DE GRUYTER OPEN

doi 10.1515/sjph-2015-0008 Zdrav Var 2015; 54(1): 58-65

RISK FACTORS FOR EATING DISORDERS AMONG MALE ADOLESCENT ATHLETES

DEJAVNIKI TVEGANJA MOTENJ HRANJENJA MED ŠPORTNIKI V ADOLESCENCI

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Received/Prispelo: Jun 07, 2014
Accepted/Sprejeto: Nov 24, 2014

Original scientific article/Izvirni znanstveni članek
UDC/UDK 613.2:616.89-053.6

ABSTRACT

Objective. Eating disorders (ED) are an important and increasing problem in adolescents. The objective of this study was to examine the risk factors and the prevalence of risk for ED among male adolescent elite athletes and nonathletic controls. Differences between male athletes competing in aerobic, anaerobic and aerobic-anaerobic sports were examined as well.

Methods. This was a cross-sectional epidemiological study. A cross-sectional questionnaire survey and anthropometric measurements were conducted on 351 adolescents (athletes n = 228; controls n = 123). All participants were aged 15-17 at the time of measuring. Risk for ED was determined using a SCOFF questionnaire.

Results. The overall prevalence of the risk for ED in male adolescents was 24.8%, with no significant differences among athletes and controls or different subgroups of athletes (p>0.05), although the highest prevalence (37.2%) was registered in aerobic subgroup of athletes. Higher number of attempts to lose weight was associated with increased risk of ED in each group (athletes and controls). Other predictors referred to lack of breakfast and body composition in aerobic subgroup of athletes and number of meals and training frequency in anaerobic subgroup. The most common reasons for dieting were improvement of sport results (19.6-44.2%) and better self-esteem (41.5%) in athletes and controls respectively.

Conclusions. Participation in the competitive sport itself is not associated with the increased risk for ED. It seems that risk factors for ED for adolescent athletes competing in aerobic and anaerobic sports represent a subject that deserves consideration and further investigation in the future.

Keywords:
metabolic processes, SCOFF questionnaire, diet, breakfasts

IZVLEČEK

***Namen**. Namen raziskave je bil ugotoviti dejavnike tveganja in prevalenco tveganja za motnje hranjenja med športniki adolescenti in kontrolno skupino ter razlike med športniki, ki tekmujejo v aerobnih, anaerobnih in v aerobno-anaerobnih športnih.*

***Metode**. Športniki so bili iz 22 različnih športnih panog (N = 228; kontrola N = 123). Merjenci so bili med meritvami stari od 15 do 17 let. Splošen vprašalnik se je nanašal na pogostost in trajanje treninga, zmanjševanje telesne teže, metode, ki so jih za to uporabljali, in prehranjevalne navade. Za oceno tveganja za nastanek motnje hranjenja je bil uporabljen vprašalnik SCOFF.*

***Rezultati**. Telesna sestava je bila izmerjena z napravo InBody230. Najvišja prevalenca tveganja za motnje hranjenja je bila opažena v aerobni skupini (37,2 %). Najpogostejši vzrok za zmanjševanje telesne teže je bil med športniki izboljšanje tekmovalnega dosežka (19,6 %-44,2 %), v kontrolni skupini pa dvig samopodobe (41,5 %). Dejavniki tveganja za razvoj motenj hranjenja se med skupinami razlikujejo. Najpogostejši je bil* število *poizkusov zmanjšanja telesne teže. V aerobni skupini se je kot najpomembnejši dejavnik pokazal zajtrk (p = 0,028).*

***Zaključek**. Dejavniki za povečano tveganje motenj hranjenja se v aerobni in aerobno-anaerobni skupini nanašajo na prehranjevalne navade, v anaerobni skupini pa na pogostost treninga. Trenerji so še vedno glavni razlog zmanjševanja telesne teže med* športniki *adolescenti.*

Ključne besede:
metabolični procesi, vprašalnik SCOFF, hujšanje, zajtrki

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1 INTRODUCTION

Eating disorders (ED) are serious mental illnesses with increasing incidence (1). These disorders are characterised by a preoccupation with food, body weight and shape that leads to behaviours such as starvation, fasting, binge eating and purging and excessive exercise (2). They are increasingly common conditions among adolescent athletes and their untrained age-matched counterparts. ED in athletes usually occurs during adolescence, which is a critical period for the continuation of their sporting careers (3). Common risk factors for ED among athletes are tendency to improve sports achievement, the specificity of the sport, gender, level of training and eating habits (4–7).

Previous studies (6, 7) have reported that female adolescents are more susceptible for ED, although in recent years there is an increase in ED occurrence among male adolescents as well (1). The prevalence of ED among the adolescent male athlete population is around 15%, while in the control – non-athlete population it is even higher – 17% (8).

The association between the prevalence of ED and different sports and/or levels of training was already addressed in previous studies (5, 7). The range of prevalence in male collegiate athletes, where sports were separated into 8 different subgroups (endurance, aesthetic, ball game, power sports, technical, weight class, antigravitation and motor) is from 1% to 22% (9–11). The prevalence of ED is higher in high trained athletes and sports where weight and body shape are a factor of success (7, 8, 12).

To our knowledge, the literature does not provide a comparison of prevalence of risk and risk factors for ED among different groups of sports based on the dominant metabolic processes in a specific sport (e.g. aerobic, anaerobic and aerobic-anaerobic). In each sport, the specificity of training must conform to the specific demands of competition, therefore grouping sports by dominant metabolic process seems logical as we know that specific body composition is related to the specificity of sport (13).

Gender, eating habits, level of training and specificity of sport are the factors that affect the development of the body and its composition in adolescence (14, 15). However, those same factors are also involved in the etiology of ED (7, 16). Therefore the evaluation of possible differences in those parameters among the subjects with and without the risk for ED is important and may provide new insights into the possible risk factors for ED in the male adolescent population.

The main aim of our study was to evaluate the frequency of risk for ED among adolescent male athletes and age-matched untrained controls and to explore the possible differences in the body composition and risk factors for ED among different sport groups based on dominant metabolic process for specific sport while using an untrained adolescent population as a control.

2 METHODS

2.1 Participants

A total of 187 adolescent male athletes and 123 age and sex matched untrained controls volunteered to participate. The adolescent athletes were enrolled in 22 different sport disciplines (40 sport clubs that were randomly selected from the list of Slovenian National Sport Federation), while controls were randomly selected from 4 different high schools in Slovenia. The main inclusion criteria for both adolescent athletes and untrained controls were (1) a birth date in 1996, 1997 or 1998 (age of 15, 16 or 17 at the time of data collection), (2) at least one year of training in a sports club (for adolescent athletes) and (3) being a 1st, 2nd or 3rd year student at one of the Slovenian high schools (for untrained controls). The average duration of club based sports activity was 4.6 (± 2.4) years in the aerobic group, 8.5 (± 2.9) years in anaerobic and 6.9 (± 3) years in aerobic-anaerobic group. Sample selection was based on the total number of adolescents born in provided years. The sample was calculated using the formula for cross sectional studies (17): considering a total population of 28,229 male individuals, the expected frequency of risk for ED of 20% and variability of 5%, it totalled 246 individuals, with a confidence interval of 95%. The study was approved by the National Medical Ethic Committee (No. 125/06/13). The respondents gave written consent to participate.

2.2 Study design

This was a cross-sectional cohort study. All participants completed a general and SCOFF questionnaire (explained in details below) regarding eating behaviour, training status and weight control methods and risk for ED. Participants were also measured for body composition, body weight, body height and waist to hip ratio (WHR).

2.3 Assessment procedure

2.3.1 Questionnaires

General questionnaire included a battery of assessment questions regarding training and physical activity history (years of club based sport activity, number of trainings per week and duration of one training), nutrition patterns (eating breakfast and number of meals per day), dieting and weight regulation history (use of diuretics, laxatives, vomiting) and a self-esteem question (scale from 1- not satisfied to 5- totally satisfied). A SCOFF questionnaire, which is a specific tool for detecting risk for ED (18), was also administered to the respondents. The SCOFF questionnaire contains five yes/no questions concerning eating habits and attitudes toward a person's weight and body shape. A threshold of 2 positive answers has been proposed to raise a suspicion on an existing ED (19). The SCOFF questionnaire appears highly effective as a screening instrument and has been widely adopted to raise the index of suspicion of an ED (20). Reliability of the Slovenian version of SCOFF questionnaire was proved with cal-

culated Cronbach alpha, which was 0.454. Results were in a line with other known studies (21, 22).

2.3.2 Body composition measurements

Weight and body composition were measured using a portable bioelectrical impedance machine InBody 230 with tetra polar eight point tactile electrodes. It shows the impedance values from the measurements at 2 frequencies (20, 100 kHz) (23). It was already used in previous studies and proved to be an acceptable device to measure body fat mass, percentage of body fat mass and total fat free mass in healthy population (24). Based on the data, we later on calculated the body mass index (BMI). Athletes were measured before training to avoid the possible influence of dehydration and increased body temperature on body composition results.

Height and waist to hip ratio were measured by the WHO STEPwise Approach to Surveillance protocol (STEPS) (25). Percentiles of BMI for age were calculated with the WHO AnthroPlus programme. BMI-for-age less than 5th percentile was taken as a cut-off for identifying thinness or underweight (26).

All the participants were measured by the same experienced examiner. During the measurement, participants were barefoot and with the least possible clothing.

2.4 Statistical analyses

The statistical analyses were carried out using SPSS version 17.0. Results were expressed as mean value with standard deviation (SD) for continuous data and as absolute numbers (N) and percentages (%) for categorical data. Chi square (x^2) test was used to examine categorical frequencies. One-way ANOVA was used to find differences between the groups, with post-hoc Bonferroni correction for multiple comparisons.

Based on the SCOFF questionnaire score, the subjects were divided into two groups: with and without the increased risk for ED, and this variable was used as a split variable when ANOVA was used (e.g. risk vs. no risk). Furthermore, adolescent athletes were classified into three subgroups based on the dominant metabolic processes (27) for given sport discipline (aerobic, anaerobic and aerobic-anaerobic; Table 1).

Table 1. Classification of the 22 different sports into aerobic, anaerobic and aerobic-anaerobic sports.

Aerobic	Anaerobic	Aerobic-anaerobic
Cross-country skiing	Sprint	Middle distance running
Long distance running	High/ long/ triple jump	Football
Rowing	Gymnastics	Basketball
Triathlon	Skiing	Volleyball
Cycling	Ski jumping	Short and middle distance Swimming
Long distance swimming	Judo	Handball
Mountain running		Tennis
		Dancing

A logistic regression analysis was carried out for predicting the likelihood between results of the SCOFF questionnaire as the depended variable and BMI, BFM% (percent of body fat mass), SMM (skeletal muscle mass), FFM (fat free mass), SLM (skeletal lean mass), training history, nutrition patterns, dieting and weight regulation history as independent variables. It was made separately for each group (aerobic, anaerobic, aerobic-anaerobic, control). Initially, only one predictor was used in logistic regression, while later on the combination of three predictors was used to find the perfect match model. The significance level for all tests was set to 0.05.

3 RESULTS

The highest prevalence of risk for ED was noticed in the aerobic group (37.2%) compared with the anaerobic (19.2%) and aerobic-anaerobic (23.9%) groups and controls (23.6%), but the difference between the groups was not significant (p=0.567). The overall prevalence of the risk for ED in our male adolescent sample was 24.8%.

A significantly higher number of controls (10/123) compared with the athletes (1/187) were defined as underweight according to BMI for age percentiles criteria ($\chi^2(2) = 12.507$, $p = 0.0004$; Table 2). No differences in the prevalence of underweight were observed between athletes competing in the aerobic (0%), anaerobic (0%) and aerobic-anaerobic (1.1%) subgroups. When comparing the anthropometric parameters of subjects with and without the risk for ED (based on the SCOFF questionnaire score), within the subgroups of athletes (aerobic, anaerobic, aerobic-anaerobic) and untrained controls, we have found that in anaerobic subgroup of athletes and control group there was no significant difference in any of the anthropometric parameters used ($p > 0.05$ for all instances). However, in other subgroups of athletes (aerobic and aerobic-anaerobic) there were some significant differences between subjects with and without the risk for ED, where subjects with increased risk for ED presented with more height, weight, BMI percentile WHO, BMI and skeletal lean mass (Table 2).

Some eating habits such as the lack of breakfast (p=0.004) and number of meals per day (p=0.009) showed a significantly different distribution between groups. The lack of breakfast was rather common in the aerobic-anaerobic group (46.7%) and controls (45.5%). The cut-off value for normal number of meals per day was 4 and normal eating pattern in regard to this was best observed in the aerobic group where only 7% of subjects had less than 4 meals per day, while among the subjects from the anaerobic, aerobic-anaerobic and control groups, the frequencies of having less than four meals per day were 28.8%, 21.7% and 29.3% respectively.

Self-esteem measured with the five rate scale was significantly different among the groups and was the lowest in the control group, where the percentage of subjects with low

Table 2. Anthropometric and body composition data presented for athletes and controls separated into groups by risk for eating disorders.

Variable	Aerobic N = 43 Risk N = 16	Aerobic N = 43 No risk N = 27	P Value	Anaerobic N = 52 Risk N = 10	Anaerobic N = 52 No risk N = 42	P Value	Aerobic-anaerobic N = 92 Risk N = 22	Aerobic-anaerobic N = 92 No risk N = 70	P Value	Untrained controls N = 123 Risk N = 29	Untrained controls N = 123 No risk N = 94	P Value
Risk for disordered eating (%)*	16 (37.2)			10 (19.2)			22 (23.9)			29 (23.6)		
Age (years), mean (SD)	16.06 (0.2)	15.63 (0.1)	0.100	16.00 (0.3)	15.78 (0.1)	0.418	16.14 (0.2)	15.81 (0.1)	0.125	16.07 (0.2)	16.20 (0.1)	0.461
Height (cm), mean (SD)	180.59 (6.8)	176.02 (5.00)	**0.015****	175.48 (5.2)	174.89 (6.8)	0.801	179.62 (8.5)	178.10 (7.3)	0.415	179.16 (6.4)	177.98 (6.3)	0.381
Weight (kg), mean (SD)	70.85 (9.4)	64.21 (8.6)	**0.023****	70.84 (9.1)	67.03 (9.9)	0.237	73.95 (12.9)	67.76 (9.7)	**0.019****	72.30 (12.1)	68.60 (13.7)	0.193
BMI percentile WHO, mean (SD)	56.43 (25.4)	49.29 (25.7)	0.382	70.44 (24.0)	60.02 (24.1)	0.224	67.66 (22.0)	55.53 (23.9)	**0.038****	63.63 (24.4)	50.81 (32.5)	0.052
WHR, mean (SD)	0.81 (0.03)	0.80 (0.03)	0.360	0.82 (0.03)	0.80 (0.04)	0.123	0.830 (0.06)	0.081 (0.05)	0.223	0.82 (0.05)	0.82 (0.05)	0.634
Skeletal muscle mass (kg),mean (SD)	36.14 (4.9)	32.60 (3.9)	**0.012****	36.04 (3.6)	33.82 (4.3)	0.140	35.97 (5.2)	33.79 (5.3)	0.094	34.31 (4.7)	32.69 (5.3)	0.146
Body fat mass (kg), mean (SD)	7.17 (3.4)	6.46 (3.1)	0.491	7.63 (4.3)	7.30 (4.5)	0.834	10.60 (7.9)	8.04 (4.2)	0.052	11.43 (6.5)	10.51 (6.3)	0.498
Percent Body Fat mass (%), mean (SD)	9.97 (3.9)	9.77 (3.5)	0.870	10.34 (4.7)	10.46 (4.8)	0.942	13.67 (7.4)	11.70 (5.7)	0.193	15.27 (5.8)	14.51 (5.79	0.535
Body mass index (kg/m^2), mean (SD)	21.66 (2.0)	20.72 (2.3)	0.184	23.05 (2.3)	21.86 (2.7)	0.211	22.82 (3.2)	21.28 (2.1)	**0.011****	22.46 (2.9)	21.52 (3.5)	0.193
Skeletal lean mass (kg), mean (SD)	60.04 (7.7)	54.51 (6.1)	**0.013****	59.73 (5.5)	56.4 (6.7)	0.149	59.70 (8.2)	56.36 (8.2)	0.099	57.39 (7.4)	54.77 (8.3)	0.131
BMI underweight; n (%)	0 (0)			0 (0)			1 (1.1)			10 (8.1)		

Underweight; BMI-for-age ≤ 5th percentile
* no significant differences in the distribution among the groups (p = 0.567)
** significant differences between the subjects with and without the risk for ED (p < 0.05)

self-esteem was 10.6%. At the time of entrance to the study, 4-9% of subjects were dieting to lose weight (no difference between groups, p>0.05) but the percentage of those who tried to lose weight more than three times was significantly higher in the anaerobic group (19.2%, p = 0.008) compared to other groups. There was no significant difference in the use of different weight-control methods (Table 3).

Aims of reducing weight were different between groups. In athlete subgroups (aerobic, anaerobic and aerobic-anaerobic), the most common aim was sports achievement, whereas the control group most often reported better self-esteem as the main reason to reduce weight. Although the majority of participants stated that the decision to lose weight was their own decision, it is worth noting that 20.9% of aerobic and 25% of anaerobic athletes reported that dieting was directed by the trainer (Table 4).

In a logistic regression analysis, the lack of breakfast was a significant predictor of higher risk for ED among aerobic group of athletes (p = 0.028). A very important predictor for this sports group was also the number of attempts to lose weight (p = 0.074), while in the aerobic-anaerobic

Table 3. Eating habits, self-esteem and weight control methods among athletes and controls.

Symptoms of disordered eating	Aerobic N = 43	Anaerobic N = 52	Aerobic-anaerobic N = 92	Controls N = 123	Difference between groups
Without breakfast	9 (20.9)	14 (26.9)	43 (46.7)	56 (45.5)	**0.004****
< 4 meals/day	3 (7)	15 (28.8)	20 (21.7)	36 (29.3)	**0.009****
Self-esteem < 3	3 (7)	1 (1.9)	6 (6.5)	13 (10.6)	**0.012***
Trying to lose weight now	4 (9.3)	3 (5.8)	7 (7.6)	5 (4.1)	0.567
Tried to lose weight ≥ 3	3 (7)	10 (19.2)	6 (6.5)	4 (3.3)	**0.008****
Weight control methods ¥	16 (37.2)	26 (50)	23 (25)	56 (45.5)	0.430
Reduce food consumption	5 (11.6)	9 (17.3)	7 (7.6)	8 (6.5)	
Sport activity	5 (11.6)	7 (13.5)	14 (15.2)	29 (23.6)	
Reduce food and sport activity	5 (11.6)	10 (19.2)	12 (13)	18 (14.6)	
Vomiting	1 (2.3)	0 (0)	0 (0)	1 (0.8)	
Diuretics	0 (0)	0 (0)	0 (0)	0 (0)	

Data are given in numbers (percentage).
¥ Total weight control methods.
**p < 0.01
*p < 0.05

Table 4. Reported reasons for dieting among athletes and controls.

Reasons for dieting	Aerobic N = 43	Anaerobic N = 52	Aerobic-anaerobic N = 92	Controls N = 123	Difference between groups
Aim of reducing weight ¥¥	27 (62.8)	28 (53.8)	42 (45.7)	68 (55.3)	**0.000*****
Sports achievement	13 (30.2)	23 (44.2)	18 (19.6)	14 (11.4)	
Better self-esteem	6 (14)	1 (1.9)	19 (20.7)	51 (41.5)	
Sports achievement and better self-esteem	8 (18.6)	4 (7.7)	5 (5.4)	3 (2.4)	
Told by:					**0.019***
Teacher/trainer	9 (20.9)	13 (25)	11 (12)	3 (2.4)	
Teammate	1 (2.3)	0 (0)	1 (1.1)	3 (2.4)	
Doctor	1 (2.3)	1 (1.9)	1 (1.1)	3 (2.4)	
Family	2 (4.7)	1 (1.9)	5 (5.4)	7 (5.7)	
Friends/partners	2 (4.7)	2 (3.8)	0 (0)	5 (4.1)	
Nobody/my decision	33 (76.7)	36 (69.2)	76 (82.6)	110 (89.4)	

Data are given in numbers (percentages).
¥¥ Total reducing weight aims.
***p < 0.001
*p < 0.05

group it was the most significant predictor for higher risk for ED (p = 0.002). In the anaerobic group, the number of trainings per week raised suspicion for ED the most (p = 0.037), while in the control group it seems that there is some relationship between self-esteem level and risk for ED (p = 0.069) (Table 5). Groups of metabolic processes did not show significant influence on risk of ED (p = 0.446; B = 0.042; Wald statistics = 0.580).

4 DISCUSSION

The main findings of this study indicate that there are no significant differences in the risk for ED occurrence between adolescent male athletes and their untrained controls. These findings are in concordance with Norwegian research where the sample characteristics were comparable to ours (5). We assume that the lack of differences might be due to a shorter period of exposure to sport-specific demands such as experienced pressure to diet, weigh-in procedures, number of weight fluctuations and subjective evaluation among adolescent compared to the adult elite athletes. The overall prevalence of risk for ED was 24.8% (77/310), with the highest prevalence recorded in the aerobic subgroup of athletes (37.2%). There are some significant anthropometric differences among the subjects with and without the risk for ED within the subgroups of aerobic athletes and aerobic-anaerobic athletes. Significantly higher values of height, weight, skeletal muscle mass and skeletal lean mass were measured

Table 5. Logistic regression analysis with disordered eating as the dependent variable in groups of athletes and controls.

Variable	B	Exp(B) (95% CI)	p Value	Percentage correct
Aerobic				
Lack of breakfast	-1.569	0.208 (0.043 to 1.001)	**0.050***	69.8
Skeletal muscle mass	-0.199	0.819 (0.690 to 0.973)	**0.023***	67.4
Skeletal lean mass	-0.125	0.885 (0,792 to 0,984)	**0.024***	67.4
Fat free mass	-0.118	0.888 (0.802 to 0.984)	**0.024***	67.4
Weight	-0.083	0.921 (0.854 to 0.992)	**0.031***	62.8
No. of attempts to lose weight	-0.784	0.457 (0.222 to 0.937)	**0.033***	72.1
Anaerobic				
No. of meals per day	-0.072	0.487 (0.124 to 1.108)	0.086	80.8
No. of attempts to lose weight	-0.536	0.585 (0.399 to 0.857)	**0.006***	84.6
No. of trainings per week	-0.727	0.483 (0.308 to 0.760)	**0.002***	88.5
Aerobic-anaerobic				
Body mass index	-0.241	0.786 (0.641 to 0.964)	**0.021***	77.2
BMI percentile	-0.025	0.976 (0.953 to 0.999)	**0.037***	76.1
No. of attempts to lose weight	-0.933	0.393 (0.228 to 0.680)	**0.001***	79.3
Weight	-0.052	0.950 (0.907 to 0.994)	**0.028***	75.0
Control				
No. of attempts to lose weight	-0.486	0.615 (0.398 to 0.950)	**0.028***	75.6
BMI percentile	-0.014	0.987 (0.972 to 1.001)	0.066	76.4
Self-esteem	0.554	1.740 (1.073 to 2.822)	**0.025***	74.8

*$p < 0.05$

in subjects with higher risk for ED in the aerobic group. In the aerobic-anaerobic group, parameters related to body mass (weight, BMI percentile and BMI) were significantly lower in the group without the risk for ED. The lack of breakfast was very common among male adolescents, accounting for 39.3% across all groups, with the highest prevalence in the aerobic-anaerobic group (46.7%) and untrained controls (45.5%). Interestingly, although the lack of breakfast was least frequent in the aerobic group of athletes (20.9%), it was a significant predictor of ED occurrence in the logistic regression model (p=0.028). Finally, it seems that risk factors that raise suspicion for ED differ significantly according to the predominant metabolic nature of the sport, as we have highlighted different risk factors that increase risk for ED in sports subgroups (aerobic, anaerobic and aerobic-anaerobic).

4.1 Prevalence of disordered eating among athletes and controls

In general, studies indicate a higher frequency of disordered eating in elite athletes than controls (6, 11). By contrast, some researches on high school athletes report no greater risk for the development of an eating disorder than for controls (8, 28, 29), which is supported also by our findings. The risk for ED (based on SCOFF questionnaire score >2) did not show a trend toward greater occurrence in adolescent male athletes. Similar results to ours were shown in research (8), which examined weight concerns, dieting, body dissatisfaction and eating behaviour of German high school athletes and compared the disordered eating behaviour of these athletes with regular high school students and founded no differences in the ED prevalence. Similar results were also reported from the female adolescent population by DiBartolo and Shaffer, who even concluded that there is less ED symptomatology and more healthy psychological functioning in athletes than non-athletes (30). It seems that in our sample participation in a competitive sport itself was not associated with increased risk for ED. The reported prevalence of risk for ED in male adolescents as described with the use of the SCOFF questionnaire ranged from 11.2% to 38.9% in previous studies (31–33). Our results are relatively high but within the range of previously reported results. The highest prevalence of risk for ED was registered in the aerobic subgroup of athletes, which is in accordance with previous findings (11, 34). Although the direct comparison with those findings is difficult because they studied female athletes and used different tools to assess eating disorder risk. The high prevalence of risk for ED in aerobic sports could be due to the fact that extra body weight can limit performance.

4.2 Risk factors for eating disorders among athletes and controls

Variables associated with disordered eating among adolescent athletes and controls differ in some main points. Analysis did not show a significant impact of specific met-

abolic processes on higher risk for ED. The only variable that was associated with symptoms of disordered eating in each group was number of attempts to lose weight. A higher number represents higher risk for ED. Results were in line with the literature (5, 35). Other predictors referred to breakfast and body composition in the aerobic group and number of meals and training frequency in the anaerobic group. Aerobic athletes are aware of the fact that being thin, fibrous and fat free is the main physical aspect of performance enhancement in their discipline (e.g. long-distance running or cycling athletes often turn to strict diets, since the loss of body fat correlates with better performance) (12). This may explain differences in body composition parameters (SMM, SLM, FFM) between aerobic athletes with risk and no risk for ED. The lower the values of body composition parameters, the lower the risk for ED. In the aerobic-anaerobic and control groups, BMI is a common predictor, but low self-esteem is the strongest predictor that raises suspicion for ED in controls. This findings may be explained by the fact that adolescents are less satisfied with their body image than adults (37). It is also known that athletes have higher self-esteem (36), which might explain the fact that self-esteem was not related with the risk for ED in athletes. BMI and low self-esteem have already been shown as risk factors for ED, especially in the adolescent population (4, 35, 38).

Although aerobic athletes have the best eating habits compared to other subgroups, which is in accordance with recent studies (39), omission of breakfast is an important predictor for higher risk for ED in this subgroup ($p = 0.028$).

4.3 Reasons for dieting in athletes and controls

As expected, athletes reported dieting to impove sport results and non-athletes to improve self image. Losing weight to improve perfomance is the most important reason among athletes. Young athletes are perfectionists and extremly performance oriented, and because of this they could be at increased risk for development of an eating disorder (40). When analysing the pressures exerted by different sporting contexts, the intrisic characteristics of each discipline were an important element. Coaches etablish certain objectives that athletes try to achieve, pushing themselves to the limit (12). Because of such circumstances, young male athletes (not just female) indicate coaches as the main promotors of their dieting (5, 12). This shows us why more attention should be placed on male athletes and their coaches to minimise risk for ED in adolescent athletes in the future.

5 CONCLUSION

Over the past decades, eating disorders were mostly related to the female population. Few studies included male adolescent athletes and age-matched controls. Yet, to our knowledge, this is the first study that has compared prevalence of risk for eating disorders among adolescent male athletes on the basis of metabolic processes. The highest prevalence was found in the group of aerobic athletes, but differences between all 4 groups were not significant. Furthermore, breakfast has been included as a risk factor for the first time. Results have shown that it is the most important predictor in the aerobic group of athletes. We can conclude that risk factors for ED in the aerobic group refer to specific body composition and breakfast consumption, while in the anaerobic group training frequency is the risk factor. Risk factors in the aerobic – anaerobic and control groups are comparable. Trainers are still the main reason for dieting among adolescent athletes.

Because of the different questionnaires and methodologies used in recent studies, longitudinal research with an experienced clinical interviewer that could show us the prevalence of true eating disorders and avoid false positives or false negatives, depending on the range of criteria, should be done in the future. Based on clinical interviews, we could probably find some differences in prevalence between athletes and controls that were not found with the self-reporting questionnaires in our case. Due to the dividing of athletes into groups, bigger samples should also be used in future. Finally, for more relevant data on eating habits and nutritional status, content and quantity of meals should be recorded as well.

CONFLICT OF INTEREST

The authors declare that no conflict of interest exists.

FUNDING

The study was partly co-financed by European Social Founds.

ETHICAL APPROVAL

Ethical approval was received from the Slovenian National Medical Ethic Committee (No. 125/06/13).

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