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Pursuit of performance excellence: a population study of Norwegian adolescent female cross-country skiers and biathletes with disordered eating

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ABSTRACT

Aim: To examine the prevalence of disordered eating (DE) among the total population of Norwegian female cross-country skiers and biathletes at the junior level, and to determine whether sociodemographic characteristics predict DE among athletes.

Methods: A cross-sectional population study of Norwegian female junior cross-country skiers and biathletes (n=262), with a response rate of 86%. Descriptive statistics and logistic regression analyses explored the prevalence of DE and its relation to sports, competitive age groups, competitive status and education. DE was defined as meeting at least 1 of the following criteria from 2 subscales of the Eating Disorder Inventory-2: the Drive for Thinness score ≥15 and/or the Body Dissatisfaction score ≥14.

Results: 18.7% of the athletes had DE. There was no significant difference in the occurrence of DE between the sports or the competitive age groups. Athletes who had dropped out of sports had a significantly higher occurrence of DE, while athletes who attended upper secondary schools of elite sports or general studies had a significantly higher occurrence of DE based on Drive for Thinness.

Conclusions: The number of female cross-country skiers and biathletes with DE is higher than that found in previous similar studies using the same screening instruments. Type of education and competitive status are significant predictors of DE, indicating that DE in addition to having adverse effects on an athlete's health, may also lead to early dropout of sport. This indicates that health and achievement are not always compatible within sports.

What are the new findings?

- Disordered eating may be a significant predictor of sport dropout.
- Attending upper secondary schools of sports specialisation was not a predictor of disordered eating as opposed to attending upper secondary schools of elite sports. Attending elite sport schools may thus constitute a health risk for adolescent female athletes.

INTRODUCTION

Disordered eating (DE) and clinical eating disorders (ED) are well-known health problems among adolescents, and young athletes do not seem to be exempt from this.[1 2] While athletes often are positively associated with good health considering the various benefits of being physically active,[3 4] research indicates that health and performance may not be compatible within sports.[5]

There is solid empirical evidence of the relatively high prevalence of DE and ED in sports in general.[5 6] DE refers to a wide range of abnormal eating behaviours such as restriction of food and dieting, binge eating, vomiting and abuse of diuretics, laxatives, diet pills and a morbid preoccupation with body weight and shape.[7] DE differs from ED in the frequency of behaviour and level of severity, and can lead to Other Specific Feeding or Eating Disorders (OSFED) and Unspecific Feeding or Eating Disorders (UFED), or clinical ED such as anorexia nervosa and bulimia nervosa.[8]

Many studies indicate a higher prevalence of DE and ED among adolescent and adult elite athletes than in non-athlete controls.[2 5 9–11] This is particularly prevalent in weight-sensitive sports where low weight and leanness are considered as a competitive advantage.[5 7 10 12] In contrast, other studies have not found support for this, especially in high school athletes.[6 13–17] The only consensus today is that female athletes have a higher risk of DE and ED than males.[2 6 10 11]

The risk factors of ED in sports are multiple and complex.[18 19] The hours of physical activity have no clear correlation with the risk of developing ED.[20 21] The competitive nature of sport has therefore been emphasised as many athletes are in a constant pursuit of performance excellence. Since

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performance is at the core of elite endurance sports, an extreme focus on nutrition and the pursuance of ideal body composition and weight may emerge,[22] as this is commonly believed to enhance performance. Some studies report that a gradual approach to weight loss may improve the performance outcome,[23 24] but this is dependent on the strategy used for weight loss and recovery, the magnitude of the weight loss and the initial percentage of body fat of the athlete.[25 26] In contrast, other studies indicate that rapid and extreme weight loss may actually impair performance,[24 27] and can result in DE or ED.[28 29] ED have severe physical and psychosocial consequences,[30 31] and are therefore not compatible with sports performance in the long run.

Whereas the prevalence of DE among adolescent athletes is fairly well documented, there is a lack of studies with representative samples of adolescent athletes and the risk factors that may predispose or contribute to the development of DE. We therefore assessed the prevalence of DE among the total population of Norwegian adolescent female cross-country skiers and biathletes, and possible sociodemographic predictors of DE. Cross-country skiing and biathlon were chosen based on their particular vulnerability to DE since body weight and leanness are considered as important determinants for performance.[32 33] The prevalence of DE within these sports is as yet unknown. ED have a peak risk of onset in adolescence[34 35] thus early identification of young female athletes is important as they have substantial risk of DE which may lead to ED. ED increase the risk of morbidity and mortality.[30 31] This further emphasises the importance of determining the prevalence and possible predictors of DE in adolescent female athletes in order to estimate the magnitude of the problem, with the ultimate goal of providing data supporting and improving earlier screening interventions.

The research questions were as follows:

1. How prevalent is DE among the total population of female cross-country and biathlon athletes at the junior level in Norway?
2. Are sociodemographic characteristics such as type of sport, competitive age group, education and competitive status possible predictors of DE?

METHODS

Participants

The total population of female cross-country skiers and biathletes in Norway at the junior level from the 2009 to 2010 season were invited to participate after the end of the season. Inclusion criteria included the top 30 athletes in at least one of the Norwegian Junior Cup races from season 2009 to 2010 within the appropriate competitive age group and sport. Some athletes competed in both athletic disciplines. The study was conducted with a web-based census survey through Questback. Data were collected in 2011. Out of 262 athletes invited, 225 responded, resulting in a response rate of 86%.

Assessment procedures

Questionnaire

A questionnaire including a battery of assessment questions regarding sociodemographic variables and Eating Disorders Inventory-2 (EDI-2) was administered to the respondents. The sociodemographic variables consisted of type of sport, competitive age group, competitive status and type of school. Within type of school, upper secondary school (USS) consisted of general studies, sports specialisation schools (SSS) and elite sport schools (ESS). The latter two are designed for athletes by combining education and sports. SSS are public schools, while most ESS are privately financed and more selective by accepting only highly talented athletes.

The EDI-2 assesses ED and subclinical eating problems.[36] The Norwegian version is not validated, but the original EDI-2 has a high reliability and validity.[36–39] While consisting of 11 subscales, only the Drive for Thinness (DT, α=0.91) and the Body Dissatisfaction (BD, α=0.91) scales were used as they are most strongly correlated with eating-related pathology, and the most sensitive detector of ED.[36 40] The DT assesses excessive concern with dieting, preoccupation with weight, thinness and fear of weight gain—and constitutes the 'morbid fear of fatness' characteristics of ED. The BD assesses the degree of body dissatisfaction, and addresses the 'body image disturbance' of ED.[36]

Statistical analyses

The data were subject to statistical analysis through IBM SPSS Statistics V.19.0. Results are expressed as absolute numbers (N) and percentage (%) for the categorical data. Logistics regressions were used to examine how sociodemographic variables predict DE. All analyses are conducted with the same set of independent variables.

DE is measured through three dependent dichotomous variables. The first dependent variable, EDI, classified DE if the athlete scored at or above the mean score for known anorectics on the DT scale ≥15 and/or BD scale ≥14,[41] which are previously used selection criteria when investigating female elite athletes with DE.[7 16 42] Since EDI assesses DE through two different scales measuring different aspects of ED, each scale was also tested separately. The second variable, EDI-DT, classified DE by a cut-off score on the DT scale ≥15. The third variable, EDI-BD, classified DE by a cut-off score on the BD scale ≥14. Scores below the cut-offs on each dependent variable were registered as not having DE. ORs are given with 95% CI. The significance level was set at 0.05. No statistical method for handling missing cases was employed, as the present study had no missing data.

RESULTS

Disordered eating

The distribution of the 225 respondents was 52% cross-country skiers (N=118), 36.4% biathletes (N=82) and 11.1% (N=25) athletes competing in both sports. The

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prevalence of athletes with DE in the total sample was 18.7% (N=42, table 1). A total of 8% (N=18) scored at or above the cut-off score for DT along with 16.9% (N=38) on BD on the EDI-2.

Sociodemographic characteristics

A higher percentage of athletes with DE were found among those who competed in both sports compared with the other sports (table 1). There is more than a twice as high prevalence of DE from the first and second competitive age groups, but the increase is not linear. Almost one in three athletes attending USS of elite sports had DE, which is almost twice as high compared with the other types of USS where the prevalence of DE was quite similar. The only exception was for those who did not study, who had no DE at all. An important finding is that DE among athletes who are no longer active is almost three times higher than among those who are still active (table 1).

Sociodemographic predictors of DE

The strongest predictor of DE, measured by EDI, was no longer being active (β=1.08), compared with still being active (table 2). This was a consistent finding in all three models, with (β=1.71) in EDI-DT and (β=2.25) in EDI-BD. Attending USS of general studies (β=2.62) was the strongest predictor of DE measured by EDI-DT compared with attending USS of sports specialisation. Athletes attending USS of elite sports had a significantly higher occurrence of DE (β=2.25) than those who attended USS of sports specialisation. Age and sport were not found to be significant predictors of an athlete's risk of DE in the three models (table 2).

Table 1 Total percentage and number of respondents with DE within the sociodemographic variables

Descriptive categories	N	DE
Totals	**42**	**18.7**
Type of sport		
Cross-country skiing	18	15.3
Biathlon	18	22.0
Both sports	6	24.0
Competitive age group		
Women17	7	10.4
Women18	15	25.9
Women 19+	20	20.0
Type of school		
USS, sports specialisation	16	16.3
USS of elite sports	13	28.9
USS of general studies	8	17.8
Higher education	5	16.7
Non-student	0	0.0
Competitive status		
Active	28	14.7
Not active	14	40.0

DE, disordered eating; USS, upper secondary school.

DISCUSSION

Prevalence of DE

In total, 18.7% of the athletes in this study had DE. This result is relatively similar compared with less well-controlled studies with age-matched high school athletes with a prevalence of DE of 20.0% within leanness sports[43] and 18.7% in endurance sport.[17] However, these studies are not directly comparable due to the usage of other screening instruments.

A recent study of Norwegian adolescent female athletes competing in leanness and non-leanness sports conducted by Martinsen *et al*[16] reported a lower risk of DE than was found in this study by using the same questionnaire, EDI-2 and cut-off scores. Martinsen *et al*[16] found no difference in the prevalence of DE between leanness and non-leanness sports and only 2.3% (N=5) and 16.6% (N=36) of the female athletes scored over the cut-off score for DT and BD on the EDI-2, compared with 8% (N=18) and 16.9% (N=38) in this study.

The pursuit of performance excellence

The prevalence of DE was higher on the BD scale (16.9%) than on the DT scale (8%). This implies that the athletes were mostly dissatisfied with their bodies as opposed to having excessive concerns regarding preoccupation with weight, dieting and a fear of gaining weight. This should be taken seriously as research implies that a risk factor in developing clinical or subclinical ED is based on a dissatisfaction with one's body and weight.[44] Body dissatisfaction may lead to dieting which increases the risk of initiation and maintenance of ED.[45] Excessive concerns regarding weight, body and appearance seem to be important maintenance factors of ED, and the onset of ED or DE normally starts with dieting behaviours.[46 47]

The high prevalence of athletes with DE in this study may be related to the pursuit of performance excellence, where weight loss and dieting are used as the means to improve athletic outcomes in response to demands for thinness in lean sport.[16 22] Cross-country skiers and biathletes are vulnerable to this aspect since a high fat mass is considered a disadvantage by decreasing efficiency of movements.[22] Thus, it may be desirable to diet in order to obtain a lean body. There are, however, inconsistent findings regarding the weight loss effect on the athlete's performance. While some studies indicate an improvement, others report on an impaired health and performance.[24 27 28] This may imply that the athletes identified with DE may inadvertently be harming their health as well as their athletic achievements.

Sociodemographic characteristics and DE

Neither age nor type of sport turned out to be significant predictors of DE. This was expected as both sports are weight and lean dependent, and therefore have relatively similar risks. Age is not significant, but this may be caused by the athletes being past the peak risk of onset for ED that seem to occur between childhood and late

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Table 2 Logistic regression of DE with sociodemographic variables†

	EDI‡			EDI-DT§			EDI-BD¶		
Explanatory	**OR**	**95% CI**	**p Value**	**OR**	**95% CI**	**p Value**	**OR**	**95% CI**	**p Value**
Sociodemographic variables									
Sport									
Biathlon	1.54	0.68 to 3.52	0.305	0.82	0.23 to 2.88	0.751	1.39	0.59 to 3.27	0.455
Both sports	2.00	0.66 to 6.06	0.219	0.60	0.07 to 5.51	0.653	2.11	0.69 to 6.39	0.189
Age									
Women 17	0.51	0.17 to 1.48	0.215	0.40	0.08 to 1.95	0.257	0.58	0.20 to 1.73	0.331
Women 18	1.34	0.55 to 3.28	0.522	0.40	0.10 to 1.64	0.203	1.53	0.62 to 3.78	0.359
Competitive status									
Not active	2.94	1.22 to 7.10	0.016*	5.50	1.56 to 19.42	0.008*	2.58	1.04 to 6.41	0.042*
Education									
USS elite sports**	2.40	1.00 to 5.89	0.055	9.44	1.74 to 51.31	0.009*	1.84	0.74 to 4.56	0.189
USS of general studies	1.42	0.51 to 3.97	0.503	13.79	2.34 to 81.35	0.004*	1.32	0.47 to 3.66	0.597
Higher education	1.04	0.30 to 3.57	0.955	2.96	0.35 to 24.72	0.317	0.61	0.15 to 2.55	0.501
Non-student	0.00	0.00	0.999	0.00	0.00	0.999	0.00	0.00	0.999
Constant	**0.12**		**0.00**			**0.000**	**0.12**		**0.000**
R^2 (Nagelkerke)	0.15						0.13		
R^2 (Cox and Snell)	0.09						0.08		
−2 Log likelihood	195.17						186.72		
X^2	21.44						17.64		

*p<0.05.
†Logistic regression analysis with cross-country skiing, women in the age group of 19+, active competitive status, and USS of sports specialisation as baseline categories.
‡EDI is based on a cut-off score ≥15 on EDI-DT and/or the cut-off score ≥14 on EDI-BD.
§EDI-DT is based on a cut-off score ≥15 on EDI-DT.
¶EDI-BD is based on a cut-off score ≥14 on EDI-BD.
**Private USS combining education and sports for highly talented athletes.
BD, body dissatisfaction; DE, disordered eating; DT, drive for thinness; EDI, eating disorders inventory; USS, upper secondary school.

adolescence,[34 35] as the majority of the sample was in their later adolescent and early adulthood. Moreover, age is often categorised as non-specific because age is related to other psychiatric disorders than just ED.[48]

Athletes who were no longer active had a significantly higher occurrence of DE based on EDI, EDI-DT and EDI-BD than those who were still active, implying that DE may be caused by a morbid fear of fatness and body image disturbances. There is a lack of research conducted on dropout, and while dropout is probably caused by multiple interacting factors, Sundgot-Borgen and Torstveit[10] report that 30% of female athletes in their study considered ending their career due to problems concerning weight and ED. Since 4 in 10 dropout athletes had DE, this indicates that DE may cause early sport dropout. In that case, the negative impact of sports causing DE is generally underestimated by looking only at the prevalence among those still active.

In this study, athletes attending USS of elite sports or general studies had a high and significant occurrence of DE measured by the EDI-DT, but this difference is not significant when controlled for other characteristics. ESS athletes had a higher frequency of DE than athletes attending general studies, with an almost twice as high OR. There is a lack of studies looking at the prevalence of DE among athletes in different types of USS and, to the best of our knowledge, this is the first study of the variation of DE across different types of schools. Martinsen *et al*[16] found a significantly higher prevalence of DE among controls at general studies as opposed to athletes at ESS, adding support to previous research.[6 14] This study is not in line with these findings. However, the studies are not directly comparable as their control group was made up of non-athletes, which may explain the different results.

The high occurrence of DE within these schools may be related to their environments. ESS are known for having a high performance pressure. This can result in a performance-focused climate that can predispose to the use of dieting methods in order to improve their performance if the athlete does not cope with the pressure. In addition, the students often move away from home to attend these schools, which may increase the risk of poor nutrition without the parental control. A similar pattern could apply to athletes in general studies, as they may experience high academic pressure in addition to sport performance pressure. Furthermore, students in general studies are often unable to train within school hours as in ESS and SSS, which may increase the pressure. These factors can result in a total strain that the athlete does not master, or maladaptive perfectionism, which in some cases may increase the risk of ED.[49]

Finally, the prevalence of DE was almost twice as high at the ESS as compared with SSS. These are two

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presumably similar types of USS, and it is therefore an interesting finding that ESS have a significantly increased risk of ED as opposed to SSS.

Methodological considerations

Being based on the total population of Norwegian female cross-country skiers and biathletes at the junior level is the main strength of this study, as this results in more representative and accurate statistics. The high response rate of 86% strengthens the validity of the results, and may be considered as representative of the target population. The validity of the findings is further strengthened by the fact that there are no missing data, thus providing a sound basis for generalisation to other female junior athletes competing within endurance sports. However, one cannot draw conclusions regarding the causality due to cross-sectional data. Reversed causality cannot be excluded. We do not know whether the sport itself may lead to DE, or whether the sport is an attractive arena for people with DE.

The use of conservative cut-off scores in EDI-2 strengthens the study by minimising the risk of identifying false-positive athletes with DE. However, clinical interviews are needed to identify clinical ED within those who scored at or above the cut-off scores. The use of dichotomisation of variables in the study gives a transparent analysis, but also leads to a loss of information.[50] However, inspection of the data reveals that the exact location of cut-off points is not crucial, since there is no concentration of observation around the chosen cut-off points.

The EDI-2 is limited by being developed before OSFED and UFED was a diagnosis of ED in Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), and may provide an inaccurate picture of athletes with DE. Errors of self-report must be taken into consideration when analysing the results. Respondents will not necessarily report their actual attitudes and beliefs, which can make it difficult to distinguish between athletes who are psychologically healthy and those who deny their psychological problems.[51]

CONCLUSION AND FURTHER RESEARCH

A large proportion of Norwegian adolescent female cross-country skiers and biathletes had DE, and this study reports a higher prevalence than previous studies with similar samples and the same screening instruments. The athletes with DE were mainly struggling with body image disturbances.

The sociodemographic characteristics are to some extent predictors of DE. Cross-country skiers and biathletes, along with their respective competitive age groups, had the same occurrence of DE. Athletes attending either USS of elite sports or general studies had a significantly higher occurrence of DE compared with other schools. DE seems to be a strong predictor of dropout, as almost half of the athlete dropouts were identified with DE.

The ultimate goal of research on DE and ED should be to improve interventions and ultimately reduce the prevalence. To better understand the causal relationship of the predictors of DE, longitudinal studies are needed on both male and female athletes younger than the junior competing level. There is a need for theory-based research on how we can change and prevent DE behaviour in sports. We need to identify psychological constructs that may influence eating behaviour in sport, and how those factors exert their influence. Controlled intervention studies aiming at preventing athletes from developing DE and ED should be conducted. The increasing emphasis on disease prevention and health promotion in the society should be incorporated into the sport culture and research.

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