescents [14]. Women with EDs who report higher levels of dysfunctional exercise have been found to exhibit greater weight concern [7], greater weight preoccupation [15] and exhibit greater distress in response to weight gain [6] as compared to women with EDs who report lower levels of dysfunctional exercise. Furthermore those with AN who exhibit dysfunctional exercise demonstrate hospitalization at a higher percent expected body weight [16] and shorter time to relapse[17] as compared to those who do not exhibit dysfunctional exercise, and frequency of dysfunctional exercise has demonstrated association with ED severity in treatment seeking youth [18]. Research demonstrating associations between dysfunctional exercise and ED risk also extends to community samples. For example, one study of adult, female exercisers in the community found that both exercising for shape/weight concern and feelings of guilt upon postponement of exercise were associated with elevated levels of ED psychopathology and a reduced quality of life [19]. Limited research has examined the presence of dysfunctional exercise and its associations with ED psychopathology in adolescent populations, though existing

research suggests that this eating disorder feature is present at relatively high rates in adolescence. For example in the Avon Study of Longitudinal Parents and Children (ALSPAC), a longitudinal population-based cohort that is also the population under investigation in the current study, 3.8% of girls and 4.8% of boys demonstrated exercise for the purpose of weight loss at age 13 years, per parent report [20]. In another community sample of adolescents, 5.5% of girls and 5.4% of boys were classified as exercise dependent, with over 15% of adolescents classified as 'at risk' for exercise dependence [21], with changes in depression, positive affect, body dissatisfaction, and body image importance predicting increases in exercise dependence over time[22]. Further, over 25% of adolescents in a diverse, population-based cohort in the United States reported exercise for weight loss [23]. In the current study, examination of cross-sectional associations between exercise and ED psychopathology will contribute to an understanding of which exercise characteristics may mark concurrent disordered eating cognitions and behaviors in adolescence, while examination of longitudinal associations will aid in identifying which characteristics of exercise are relevant to future risk.

The specific aims of this study are as follows:

1. To determine the prevalence of exercise for weight loss (EWL) with and without psychological drive to exercise (driven exercise) in a population-based sample of adolescents from the Bristol Avon Longitudinal Study of Parents and Children (ALSPAC)
2. To investigate, using regression-based approaches, whether those reporting EWL or driven exercise, as compared to those who do not report EWL, also present with higher levels of ED behaviors and cognitions at 14 years.
3. To investigate, using regression-based approaches, whether those reporting EWL or driven exercise at age 14, as compared to those who do not report EWL at 14 years, demonstrate increased risk for ED behaviors at 16 years of age.

Methods

Study Overview

The Avon Longitudinal Study of Children and Parents (ALSPAC) [24, 25] was established to understand how genetic and environmental characteristics influence health and development in parents and children. All pregnant women living in the geographical area of Avon, UK, who were expected to deliver between April 1, 1991, and December 31, 1992, were invited to participate in the study. Children from 14,541 pregnancies were enrolled; 13,988 children were alive at 1 year. An additional 913 children were enrolled during subsequent phases of enrollment, with a total sample size alive at 1-year of 14,901. All women gave informed and written consent. Among twin pairs, 1 twin per pair was randomly excluded from the current study. We included youth based on participation to 2 waves of data collection: at child age 14 years (Wave 14+) and 16 years (Wave 16+). At Wave 14+ 10,581 and at Wave 16+ 9,702 adolescents were eligible for follow-up (i.e., had not withdrawn consent and were contactable for data collection when questionnaires were sent out) and

were sent questionnaires; of these, 6,140 (58%) and 5,069 (52%), respectively, completed questionnaires.

A fully searchable ALSPAC data dictionary is available (http://www.bris.ac.uk/alspac/researchers/data-access/data-dictionary/).

Predictor: Exercise-related Cognitions and Behaviors

EWL and driven exercise were assessed at age 14 using several questions adapted from the Youth Risk Behavior Surveillance System questionnaire[26] with additional questions derived specifically for this study. Adolescents were first asked how often they exercised in the previous year. Participants who reported exercising were asked: a) if they exercised to lose weight or avoid gaining weight, b) if they exercised even when sick or injured, and c) if it was 'hard to do schoolwork or work because of the amount of exercise performed'. From these questions we generated a variable with three categories. Participants who responded that they did not perform any exercise along with those who reported regular exercise without intention to lose or avoid gaining weight were placed in the no exercise for weight loss ('no-EWL') category. Participants who reported only exercising to lose weight or avoid gaining weight were categorized as exercising for weight loss ('EWL'). To capture the psychological dimension of driven exercise [27], participants who responded engaging in exercise for the purpose of weight loss and exercising even when sick/injured or that their school or work performance was affected by the amount of exercise they engaged in were categorized as 'driven exercise'.

Outcomes

ED Behaviors—Data on ED behaviors were collected using questions adapted from the Youth Risk Behavior Surveillance System questionnaire [28], validated in adolescents from community samples [29] enquiring about the previous year. ED behaviors were dichotomized as present or absent in the past year. Binge eating was assessed as present among adolescents who reported eating a very large amount of food at least once a week ("During the past year, how often did you go on an eating binge?") and feeling out of control during these episodes ("Did you feel out of control, like you couldn't stop eating even if you wanted to stop?"). Purging was assessed by asking how often in the past year the adolescent made himself or herself sick ("During the past year, how often did you throw up to lose or avoid gaining weight?") or used laxatives ("During the past year, how often did you use laxatives to lose or avoid gaining weight?") to lose weight or avoid gaining weight, and was defined as present if the adolescent reported these behaviors, on average, at least monthly in the past year. Both questions have been validated in an adolescent population-based sample [30]. Fasting was assessed with 1 question: "During the past year, how often did you fast (not eat for at least a day) to lose weight or avoid gaining weight?". Again, fasting was considered 'present' at a level of at least once per month.

ED Cognitions at age 14—*Body dissatisfaction* was assessed using the Body Dissatisfaction Scale [31]; this scale asks individuals to rate their satisfaction with nine body parts on a Likert scale, from 'extremely satisfied' to 'extremely dissatisfied'. Questions were slightly adapted in the female questionnaire version ('body build' in the male version

was replaced by 'breasts') following feedback from the ALSPAC teenage advisory panel. A continuous score was derived, with higher values indicating higher dissatisfaction. *Thin idealization* was assessed using the Ideal-Body Stereotype Scale-Revised [32]; questions were scored on a Likert scale from "strongly agree to "strongly disagree". Questions were gender-specific, girls were asked 5 questions and boys 6 questions [33]. *Pressure to lose weight* was assessed using an adapted version of the Perceived Sociocultural Pressure Scale [34]. Participants were asked to rate the statements: 'I have felt pressure to lose weight: (a) from my friends, (b) from my family, (c) from the boys/girls I have gone out with, and (d) from the media (e.g. TV, magazines)' on a four-point Likert scale (from 'not at all' to 'a lot'). Finally, *Pressure to increase muscle* was assessed in males only using an adapted version of the Perceived Sociocultural Pressure Scale [34]. Participants were asked to rate the statements: 'I have felt pressure to increase muscle: (a) from my friends, (b) from my family, (c) from the boys/girls I have gone out with, and (d) from the media (e.g. TV, magazines)' on a four-point Likert scale (from 'not at all' to 'a lot').

Covariates—Maternal education (as a proxy for family SES) and ethnicity were collected at enrollment and were included as *a priori confounders* in all regression models, as exercise behaviors and eating disorder risk both demonstrate some differences across SES and ethnicity [35–37]. Body mass Index (BMI) was included as an additional covariate in fully adjusted models based on the hypothesis that BMI may directly influence both exercise and ED behaviors. Gender and age-adjusted BMI z-scores at age 14 years were obtained from a combination of objective BMI collected at a face-to-face assessment at mean age 13.7 years (available for 4,602 adolescents) and self-reported BMI at 14 years (available for 3,305 adolescents) (see [38] for details); the correlation of self-reported and objective BMI was 0.89. BMI was categorized by weight status ('underweight', 'normal weight', and 'overweight/obese'), which was determined using age, gender and BMI-specific cutoffs (based on UK reference data)[39] corresponding to World Health Organization (WHO) grade 1 thinness [40]; overweight and obese categories were obtained using age- and gender-adjusted cut offs for adolescents (from the *International Obesity Task Force*)[41].

Statistical Analyses—Data were analyzed using STATA 15 [42]. Frequencies and/or means were employed to provide descriptive statistics with respect to socio-demographic characteristics. Regression analyses were employed to determine the association between exercise-based group membership at age 14 years as the independent variable and eating disorder cognitions and behaviors at ages 14 and 16 years as dependent variables, completing separate regression models for each dependent variable. Exercise categories were dummy coded in analyses, with the no-EWL group entered as the reference category. Coefficients for the EWL and driven exercise predictors in these models represent relative odds ratios and regression coefficients for these groups in comparison to the no-EWL group. Odds ratios are interpreted as the relative odds of engaging in a specific behavior relative to the no-EWL group. That is, an odds ratio of 2 indicates that individuals in the identified group are twice as likely to report the specified ED behavior, as compared to those in the no-EWL group. Models for ED cognitions (evaluated continuously) were estimated using linear regression, and models ED behaviors (evaluated dichotomously) were estimated using logistic regression. Analyses were carried out for the complete sample and also stratified

by sex, with sex-stratified analyses presented in primary analyses. Age 14 analysis were adjusted for body mass index, ethnicity and maternal education. Age 16 analyses were adjusted for body mass index, ethnicity, maternal education, and eating disorder behaviors at 14 years. A two-sided value of $p<0.05$ or less was deemed significant. In addition, we will interpret the clinical significance of statistically significant ORs by evaluating the degree to which they deviate 1. ORs for eating disorder behaviors less than 0.8 and greater than 1.2 represent a 20% decreased or increased risk of eating disorder behaviors based on exercise group and, if also statistically significant, are deemed clinically relevant.

Attrition and Missing Data—The final sample for the study included N=5,761 individuals at 14 years, and N=4,054 at 16 years. Attrition and drop out from the study between the ages of 14 and 16 years was significantly negatively predicted by the presence of purging and fasting at 14 years (purging: OR: 0.56; fasting: OR: 0.34, both $p<0.001$), but not associated with ethnicity, maternal education or parity.

Multiple random imputation was performed in STATA 15 to account for missing data on sociodemographic variables, including child ethnicity (11.0% missing), maternal education (10.9% missing) and maternal parity (10.6% missing). These binary variables were imputed using a logistic regression imputation method. All predictor and outcome variables were used in the imputation model, which was set for 10 imputations. Analyses were run on complete case and imputed datasets, and a comparison of results showed that differences were negligible. Only results based on imputed datasets are presented here as complete case analysis is thought to suffer from more chance variation, and multiple random imputation is assumed to correct any bias. The rules of Rubin et al. [43] were used to combine the estimates to obtain valid overall estimates.

Ethical Approval—Ethical approval for this study was granted by the ALSPAC Law and Ethics Committee and Local Ethics Committees.

Results

Baseline data at 14 years were available for 3,404 girls and 2,706 boys in this study, sociodemographic variables for this sample are summarized in Table 1. Of those children who responded to questions on driven exercise at age 14, 4,054 (66.35%) were followed up at 16 years and responded to questions about ED behaviors. Those who responded did not differ from those who did not respond on level of EWL and driven exercise at age 14. The prevalence of both exercise for weight loss and driven exercise reported at 14 years in this sample was higher in girls than boys, respectively 33.02% and 18.12% in girls, and 10.77% and 7.01% in boys (Table 1). Within no-EWL group, the vast majority reported engaging in regular exercise – 96% of this sample reported exercising at least 1–3 times per week; 2.3% of this sample reported no regular exercise.

Dysregulated Exercise: Cross-Sectional associations with ED behaviors and cognitions at age 14 years

ED behaviors—Associations of ED pathology and concurrent EWL and driven exercise at age 14, adjusted for body mass index (BMI) and sociodemographic variables are presented

in Table 3. Analyses controlling for sociodemographic variables only are presented in Supplemental Table 1.

In fully-adjusted analyses amongst girls, EWL and driven exercise groups both demonstrated increased odds of purging, binge eating and fasting relative to the no-EWL group at age 14. Odds ratios were consistently highest for the driven exercise group (Table 3). Amongst boys, those reporting EWL at age 14 also reported increased odds of concurrent fasting, but not binge eating or purging, when compared to boys who did not report EWL. In contrast, boys reporting driven exercise at age 14 demonstrated higher odds of all three ED behaviors (purging, binge eating, fasting) relative to boys who reported no EWL at age 14. Again, relative odds of ED behaviors were highest for driven exercise group.

ED cognitions—In fully adjusted cross-sectional analysis of both boys and girls at age 14 years, both the EWL and driven exercise groups reported higher levels of ED cognitions (thin-ideal internalization, body dissatisfaction, pressure to lose weight, pressure to gain muscle in boys) as compared to those who did not report EWL at age 14. Effect sizes were consistently higher for the driven exercise group relative to the EWL group across genders.

Excessive Exercise at 14 years: prospective associations with ED behaviors at 16 years of age

Prospective associations between exercise groups at age 14 and ED behaviors at age 16, adjusted for body mass index (BMI), sociodemographic variables, and ED behaviors at age 14 are presented in Table 3. Minimally adjusted analyses (adjusted only for sociodemographic variables) are presented in Supplemental table 1.

ED Behaviors—Girls in the EWL group at age 14 reported higher odds of engaging in multiple ED behaviors at age 16, including fasting, binge eating, and purging, relative to girls in the no-EWL group at age 14. In fully-adjusted analyses, boys in the EWL group at age 14 reported higher odds of fasting, but not binge eating or purging, at age 16. Girls reporting driven exercise at age 14 demonstrated greater odds of both fasting and purging at age 16 relative to girls in the no-EWL group at age 14, and boys reporting driven exercise at age 14 reported greater odds of fasting at age 16, again relative to boys in the no-EWL group at age 14.

Discussion

This study aimed to investigate the cross-sectional associations between EWL, driven exercise, and eating disorder cognitions and behaviors at 14 years, and to also understand the longitudinal associations between EWL and driven exercise at age 14 years with ED behaviors at 16 years. Specifically, we aimed to disentangle effects of EWL with and without psychological drive to exercise as it relates to ED psychopathology in youth. By creating distinct groups of those who reported EWL with and without psychological drive to exercise, we were able to determine whether EWL alone was associated with increased ED risk, or whether such associations were present only when EWL was paired with a drive to exercise that manifested in experiencing difficulties completing work or school assignments because of exercise or exercising when sick or injured.

Driven exercise in the previous year was more common in girls (10.7%) as compared to boys (7.1%) at age 14 in this population-based sample of adolescents, similar to rates reported in the past 3 months among 13-year old youth in this sample [20]. Additionally, driven exercise was both cross-sectionally and longitudinally predictive of ED behaviors in this sample. In addition to evaluating the relationship between driven exercise and eating pathology, we also examined whether those who reported EWL alone also demonstrated increased ED risk. We found that those in the EWL and driven exercise groups at age 14 reported higher levels of ED cognitions at age 14 and behaviors at ages 14 and 16 as compared to those in the no-EWL group. Cross-sectionally at age 14, higher odds of ED behaviors and stronger ED cognitions appearing consistently for the driven exercise relative to the EWL group While ED cognitions and behaviors at age 14 are denoted as 'outcome' variables in our statistical models, the cross-sectional nature of these analyses precludes inferences regarding directionality, and, given that some ED cognitions assessed in this study are established ED risk factors [44], cross-sectional findings are interpreted to reflect the nature of dysfunctional exercise at this age (i.e. exercise for weight loss that interferes with work or school and/or exercise for weight loss when sick or injured could be a specific marker of broader ED psychopathology), but not necessarily the nature of this relationship. Longitudinally, both the driven exercise and EWL groups at age 14 demonstrated similar odds of ED behaviors at age 16, indicating that both groups may be at increased risk for ED psychopathology as development progresses.

This is the first study, to our knowledge, to prospectively investigate associations between EWL, driven exercise, ED behaviors and cognitions in adolescents in the community. These findings are consistent with both adolescent [13] and adult [8] studies supporting associations between driven exercise and ED diagnoses [7, 45–47]. While the percentage of boys reporting ED behaviors in the current study is small, reflecting the lower prevalence of EDs in male adolescents which has been reported in previous studies[48], we found consistent associations between both EWL and driven exercise and likelihood of engaging in ED behaviors across genders.

Strengths of this study include its large sample size, population-based nature, length of follow up and retainment of participants at follow up, and the wide range of outcomes which were collected using structured questionnaires. Furthermore, due to the low prevalence of EDs in adolescent males, few studies to date have investigated the specific predictors of ED behaviors in adolescent males. Limitations of this sample relate to representativeness of the sample recruited in South West England, attrition in the sample over time, along with selective loss of participants of a lower socioeconomic status [49]. Further, our definition of dysfunctional exercise centered on individuals responding that they were exercising to lose weight. Some individuals, particularly boys, may experience dysfunctional exercise that is not tied to weight loss, but rather is associated with drive for weight and/or muscle gain [50], which was not captured in this study.

Conclusion

The current study found that, in a large population-based cohort, EWL and driven exercise are both associated with concurrent and future ED symptoms, with the strongest associations

appearing amongst girls. Findings that cross-sectionally driven exercise demonstrated the strongest relationship to current ED features support the psychological component of drive to exercise may be primary to defining dysfunctional exercise risk. Findings that both EWL and driven exercise were predictive of future ED behaviors highlight that EWL, even in the absence of psychological features, may represent a relevant indicator of ED risk in adolescence. As the field advances in risk detection, assessment of EWL in early adolescence may prove a useful variable in models identifying youth at high risk for development for eating pathology. Given the high prevalence of EWL and driven exercise among adolescents, this study has implications for early identification of behavioral risk factors for EDs. Overall, this study highlights EWL and driven exercise as potential risk factors for the development of ED behaviors in later adolescence or early adulthood. Future research which integrates physical activity monitoring data will supplement the current findings regarding exercise-related cognitions. Findings suggest that monitoring changes in exercise patterns in youth, and specifically screening for EWL and maladaptive exercise-related cognitions, may be relevant for assessment of ED risk.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

BMI	Body Mass Index
DEx	driven exercise
ED	eating disorder
ALSPAC	Avon Longitudinal Study of Parents and Children
EWL	exercise for weight loss

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Implications and Contribution

Overall, this study highlights exercise for weight loss and, even more-so, driven exercise, as a potential risk factor for the development of eating disorder behaviors in later adolescence or early adulthood. Findings suggest that monitoring changes in exercise patterns in youth may be relevant for assessment of eating disorder risk.

Table 1:

The distribution of Sociodemographic and Predictor variables across the boys and girls sample

Sociodemographic Variables		
	Girls	**Boys**
Age at assessment, years		
n	3404	2736
Mean (SD)	14.02 (0.17)	14.05 (0.20)
BMI at 14 years, kg/m ^{2}		
n	2799	2348
Mean (SD)	20.68 (3.47)	19.90 (3.27)
Parental lowest combined social class at enrolment		
n	2703	2236
Manual n (%)	435 (16.09)	302 (13.51)
Non-Manual n (%)	2268 (83.91)	1934 (86.49)
Maternal Parity		
n	3010	2483
Primar n (%)	1418 (47.11)	1198 (48.25)
Multipar n (%)	1,592 (52.89)	1285 (51.75)
Maternal Education		
n	2997	2483
<A Level n (%)	1671 (55.76)	1198 (48.25)
>A Level n (%)	1326 (44.24)	1285 (51.75)
Predictor Variables		
Excessive Exercise		
Level 1: Non-Excessive Exercise for weight loss, n (%)	1098 (33.02)	473 (18.12)
Level 2: Excessive Exercise for weight loss, n (%)	358 (10.77)	183 (7.01)

Table 2:

Distribution of Eating Disorder Behaviors and Eating Disorder Cognitions across the boys and girls ALSPAC sample

Outcome Variables				
Eating Disorder Behaviors				
Age 14			χ^2	
	Girls	**Boys**		
	M (SD)	**M (SD)**		
Any compensatory ED behaviors, n (%)	607 (18.57)	230 (9.01)	106.41	$p< 0.001$
Fasting ever reported, n (%)	350 (10.47)	63 (2.37)	151.92	$p< 0.001$
Binge eating ever reported, n (%)	254 (8.56)	95 (3.89)	48.55	$p< 0.001$
Purging ever reported, n (%)	81 (2.42)	21 (0.79)	23.52	$p< 0.001$
Age 16				
Any compensatory ED behaviors, n (%)	289 (11.45)	38 (2.21)	122.91	$p< 0.001$
Fasting ever reported, n (%)	501 (20)	49 (2.86)	263.95	$p< 0.001$
Binge eating ever reported, n (%)	389 (15.47)	64 (3.73)	146.82	$p< 0.001$
Purging ever reported, n (%)	249 (9.87)	21 (1.22)	128.28	$p< 0.001$
Eating Disorder Cognitions				
Age 14			*F*	
Thin Idealization, M (SD)	14.82 (2.35)	18.46 (3.37)	$F(1, 5759) = 2325.39$	$p< 0.001$
Body Dissatisfaction, M (SD)	24.11 (8.07)	19.96 (7.17)	$F(1, 5101) = 364.38$	$p< 0.001$
Pressure to Lose Weight, M (SD)	1.52 (1.97)	0.64 (1.36)	$F(1, 5976) = 379.87$	$p< 0.001$
Pressure to Increase Muscle, M (SD)		1.10 (1.82)		

χ^2 = Chi Square Results

F = Two-way ANOVA Results.

Table 3:

Associations between eating disorder cognitions (age 14 years) and behaviors (ages 14 and 16 years) and likelihood of engaging in exercise for weight loss with and without driven exercise in the ALSPAC sample (fully adjusted)

	Exercise for Weight Loss				**Driven Exercise**			
	Boys		**Girls**		**Boys**		**Girls**	
Eating Disorder Cognitions Age 14 Years								
	β (95% CI)	***P***	**β (95% CI)**	***P***	**β (95% CI)**	***P***	**β (95% CI)**	***P***
Body dissatisfaction	3.66 (2.39; 4.92)	<0.001	4.94 (4.26; 5.62)	<0.001	3.57 (2.76; 4.39)	<0.001	6.54 (5.01; 7.59)	<0.001
TI internal	0.44 (0.04; 0.84)	0.031	0.51 (0.30; 0.72)	<0.001	1.23 (0.63; 1.83)	<0.001	0.92 (0.59; 1.24)	<0.001
Pressure to lose wt	0.88 (0.74; 1.02)	<0.001	1.31 (1.15; 1.46)	<0.001	1.56 (1.35; 1.77)	<0.001	2.03 (1.79; 2.27)	<0.001
Pressure to inc muscle	0.51 (0.29; 0.71)	<0.001	--	--	1.86 (1.54; 2.18)	<0.001	--	--
Eating Disorder Behaviors Age 14 Years								
	OR (95% CI)	***P***	**OR (95% CI)**	***P***	**OR (95% CI)**	***P***	**OR (95% CI)**	***P***
Purging	4.32 (0.92; 20.19)	0.062	2.32 (1.09; 4.95)	0.029	27.63 (7.06; 108.01)	<0.001	8.58 (4.02; 18.33)	<0.001
Binge Eating	1.79 (0.98; 3.28)	0.060	3.67 (2.47; 5.46)	<0.001	5.93 (3.18; 11.06)	<0.001	5.81 (3.58; 9.48)	<0.001
Fasting	3.47 (1.57; 7.66)	0.002	3.65 (2.53; 5.27)	<0.001	10.38 (4.62; 23.31)	<0.001	11.8 (7.78; 17.54)	<0.001
Eating Disorder Behaviors Age 16 Years								
	OR (95% CI)	***P***	**OR (95% CI)**	***P***	**OR (95% CI)**	***P***	**OR (95% CI)**	***P***
Purging	2.05 (0.58; 7.30)	0.264	2.22 (1.48; 3.31)	<0.001	2.30 (0.40; 12.93)	0.344	2.94 (1.69; 5.14)	<0.001
Binge Eating	1.59 (0.71; 3.56)	0.257	1.66 (1.15; 2.40)	0.006	1.85 (0.67; 5.10)	0.232	1.65 (0.93; 2.92)	0.084
Fasting	4.18 (1.75; 9.99)	0.001	2.08 (1.52; 2.84)	<0.001	4.84 (1.58; 14.87)	0.006	1.84 (2.01; 4.93)	<0.001

Note. TI internal = thin-ideal internalization; Pressure to inc muscle = pressure to increase muscle; Pressure to lose wt = pressure to lose weight; Male Age 14 = 2,549; Female Age 14: 3,212; Female Age 16 N = 2,469; Male age 16 = 1,655. Age 14 analyses adjusted for body mass index, ethnicity, and maternal education; age 16 analyses adjusted for body mass index, ethnicity, maternal education, and eating disorder behaviors at 14 years.