

## Prevalence of Disordered Eating Behaviors and Body Dissatisfaction among Israeli Adolescent Female Aesthetic Athletes

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### Abstract

**Introduction:** Dissatisfaction with body figure and weight are described as risk factors for the development of subclinical and clinical eating disorders. Studies have shown that adolescent athletes have an increased risk of developing an eating disorder pathology compared with non-athlete adolescents. Studies have found a higher prevalence of clinical and subclinical eating pathology among females, and in leanness-dependent sports compared with other sports.

**Objectives:** To investigate the prevalence of disordered eating behaviors and body dissatisfaction among Israeli adolescent female athletes involved in different aesthetic sports compared with non-athlete female adolescent controls.

**Methods:** 176 Israeli female adolescent aesthetic athletes (59 figure skaters, 67 dancers, and 50 gymnasts) and 176 non-athlete female adolescents, completed self-report measures. Self-report assessments included height and weight, menses details, eating disorder pathology, pathological behaviors and perception assessed by the eating disorders inventory (EDI-2), societal and interpersonal aspects of appearance ideals assessed by SATAQ-4, and body perceptions assessed by the Body Esteem Scale (BES).

**Results:** Significant differences were found between athletes and non-athletes in all measures except internalization of media pressures and body esteem attribution subscales. Athletes' scores were more pathologic than non-athletes' scores on all subscales. Odds ratio (OR) for scoring in the most pathologic quartile was significantly higher for athletes compared with non-athletes in all subscales except body esteem attribution.

No significant differences were found between the sport branches in any subscale. OR for scoring in the most pathologic quartile of the EDI-2 interpersonal distrust subscale was significantly lower for gymnasts compared with figure skaters. Gymnasts had a higher OR than figure skaters for scoring in the most pathologic quartile of the SATAQ-4 internalization of thinness subscale.

**Conclusions:** Aesthetic athletes are at a higher risk for developing eating disorders, and have a higher prevalence of disordered eating behaviors and body dissatisfaction compared with non-athlete controls. The sport branches did not differ significantly on these measures.

**Keywords:** Adolescents; Aesthetic Athletes; Body Dissatisfaction; Disordered Eating; Eating Disorders

### Abbreviations

EDI: Eating Disorders Inventory; SATAQ: Sociocultural Attitudes Towards Appearance Questionnaire; BES: Body Esteem Scale; SD: Standard Deviation; OR: Odds Ratio; BMI: Body Mass Index; ANOVA: Analysis of Variance; ANCOVA: Analysis of Covariance; CI: Confidence Interval

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## Introduction

This study is among the first to examine the prevalence of disordered eating and body dissatisfaction in Israeli adolescent aesthetic athletes.

Disordered eating broadly refers to maladaptive eating behaviors and has been conceptualized on a continuum from dieting to clinical eating disorders [1]. Dissatisfaction with body figure and weight are described as risk factors for the development of subclinical and clinical eating disorders [2].

The onset of eating disorders typically occurs during adolescence when changes in body shape affect personal appearance [2]. The typical age of onset is between 14 and 25 years of age, and up to 15% of adolescent females report subclinical eating disorder symptomatology [3]. Studies have shown that adolescent athletes have an increased risk of developing an eating disorder pathology compared with non-athlete adolescents [4]. In a study of 522 Norwegian elite female athletes aged 12 - 35 and 448 age-matched non-athlete controls, 18% of athletes were diagnosed with an eating disorder compared to 5% of non-athletes [5]. Clinical and subclinical eating pathology is more prevalent among females, and in leanness-dependent sports (including aesthetic sports such as figure skating and dance) compared with other sports [6]. In 2015, Thiemann, *et al.* compared German female professional athletes aged 12 to 34 years and 108 age-matched female non-athletes and found rates of eating disorders were 17% in aesthetic sports compared to 2% in ball sports and 2% in non-athletes [7].

Adolescent aesthetic athletes face a dual challenge: trying to control body weight for a lean-build sport while meeting the high energy demands of training [8]. Additionally, recurrent peer, parental, and media messages that equate desirability with thinness play a central role in creating and intensifying the phenomenon of body dissatisfaction [9]. Media coverage of women in sport is rare; however, it is recognized that when sportswomen are portrayed in the media there is often a focus on appearance, rather than performance [3]. It was hypothesized that the inner concern to accomplish success combined with the external pressure imposed by the media, coaches, and public has the potential to drive athletes involved in aesthetic events to practice disordered eating behaviors [10].

Restrictive eating attitudes and inadequate dietary intake may lead to variety of short and long-term consequences, such as altered athletic performance, fatigue, injuries, amenorrhea (or menstrual dysfunction), and eating disorders [8]. Although low body and fat mass are considered advantageous for movement efficacy and artistic expression in aesthetic sports, extremely low levels can negatively influence performance potential and adolescent growth [11].

Few studies have assessed the prevalence of eating disorders in Israel [12]. A study that compared Israeli aesthetic athletes' eating attitudes with those of anorexic women, non-aesthetic athletes, and non-athlete non-anorexic controls found no differences between the aesthetic athletes and the controls on any self-report measure. Despite this, significantly more aesthetic athletes (11.7%) than non-aesthetic athletes (5.8%) and controls (4.4%) had a lifetime diagnosis of eating disorders not otherwise specified [13].

The primary aim of this cross-sectional study was to investigate the prevalence of disordered eating behaviors and body dissatisfaction in Israeli adolescent female athletes involved in different aesthetic sport branches: dance, figure skating, and gymnastics.

We hypothesized that the rates of disordered eating behaviors, body dissatisfaction, primary and secondary amenorrhea, and external effects on body image are higher among adolescent female aesthetic athletes compared with non-athlete female adolescent controls, and are similar to those reported in aesthetic athletes in the western world. We also hypothesized that no significant differences would be found between the different aesthetic sport groups.

## Materials and Methods

### Study design and sample size calculation

This is a cross-sectional study to assess the prevalence of eating disorders and body dissatisfaction among aesthetic athletes in Israel. A power calculation based on the body esteem scale score showed that 137 subjects in each group would be sufficient to show significant differences (10%) between groups ( $p < .05$ ) with 80% power [14].

### Procedures and participant recruitment

The study protocol was approved by the institutional review board of Tel Hai Academic College. Coaches of 176 aesthetic athletes from Israel were approached. The registration number of this study is NCT03211468. To minimize response bias, a link to a computerized questionnaire using Qualtrics online software was provided, after providing explanation about the study purposes and procedures. Prior to participation in the study, written informed consent was obtained from all participants and, where necessary, from their legal guardians. Participation was voluntary and anonymity of results was ensured.

### Participants

The athletes group consisted of 176 Israeli female adolescent aesthetic athletes (59 figure skaters, 67 dancers, and 50 gymnasts of varying levels of competition) recruited via their coaches and the local Facebook channel. Participants aged 9 - 21 ( $M = 14.9$ ,  $SD = 2.4$ ). The control group consisted of 176 non-athlete female adolescents, recruited via their camp counselors, school teachers and local Facebook channels. Participants were aged 9 - 20 ( $M = 15.0$ ,  $SD = 2.9$ ) and did not participate in competitive sports.

### Measures

The following items and scales were included in the present study.

### Participant demographic and anthropometric characteristics

Personal and familial details were obtained from each participant including menses details and current height (in cm) and weight (in kg). BMI was calculated (weight in kg/height in  $m^2$ ), as well as BMI percentiles and Z-scores for participants under the age of 19 (BMI for age, World Health Organization, 2007). Primary amenorrhea was determined in participants over the age of 16 who reported non-occurrence of menses. Secondary amenorrhea was determined in participants who reported absence of menstruation for three or more months. Participants answered questions regarding their history of eating disorder pathology categorized as having (1) no history of eating disorders; (2) a history of disordered eating behaviors but no clinically diagnosed eating disorder; or (3) a previous diagnosis of a clinical eating disorder.

### Disordered eating

To assess current pathological behaviors and perception, the Eating Disorders Inventory-2 (EDI-2) was used. [15]. The EDI-2 consists of 91 items divided to 11 subscales: (1) drive for thinness, (2) bulimia, (3) body dissatisfaction, (4) ineffectiveness, (5) perfectionism, (6) interpersonal distrust, (7) interceptive awareness, (8) maturity fears, (9) asceticism, (10) impulse regulation, and (11) social insecurity [16]. The subscale scores are rated on a 6-grade scale [15]. The subscales demonstrated in our study relatively high levels of internal consistency, indicated by an average Cronbach's alpha value of 0.77.

### Thin-ideal internalization and socio-cultural pressures

The Sociocultural Attitudes Towards Appearance Questionnaire-4 (SATAQ-4) was used to assess internalization of appearance ideals due to societal and interpersonal pressures [17]. It consists of 22 items divided into five subscales: (1) Internalization of thin/low body fat (to what extent a respondent endorses a thin body with low body fat as an ideal). (2) Internalization of muscular/athletic (to what extent a respondent endorses an athletic body with muscles as an ideal). (3) Pressures by family (to what extent a respondent feels pressure from family to obtain a certain appearance). (4) Pressures by peers (to what extent a respondent feels pressure from peers to obtain a certain appearance). (5) Pressures by media (to what extent a respondent feels pressure from the media to obtain a certain appearance) [18]. The mean total and subscale scores are rated on a 6-grade rating scale [17]. In our study, the subscales had high internal consistency, indicated by a total Cronbach's alpha value of 0.94.

### Body dissatisfaction

The Body Esteem Scale (BES) for adolescents and adults [19] was used to assess body perceptions. It consists of 23 items divided into 3 subscales: Appearance (general feelings about appearance), Weight (weight satisfaction), and Attribution (evaluations attributed to others about one's body and appearance). The mean total and subscale scores are rated on a 5-point Likert scale. Higher scores represent higher body esteem [14]. In our study, the subscales had high internal consistency, indicated by a total Cronbach's alpha value of 0.96.

### Data analysis

All analyses were conducted using SPSS 23® (IBM Corp., 2016). Normality distributions and outliers for each outcome variable were examined prior to commencing analysis. Chi-square analyses for categorical variables and independent sample t-tests for continuous variables were conducted to test differences between athletes and controls in the demographic and anthropometric variables. Chi-Square analyses and one-way analyses of variance (ANOVAs) were conducted to detect differences among the dancers, figure skaters, and gymnasts in the demographic, anthropometric, and sport-specific variables.

Univariate ANCOVAs were conducted to test differences between athletes and non-athletes in the continuous outcome variables: disordered eating, thin-ideal internalization and socio-cultural pressures, and body dissatisfaction, with BMI z-scores as a covariate and residence type as a fixed factor. Univariate ANCOVAs were also conducted to test differences in outcome variables between the three athlete groups, with age, BMI Z-scores, weekly training hours, and number of annual competitions as covariates.

Binary logistic regression analyses were conducted for each of the outcome variables, dichotomized to separate the top most pathologic quartile scores from the lower, less pathologic scores, in order to test the association between sports participation (total athletes compared with non-athletes) and type of aesthetic sport (figure skating compared with dancers and gymnasts) and risk of scoring in top quartile. In the body esteem scale, the bottom quartile was defined as the most pathologic, since a higher score is related to more positive body esteem. The variables: age, BMI Z-scores, weekly training hours, and number of annual competitions were included as covariates. The associations derived from the analyses were expressed as odds ratios (ORs), with 95% confidence intervals (95% CIs). An alpha level of  $p < 0.05$  was used.

## Results

### Descriptive statistics

Table 1 displays demographic, anthropometric and sport-specific characteristics of the study sample. Significant differences were found using post hoc Bonferroni between non-athletes and the total athlete sample, and between the sport branches. Fewer non-athletes compared with athletes resided in cities compared with other residence types. Non-athletes also had higher BMI z-scores. Figure skaters were younger than dancers and gymnasts. BMI z-scores of figure skaters and of dancers were greater than those of gymnasts. Figure skaters reported on fewer weekly training hours than dancers and gymnasts. Fewer annual competitions were reported by figure skaters and dancers compared to gymnasts.

	Non- athletes n = 176	Total athletes n = 176	X <sup>2</sup> /T	p	Figure skaters n = 59	Dancers n = 67	Gymnasts n = 50	X <sup>2</sup> /F	p
<b>Age</b>	15.0 (2.9)	14.9 (2.4)	0.55	0.583	13.9 (2.7) <sup>a</sup>	15.1 (1.7) <sup>b</sup>	15.8 (2.5) <sup>b</sup>	7.39	0.001
<b>Country of birth</b>			0.94	0.332				5.85	0.054
Israel	164 (93.2%)	159 (90.3%)			50 (84.7%)	65 (97.0%)	44 (88%)		
Other	12 (6.8%)	17 (9.7%)			9 (15.3%) <sup>a</sup>	2 (3.0%) <sup>b</sup>	6 (12%)		
<b>Residence</b>			24.36	< 0.001				5.16	0.076
City	55 (31.3%)*	101 (57.4%)*			40 (67.8%)	32 (47.8%)	29 (58%)		
Other	121 (68.8%)*	75 (42.6%)*			19 (32.2%)	35 (52.2%)	21 (42%)		
<b>Parental status</b>			2.05	0.359				1.26	0.867
Married	148 (84.1%)	147 (83.5%)			47 (79.7%)	57 (85.1%)	43 (86%)		
Divorced	23 (13.1%)	19 (10.8%)			8 (13.6%)	7 (10.4%)	4 (8%)		
Single	5 (2.8%)	10 (5.7%)			4 (6.8%)	3 (4.5%)	3 (6%)		
<b>Number of siblings</b>			2.73	0.099				2.09	0.339
≤4	163 (92.6%)	170 (96.6%)			58 (98.3%)	63 (94.0%)	49 (98.0%)		
≥5	13 (7.4%)	6 (3.4%)			1 (1.7%)	4 (6.0%)	1 (2.0%)		
<b>Religion</b>			3.87	0.144				2.75	0.600
Religious	2 (1.1%)	8 (4.5%)			2 (3.4%)	5 (7.5%)	1 (2.0%)		
Traditional	33 (18.8%)	29 (16.5%)			10 (16.9%)	11 (17.9%)	7 (14.0%)		
Secular	141 (80.1%)	139 (79%)			47 (79.7%)	50 (74.6%)	42 (84.0%)		
<b>Birth order</b>			0.50	0.779				5.79	0.215
Eldest child	59 (33.5%)	53 (30.1%)			13 (22.0%)	22 (32.8%)	18 (36.0%)		
Youngest child	65 (36.9%)	67 (38.1%)			29 (49.2%)	24 (35.8%)	14 (28.0%)		
Other	52 (29.5%)	56 (31.8%)			17 (28.8%)	21 (31.3%)	18 (36.0%)		
<b>BMI Z-scores</b>	0.1 (0.8)*	-0.4 (0.9)*	5.34	< 0.001	-0.3 (1.0) <sup>ab</sup>	-0.3 (0.8) <sup>a</sup>	-0.7 (0.9) <sup>b</sup>	4.02	0.020
Training (h/week)	-----	9.9 (6.5)	-----	-----	7.1 (4.5) <sup>a</sup>	10.3 (6.1) <sup>b</sup>	12.7 (7.5) <sup>b</sup>	13.1	< 0.001
Annual competitions	-----	5.7 (5.6)	-----	-----	4.8 (4.0) <sup>a</sup>	4.1 (4.6) <sup>a</sup>	8.9 (7.0) <sup>b</sup>	9.07	< 0.001
<b>History of ED symptoms</b>			6.7	0.035				22.08	< 0.001
No history	156 (88.6%)*	138 (78.4%)*			54 (91.5%) <sup>a</sup>	56 (83.6%) <sup>a</sup>	28 (56.0%) <sup>b</sup>		
History of disordered eating	15 (8.5%)*	29 (16.5%)*			3 (5.1%) <sup>a</sup>	8 (11.9%) <sup>a</sup>	18 (36.0%) <sup>b</sup>		
Diagnosed with ED	5 (2.8%)*	9 (5.1%)*			2 (3.4%) <sup>a</sup>	3 (4.5%) <sup>a</sup>	4 (8.0%) <sup>a</sup>		
<b>BMI range</b>								4.366	0.359
Healthy (3%-85%)	148 (85.5%)	156 (89.1%)	11.66	0.003	51 (86.4%)	62 (93.9%)	43 (86.0%)		
Overweight (above 85%)	23 (13.3%)*	9 (5.1%)*			5 (8.5%)	1 (1.5%)	3 (6.0%)		
Underweight (below 3%)	2 (1.2%)*	10 (5.7%)*			3 (5.1%)	3 (4.5%)	4 (8.0%)		
<b>Menstrual Irregularities (over 16)</b>	n = 77	n = 69	14.15	0.001	n = 15	n = 27	n = 27	9.014	0.061
Normal	77 (100%)*	60 (87%)*			14 (93.3%)	24 (88.9%)	22 (81.5%)		
Primary amenorrhea	0 (0.0%)	3 (4.3%)			1 (6.7%)	2 (7.4%)	0 (0.0%)		
Secondary amenorrhea	0 (0.0%)*	6 (8.7%)*			0 (0.0%)	1 (3.7%)	5 (18.5%)		

**Table 1:** Demographic, anthropometric, and sport-specific characteristics of 176 non-athlete controls and 176 aesthetic athletes.

\*: Significant differences between non-athletes and the total athlete sample

a, b: Significant differences between the sport branches

### Differences between athletes and non-athletes in outcome variables

Significant differences in categorical outcome variables between athletes and non-athletes and between the sport branches are displayed in table 1. Overweight was more prominent among non-athletes compared with athletes and underweight was less frequent among non-athletes. All non-athlete participants reported normal menstruation compared with 77% of athletes. Significantly fewer non-athletes compared with athletes reported a history of disordered eating behaviors and clinically diagnosed eating disorders.

Table 2 displays the differences in continuous outcome variables between athletes and non-athletes and between the sport branches. Athletes scored significantly higher than non-athletes on all subscales except internalization of ideal shapes due to media pressure (SATAQ-4) and body esteem attribution. No significant differences were found between the sport branches in any of the EDI subscales.

Outcome variable	Athletes vs non-athletes <sup>1</sup>				Figure skaters/ dancers/ gymnasts <sup>2</sup>		
	df	F	Sig.	Partial $\eta^2$	F	Sig.	Partial $\eta^2$
Drive for thinness	1	35.716	0.000	0.100	1.975	0.142	0.025
Bulimia	1	13.107	0.000	0.039	2.185	0.116	0.028
Body dissatisfaction	1	20.436	0.000	0.060	0.791	0.455	0.010
Ineffectiveness	1	9.962	0.002	0.030	0.250	0.779	0.003
Perfectionism	1	37.533	0.000	0.104	0.396	0.674	0.005
Interpersonal distrust	1	13.911	0.000	0.041	0.485	0.616	0.006
Interceptive awareness	1	24.084	0.000	0.070	0.567	0.569	0.007
Maturity fears	1	15.712	0.000	0.047	3.042	0.051	0.036
Asceticism	1	21.069	0.000	0.061	2.338	0.100	0.030
Impulse regulation	1	12.228	0.001	0.037	0.068	0.934	0.001
Social insecurity	1	21.194	0.000	0.062	0.207	0.813	0.003
SATAQ- total	1	43.387	0.000	0.119	0.037	0.964	0.000
Internalization: thin	1	43.126	0.000	0.118	0.235	0.791	0.003
Internalization: athletic	1	76.428	0.000	0.192	0.433	0.649	0.006
Pressures: family	1	12.638	0.000	0.038	0.085	0.918	0.001
Pressures: peers	1	10.003	0.002	0.030	0.291	0.748	0.004
Pressures: media	1	2.421	0.121	0.007	0.230	0.795	0.003
Body esteem- total	1	21.968	0.000	0.064	0.455	0.635	0.006
Body esteem- appearance	1	16.961	0.000	0.050	0.631	0.533	0.008
Body esteem- weight	1	33.301	0.000	0.094	0.439	0.646	0.006
Body esteem- attribution	1	0.097	0.755	0.000	0.061	0.941	0.001

**Table 2:** Univariate ANCOVAs comparisons for outcome variables between 176 athletes and 176 non-athletes, and between sport branches: figure skaters, dancers, and gymnasts.

1: Covariates: BMI z-scores; fixed factors: residence type.

2: Covariates: age, BMI z-scores, weekly training hours, number of annual competitions

Athletes and non-athletes mean scores and SDs of the Eating Disorders Inventory subscales (EDI-2) are described in table 3, in comparison with data collected in Israel of Jewish-Israeli female adolescents [20], as well as with data collected from patients with eating disorders and normal controls [21]. Athletes in our study scored higher on drive for thinness, bulimia, perfectionism, and maturity fears

subscales, compared with the female adolescents from the former Israeli study; however, they scored lower than patients with eating disorders on all EDI subscales.

	Current study				Latzer, et al. 2007 [20]		Clausen., et al. 2011 [21]			
	Athletes (n = 176)		Non-athletes (n = 176)		Israeli female adolescents (n = 1885)		Eating disorder patients (n = 561)		Normal controls (n = 878)	
	M	SD	M	SD	M	SD	M	SD	M	SD
Drive for thinness	7.11	5.21	3.11	5.21	5.1	5.61	19.29	7.23	7.24	7.07
Bulimia	2.56	3.49	1.33	2.70	1.86	2.9	14.39	9.35	2.54	4.31
Body dissatisfaction	8.37	7.33	4.89	6.95	8.29	7.64	27.89	10.07	15.34	11.27
Ineffectiveness	3.67	4.34	2.24	4.00	3.43	4.33	12.46	5.38	3.99	4.45
Perfectionism	8.50	4.47	5.37	3.51	5.66	3.93	10.82	5.45	5.85	4.90
Interpersonal distrust	3.32	3.39	2.08	2.79	4.03	3.5	9.41	5.56	3.72	4.26
Interceptive awareness	4.39	4.85	2.24	3.88	4.05	4.42	18.74	7.27	5.50	5.92
Maturity fears	7.16	4.12	5.28	3.82	5.9	4.0	10.27	6.64	6.11	4.81
Asceticism	4.08	3.52	2.34	3.14	5.40	3.58	11.87	5.89	4.04	4.27
Impulse regulation	3.15	4.45	1.94	3.68	4.00	4.66	9.08	5.68	3.48	3.95
Social insecurity	2.87	3.68	1.37	2.32	3.11	3.44	10.38	5.73	4.95	4.75

Table 3: Means (M) and standard deviations (SD) of EDI subscale scores in current study compared with relevant literature.

Prediction of highest-quartile scores by aesthetic sport participation

A binary logistic regression model for each subscale, controlling for BMI z-score and residence type, showed that the odds ratio (OR) for scoring in the most pathologic quartile was significantly higher for athletes compared with non-athletes in all subscales except body esteem attribution. Statistically significant ORs ranged from 1.8 (95% CI 1.09 - 3.12, P = 0.023) for the body esteem appearance subscale to 5.6 (95% CI 2.920 - 10.89 P < 0.001) for the SATAQ-4 internalization of thinness subscale.

Prediction of highest-quartile scores by aesthetic sport branch

Table 4 displays the results of the binary logistic regression model for each subscale, controlling for age, BMI Z-scores, weekly training hours, and number of annual competitions, showing a significantly lower OR for scoring in the most pathologic quartile of the EDI-2 interpersonal distrust subscale in gymnasts compared with figure skaters (OR = 0.163, 95% CI 0.043-0.618, P = 0.008). Despite this, gymnasts had a higher OR than figure skaters for scoring in the most pathologic quartile of the internalization of thinness subscale (SATAQ-4) (OR = 3.336, 95% CI 1.152 - 9.659, P = 0.026). In addition, the sport branch variable significantly predicted pathologic scores in the SATAQ-4 subscales internalization of athletic and internalization of family pressures, although no significance was found when comparing the reference category (figure skaters) with the dancers and gymnasts.

Dependent variable	Sport branch	B	SE B	Sig.	OR	95% CI OR
Interpersonal distrust	Figure skaters			0.027		
	Dancers	-0.658	0.465	0.157	0.518	[0.208, 1.289]
	Gymnasts	-1.817	0.681	0.008	0.163	[0.043, 0.618]
Internalization: thin	Figure skaters			0.043		
	Dancers	0.235	0.520	0.652	1.265	[0.456, 3.507]
	Gymnasts	1.205	0.542	0.026	3.336	[1.152, 9.659]
Internalization: athletic	Figure skaters			0.028		
	Dancers	-0.795	0.576	0.167	0.451	[0.146, 1.396]
	Gymnasts	0.665	0.558	0.233	1.944	[0.652, 5.799]
Pressures: family	Figure skaters			0.033		
	Dancers	-0.988	0.507	0.052	0.372	[0.138, 1.007]
	Gymnasts	0.291	0.508	0.567	1.337	[0.494, 3.618]

Table 4: Binary logistic regression: subscale scores for different sport branches.

Figure skaters are the reference category

Controls are: Age, BMI z-score, weekly training hours, annual competitions (omitted from the table)

OR indicates likelihood of score in highest (most pathologic) quartile

Only statistically significant results shown

## Discussion

The main purpose of the present study was to investigate the prevalence of disordered eating behaviors and body dissatisfaction in Israeli adolescent female athletes from different aesthetic sports: dance, figure skating, and gymnastics, in order to identify the most at-risk group. A second aim was to compare athletes to non-athletes and confirm the athletes' higher risk of developing eating disorders.

The overall pattern of results in this study was very consistent, and our findings are similar to previous studies, showing that aesthetic athletes are at a higher risk for developing eating disorders, and have a higher prevalence of disordered eating behaviors and body dissatisfaction compared with non-athlete controls [7,22].

The majority of literature shows that the prevalence of eating disorders and disordered eating is higher in athletes compared to non-athletes (Holm-Denoma, *et al.* 2009). This is in line with our findings, as all EDI-2 subscales and specifically the drive for thinness and bulimia subscales scores were significantly higher in the total athlete group compared with the non-athlete controls.

Despite this, when comparing our results with relevant literature, the athletes in this study scored lower than eating disorder patients [21] on all EDI subscales, and were more similar to the Jewish-Israeli female adolescents' scores, although athletes scored higher on the drive for thinness, bulimia, perfectionism, and maturity fears subscales [12]. The less-than-pathologic scores found in athletes could be due to underreporting of symptoms and perhaps reasons of social desirability. Elite athletes tend to under-report eating disorder symptoms to a higher degree than controls [22], and significant underreporting of eating disorders among athletes has been demonstrated in self-report measures compared with interviews [5]. Self-report instruments and screening tools designed for the general population may not be suitable for athletes [22]. Future studies should include interview-based assessment as well.

There is also evidence suggesting that competing in sports may have potentially prevent the development of eating disorders in girls and young women [2]. The inclusion of retired aesthetic athletes in future studies could shed light on such protective effects by eliminating the confounding factor of current sport participation.

Sociocultural and media-driven emphasis on appearance thinness is known to be a predisposing risk factor for eating disorders among athletes [9]. Aesthetic sports athletes scored significantly higher on several SATAQ-4 scales compared with ball game sport athletes, but not compared with non-athletes [7]. In our study, athletes scored higher on all SATAQ-4 subscales except pressures by media compared with the non-athletes.

Overall, we found a higher prevalence of body dissatisfaction among athletes with lower scores in body esteem and body dissatisfaction (EDI-2) compared with non-athletes. These findings are in line with the presumption that the higher prevalence of disordered eating in athletes, and the alleged presence of body image disturbances in all individuals with eating disorder symptomatology, may lead to a more negative body image among athletes [23].

The increased risk of developing eating disorders in female aesthetic athletes stems from pressure induced by aesthetic demands, maladaptive self-care patterns, and preoccupation with weight and dieting. Although reports of prevention programs for this population are scarce, intervention programs to prevent eating disorders in athletes have yielded promising results. Early intervention is necessary to prevent the physical and psychological consequences related to eating disorders.

Education of athletes, parents, and coaches about unhealthy weight loss behaviors and their negative impact on health and athletic performance is important to prevent adverse health effects [24]. Health care professionals as well as coaches and athletic administrators should aim to educate athletes on how to optimize their energy availability and bone health to prevent injury [25].

The results of this study emphasize the need for prevention and possibly intervention programs for this population in Israel.



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## Conflict of Interest

All the authors declare that they have no competing interests.

The study protocol was approved by the institutional review board of Tel Hai Academic College. The registration number of this study is NCT03211468. Informed consent was obtained in writing from participants and their guardians.

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