Coaches’ Knowledge and Management of Eating Disorders: A Randomized Controlled Trial

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ABSTRACT

MARTINSEN, M., R. T. SHERMAN, R. A. THOMPSON, and J. SUNDGOT-BORGEN. Coaches’ Knowledge and Management of Eating Disorders: A Randomized Controlled Trial. Med. Sci. Sports Exerc., Vol. 47, No. 5, pp. 1070–1078, 2015. Purpose: It has been suggested that programs regarding early identification and prevention of eating disorders (ED) among athletes are unlikely to succeed without their coaches’ endorsement and participation. Therefore, we developed a 1-yr intervention aiming to prevent the development of ED among adolescent elite athletes by targeting athletes and their coaches. The separate part of the intervention targeting the coaches was designed to provide knowledge and strategies regarding healthy nutrition, eating behavior, and ED (symptoms, identification, management, and prevention). In this trial, we examined the effect of the educational program on the coaches’ knowledge and management index in three content areas (nutrition, weight regulation, and ED). We also examined their subjective evaluation of their ED knowledge. Methods: All Norwegian Elite Sport High Schools were included (intervention group (n = 9) and control group (n = 7)). Seventy-six coaches employed at and coaching first year student athletes at the different schools were followed for three school years (2008–2011). At pretest and posttest (9 months after intervention), they completed a questionnaire regarding nutrition, weight regulation, and ED. Results: Intervention coaches had higher knowledge index scores than control coaches for weight regulation (6.2 ± 1.7 vs 4.8 ± 1.3, P < 0.001), ED (including recognition and management) (19.3 ± 4.4 vs 16.5 ± 5.0, P = 0.004), and total knowledge (weight regulation, ED, and nutrition) (35.0 ± 7.2 vs 31.6 ± 8.0, P = 0.021) at posttest. Moreover, the coaches likelihood of describing knowledge of ED as “somewhat good” or better was seven times higher for intervention than control coaches at posttest (OR = 7.1, 95% CI, 2.2–23.2, P = 0.001). Conclusion: Intervention coaches had higher index scores on total knowledge, weight regulation, and ED (including recognition and management) than control coaches. The intervention also was successful in producing effects on the coaches’ subjective evaluation of their ED knowledge. Key Words: DISORDERED EATING, ELITE, ADOLESCENT, ATHLETE, INTERVENTION, PREVENTION

In various sports, body weight and body composition are crucial performance variables, and many athletes use extreme methods to reduce mass rapidly or maintain a low body mass in order to gain a competitive advantage (1). Research indicates that the prevalence of eating disorders (ED) is higher among elite athletes than nonathletes, particularly among those competing in weight-sensitive sports (33,35). Also, the prevalence of disordered eating (DE) (15,26) and ED (16) is high among adolescent elite athletes. Early identification decreases possible medical and psychological consequences of the disorder and perhaps decreases the difficulty and length of treatment (17).

The International Olympic Committee (IOC) and international sports governing bodies have acknowledged a mandated duty of care to protect the physical and psychological health and safety of all athletes including adolescent elite athletes (8,11). Consequently, the importance of early detection of ED behavior has been stressed by the IOC, the American College of Sports Medicine, the National Collegiate Athletic Association, the Society for Adolescent Medicine, the American Psychiatric Association, and the National Athletic Trainers Association (3). More specifically, the IOC Medical Commission and the American College of Sports Medicine recommend that professionals participating in health maintenance and performance enhancement of athletes should be provided with specific knowledge and problem-solving skills to better detect, manage, and prevent extreme dieting, ED, and the triad components (7,17).

Due to coaches having daily and intensive contact with their athletes, they can play an important role in their unique position by identifying early signs and symptoms, directing athletes to professional help, and preventing the development of ED (17,27). Furthermore, based on the importance athletes tend to ascribe to coaches (19), successful prevention programs in the athletic setting are unlikely to succeed...
without commitment and support from their coaches (32). In addition, in an educational injury prevention (brain and spinal cord injury) study among adolescent ice hockey players in Canada, there was consensus among the coaches that changing coaching behaviors would lead to the greatest effect on player behavior (5). This is supported by well-founded theories suggesting that if people think their significant others want them to perform a behavior, this results in a higher motivation and greater likelihood of action (2,25). In addition, athletes who are dieting to enhance performance tend to report that their coaches recommended that they lose weight (15,30).

It is important for coaches who work with young athletes to address health issues related to ED even before low energy availability leads to consequences severe enough to negatively affect performance and shorten a sport career (6). Unfortunately, it is tempting for coaches to equate performance with health. Beyond knowledge, they need to understand that good sport performance does not always imply good health (31). Some athletes are initially able to perform well despite eating problems. In order to adequately perform a supportive function, many coaches need factual information on nutrition, factors determining weight, risks, and causes of DE, menstrual (dys)function, and psychological factors that both negatively and positively affect health and athletic performance (34). To have the potential to behave in a particular way, knowledge is required.

In an effort to combat the high prevalence of DE and ED in adolescent elite athletes and decrease treatment delay and related complications, we developed the first randomized controlled trial including both athletes and coaches to prevent the development of ED among adolescent male and female elite athletes (14). In order to use the power and influence of coaches to create supportive environments regarding the prevention of ED, a special educational program was developed for coaches and included as a separate part of the intervention program for athletes and coaches (Table 1). This educational program was developed to provide the coaches with knowledge and strategies regarding identification, management, and prevention of ED. The aim of this trial was to examine the effect of the education program on the coaches’ total knowledge and for each of the three knowledge content areas of nutrition, weight regulation, and ED (including recognition and management). A second aim was to examine the coaches’ subjective evaluation of their knowledge of ED.

### METHODS

We invited the total population of coaches employed at, and working with, first year students at the Elite Sport High Schools (n = 16) in Norway. The different schools were stratified (by size) and randomized to the intervention (n = 9) or control group (n = 7); all coaches from each school were randomized to the same treatment arm (intervention or control). The statistician who conducted the randomization did not take part in the intervention. The Regional Committee for Medical and Health Sciences Research Ethics in

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**TABLE 1.** The educational program from the health, body, and sports performance intervention program given the coaches at the intervention schools.

<table>
<thead>
<tr>
<th>Time Point</th>
<th>Themes</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Winter 2009 Outside-school seminar</strong></td>
<td>Nutrition: sports nutrition; fluid and fuel intake before, during, and after training/competition; health and performance enhancing nutrition</td>
<td>• Increase knowledge, challenge myths, and correct possible misinformation related to nutrition, health, and performance</td>
</tr>
<tr>
<td></td>
<td>Physiological growth and development; adolescent athletes health</td>
<td>• Be aware of the physical and psychological challenges related to puberty (e.g., self-appearance and self-esteem) and how they may affect sport performance and become possible stress factors</td>
</tr>
<tr>
<td></td>
<td>Prevention: Detecting and managing ED</td>
<td>• Understand how athletes experience pressure to lose weight from coaches and peers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase confidence in how to identify and manage DE and ED among athletes</td>
</tr>
</tbody>
</table>

| **Winter 2010 Coaches guide (self-study book)** | Prevention: detecting ED (how to identify in the sport environment); manage ED (how to prepare and plan the first consultation/meeting and follow up with athletes ‘at risk’ and athletes who might be suffering) | • Be able to recognize signs and symptoms associated with ED in the general population and ED in athletes |
| | Test | • Know how to show concern without making accusations |
| | School-wide seminar | • Understand the behavior of an athlete with an ED |
| | Mental training: relaxation; self-talk; visualization; present the program for the athletes and how to follow up the mental training assignments | • Reading the Coaches guide |
| | Self-esteem: role of self-confidence in athletes; stress management | • Individual feedback to all coaches |
| | Prevention: detecting ED (symptoms and signs, understand the nature and course; discussing cases); managing ED (difficulties, guidelines (e.g., training); responsibility (as coach, the school, etc.)); Management protocol; team infrastructure | • Increase ability to implement mental training |

Moderated from Martinsen et al. (14).
Southern Norway and the Norwegian Social Science Data Service approved the study.

The Norwegian Elite Sport High Schools are private and public schools with programs designed for talented athletes. The schools were told that those allocated to the intervention condition would receive a 1-yr intervention program aimed at preventing athletes from developing ED. The intervention included both athletes and their coaches at the Elite Sport High Schools. For the purpose of this paper, however, only data concerning the educational program for the coaches are presented. The results among the athletes were presented previously (14).

Participants

We invited 125 coaches to participate during the 2008–2009 school year. Of these, 24 did not participate. Other than illness, reasons for not participating included involvement in training camps, competitions, and teaching/working outside the school during that day. This resulted in a sample of 101 coaches participating in the pretest. Of these, 18 quit working at the schools, one retired, one went on sick leave, and five were lost to follow-up for reasons unknown. This resulted in a final sample of 76 coaches participating in both the pretest and posttest. Ninety-three percent were male. The flow of participants through the study can be seen in Figure 1.

We obtained permission to invite the coaches to participate and to collect data from each principal prior to randomization. Coaches provided written or oral consent to participate at their school. For coaches not in attendance the day consent was obtained in person, consent was provided by phone or e-mail.

Intervention

The 1-yr intervention program was devised using current knowledge about possible risk factors, as well as results from existing studies aimed at preventing DE and ED in the general (4,28,29,40) and the athletic populations (7,21,30,35). The intervention was sport specific in the sense that the program was developed for elite athletes and their coaches. It included increasing health promoting and possible protective factors while decreasing multiple risk and potentiating factors, which are essential in preventing ED (4). The intervention program targeting the athletes has been described in detail previously (14).

The education program from the intervention targeting coaches focused on educating them regarding self-esteem, self-efficacy, mental training, sports nutrition, body composition, and weight issues. In addition, they were provided with knowledge and strategies to identify, manage, and prevent ED among athletes. We organized two seminars (2 × 3 h) and provided a “coaches guide” to increase knowledge about nutrition, as well as how to identify and manage ED in the sport environment. In the coaches guide, we also included questions on the last page that the coaches were required to answer and return to the first author. These questions were related to nutrition, dieting, ED, and how to identify and manage ED in the sport environment. All coaches received individual feedback on their assignments. In addition to the seminar lectures, identification and management of clinical and subclinical cases were discussed in the workshop during the seminar at school. Coaches were informed about the intervention program provided for the athletes and were also encouraged to attend the lectures arranged for the athletes. In addition, they were presented with ideas on how to include and follow-up with the mental training assignments. This was done based on the assumption that repeated exposure facilitates cognitive elaboration of the message, which, in turn, leads to greater change in attitudes (20). An overview

![Flow chart of the study and participants' movement.](http://www.acsm-msse.org)
of the educational program for the coaches from the intervention program is presented in Table 1.

**Assessment Procedures**

**Questionnaire.** At pretest and posttest (9 months after intervention), the coaches completed a questionnaire including questions regarding educational background, athletic career, coaching experience, and coaching philosophy. The specific topics dealt with in the intervention, such as their knowledge about nutrition (related to health, physical training, and performance), growth and development, knowledge and awareness of training principles, weight regulation, and ED, were assessed with the questionnaire. The questionnaire was tested in a pilot study with five coaches working at high schools with sports specialization (not Elite Sport High Schools). As a result of that pilot study, changes were made to the questions regarding their education.

The Questions and the Knowledge Indexes

The questions included in the posttest measuring the coaches’ knowledge and strategies regarding identification, management, and prevention of ED were divided into the following subindexes: nutrition (10 questions), weight regulation (5 questions), and ED (10 questions). We also combined the subindex scores on nutrition, weight regulation, and ED to create a total knowledge index score consisting of 30 questions with a maximum score of 55 points. In the analysis at posttest, we adjusted for the total knowledge index score at pretest.

The coaches’ nutrition index consisted of 10 questions measuring knowledge about energy and nutrient intake for health and performance (e.g., “Which nutrients are important for strong bones among athletes?”). Questions regarding existing recommendations and sources of protein, fat and carbohydrate, calcium, and iron were also included in the index. More practical questions were included, such as the following: “An athlete of yours will perform a 60-minute running session at 70% of maximum heart rate. What, when and why do you recommend to him/her to ingest up to 2 h before, during and one hour after the training?” The coaches’ answers were scored from 0 to 1 or 0 to 3 depending on the questions’ comprehensiveness. The maximum nutrition index score was 16 points.

The coaches’ weight regulation index consisted of five questions measuring coaches’ ability to manage issues concerning body weight, puberty, and performance (e.g., “One of your female athletes thinks she weighs 4 kg too much to perform well. She wants to lose weight and asks for advice. How will you respond to her?”). In addition to the question, there were six suggested answers that the coaches had to answer “yes” or “no.” “Which of these method(s) will be most appropriate to use when considering the need for weight regulation/change in body composition in an athlete?” The coaches could choose between six different methods. These include body mass, body composition via InBody multicurrent segmental body composition analyzer or dual energy x-ray absorptiometry, body mass index, hip-to-waist ratio, and skin folds, as well as writing their own suggestion. The coaches’ answers were scored from 0 to 1, 0 to 2, and 0 to 3 with a maximum total weight regulation index score of 10 points.

The coaches ED index consisted of 15 questions measuring three factors: ability to detect and manage ED (e.g., recognize symptoms and signs, how to show concern and to plan an initial meeting with an athlete), awareness of ED (e.g., understand the nature and progression of the ED behavior), and responsibility for the athlete (e.g., the potential pressure coaches and peers can put on an athlete). Examples of questions were as follows: “Can you name some physical signs of ED?” “Can you name some behavioral signs of ED?” “Are you familiar with the female athlete triad (yes/no)?” “Can you please describe the components of the female athlete triad?” “If you get concerned that one of your athletes has an ED, what would you do?” “What do you think are the reasons for an athlete developing an ED?” The coaches’ answers were scored from 0 to 1, 0 to 2, and 0 to 3 with a maximum total ED index score of 29 points.

**Outcome Measures**

The primary outcome was the coaches’ total knowledge index score at posttest adjusted for pretest value, as well as scores for each of the three knowledge index content areas: nutrition, weight regulation, and ED (including recognition and management). The secondary outcome was the coaches’ subjective evaluation of their knowledge of ED at posttest.

**Statistical Analysis and Data Presentation**

In this study, we have not accounted for a clustered design because in the data set from the primary study, we found that the effect of clustering was small (data not shown) (14). In addition, no specific power calculation was made for this study because the primary study was designed for other purposes. Statistical analyses were carried out using SPSS Statistics 21 for Windows (IBM Corporation, Route, Somers, NY). Results are expressed as frequencies (N) and percentages (%) for categorical data and mean values with SD for continuous data. To compare mean differences, an independent-sample t-test was used. We also used the chi-squared and Mann–Whitney U tests to assess group differences when nonparametric tests were appropriate. Fisher’s exact test was used in cases where the expected number of counts per cell was five or less. A binary logistic regression analysis was conducted to test for difference by treatment group of the likelihood of reporting “somewhat good” knowledge or better at posttest. We used the reported knowledge as the dependent variable and school type (intervention/control) and pretest value as covariates. To compare differences in the coaches’ scores on knowledge at posttest, a general linear model was used. We used the knowledge score as the dependent variable with school type (intervention/control) as a fixed factor and total knowledge score at pretest as a covariate.
Odds ratio and regression coefficients are presented with 95% CI and P values. The significance level was set at 0.05, and both genders are included in all analysis.

RESULTS

Subject characteristics. Characteristics of the coaches are shown in Table 2.

The majority of the coaches (65.8%) had formal education in sport sciences or physical education (PE) (Table 2). Among these, 52.0% had a bachelor’s degree and 8.0% a master’s degree, and 93.4% had fulfilled or were in the process of fulfilling a specific education program and/or courses targeting coaches (Table 2).

A drop-out analysis was conducted between coaches who completed and those who were excluded due to resignation (n = 18), retirement (n = 1), and long-term sick leave (n = 1) and did not answer the posttest for reasons unknown (n = 5). There were no statistically significant differences in any of the characteristics between coaches fulfilling the trial and the drop-outs.

Knowledge of nutrition, weight regulation, and ED. At pretest, there was no difference between coaches at intervention and control schools in the total knowledge index (21.7 ± 6.8 vs 21.7 ± 5.0, P = 0.975). Mean score was 57.1% of maximum (maximum = 38) for coaches representing both intervention and control schools. Knowledge index scores for the different content areas at posttest adjusted for pretest value are presented in Table 3. The coaches at intervention schools had higher index scores than control school coaches on total knowledge, weight regulation, and ED. On the nutrition index knowledge scores, there was no significant difference between the intervention and control school coaches.

Recognition and management of ED in athletes. Because we were interested in whether the coaches would be able to have constructive behavior or bring their knowledge to practice, the coaches were asked about how they would behave and manage ED in athletes with the following two questions that also are included in the ED knowledge index score: “If you get concerned that one of your athletes has an ED, what would you do?” which were scored 0 (not correct), 1 (average), and 2 (very good). There were no difference between the coaches’ reported management at the intervention schools versus control schools at posttest adjusted for pretest value (mean 0.892 vs mean 0.863, difference in mean: 0.029, 95% CI, −0.347 to 0.406, P = 0.779). However, when the coaches answered the follow-up question “If you still are concerned that one of your athletes has an ED after you have had a meeting/conversation, you should?” a higher percentage of the coaches at the intervention schools than control schools reported a correct approach (98.0% vs 77.8%, P = 0.007). In addition, in the weight regulation knowledge index, two questions measured the coaches’ management of athletes wanting to reduce weight. In the first question, the coaches were asked how they would respond if “One of your female athletes thinks she weighs 4 kg too much to perform well. She wants to lose weight.” In the second question, they were asked, “One of your athletes contacts you and says she feels heavy and wants to decrease her weight. Without telling her, you agree that her body composition could be improved. How will you respond to her?” There were four suggested answers from which the coaches could choose one. In both questions, the intervention school coaches scored higher than coaches at the control schools by reporting the most preferred approach (question 1: mean 0.898 vs 0.185, difference in mean 0.713, 95% CI, 0.510–0.916, P < 0.001, and question 2: mean 1.857 vs 1.630, difference in mean 0.228, 95% CI, 0.018–0.437). On

### Table 2. Characteristics of the coaches representing the intervention schools and control schools at pretest of the study.

<table>
<thead>
<tr>
<th></th>
<th>Intervention, N = 49</th>
<th>Control, N = 27</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>36.8 ± 8</td>
<td>40.7 ± 10</td>
<td>0.077</td>
</tr>
<tr>
<td>Coaching experience (yr)</td>
<td>11.3 ± 7.87</td>
<td>11.1 ± 8.9</td>
<td>0.955</td>
</tr>
<tr>
<td>Coaching experience at high schools with sports specialization (yr)</td>
<td>5.9 ± 5.3</td>
<td>5.8 ± 5.8</td>
<td>0.924</td>
</tr>
<tr>
<td>Coaching sport teams/athletes in addition to the athletes at the Elite Sport High Schools</td>
<td>40 (81.6)</td>
<td>22 (81.5)</td>
<td>1.000</td>
</tr>
<tr>
<td>Competed at national or international level</td>
<td>40 (81.6)</td>
<td>23 (82.1)</td>
<td>0.762</td>
</tr>
<tr>
<td>Formal education in sport sciences and/or PE</td>
<td>35 (71.4)</td>
<td>15 (55.6)</td>
<td>0.209</td>
</tr>
<tr>
<td>Specific education program and/or courses targeting coaches</td>
<td>47 (95.9)</td>
<td>24 (88.9)</td>
<td>0.340</td>
</tr>
</tbody>
</table>

Values are given in absolute numbers and valid percentage (%), which is the percentage when only cases without missing values are considered. Range of missing: coaching experience, coaching experience at high schools with sport specialization, and coaching teams/athletes in addition to the athletes at the Elite Sport High Schools N (1–4).

### Table 3. Posttest index values for the various knowledge content areas among the coaches at intervention and control schools.

<table>
<thead>
<tr>
<th></th>
<th>Intervention</th>
<th>Control</th>
<th>Adjusted Difference</th>
<th>Intervention vs Control⁴</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrition</td>
<td>9.5 ± 3.5 (0 to 15)</td>
<td>10.3 ± 3.2 (0 to 14)</td>
<td>-0.80</td>
<td>-2.2 to 0.61</td>
<td>0.260</td>
<td></td>
</tr>
<tr>
<td>Weight regulation</td>
<td>6.2 ± 1.7 (3 to 10)</td>
<td>4.8 ± 1.3 (2 to 7)</td>
<td>1.37</td>
<td>0.65 to 2.1</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>ED</td>
<td>19.3 ± 4.4 (7 to 27)</td>
<td>16.5 ± 5.0 (4 to 24)</td>
<td>2.83</td>
<td>0.90 to 4.7</td>
<td>0.004</td>
<td></td>
</tr>
<tr>
<td>Total knowledge score</td>
<td>35.0 ± 7.2 (17 to 46)</td>
<td>31.6 ± 8.0 (9 to 43)</td>
<td>3.40</td>
<td>0.51 to 6.2</td>
<td>0.021</td>
<td></td>
</tr>
</tbody>
</table>

Delta (Δ) values are the difference between intervention and control schools for the various knowledge content areas adjusted for pretest value.

⁴General linear model was used with the different knowledge content scores at posttest as the dependent variable, school type (intervention/control) as fixed factor, and total knowledge score at pretest as covariate. Maximum score for the different knowledge contents at posttest: nutrition = 16, weight control = 10, ED = 29, and total knowledge score = 55.
question 2, 85.7% of the intervention school coaches compared to 66.7% coaches at control schools reported the most preferred approach.

**Coaches’ experience of perceived knowledge of ED in athletes.** There were no differences between coaches at intervention school and control school experience in coaching athletes with an ED (26.1% vs 18.5%, \( P = 0.460 \)) and previously coached athletes with an ED (48.7% vs 27.3%, \( P = 0.102 \)). In addition, only 3 of the 49 coaches at the intervention schools and none of the 27 coaches from the control schools reported ED to be prevalent at the school where they coached. Moreover, 18.4% from the intervention schools compared to 25.9% at the control schools did not know if ED was prevalent at their school, \( P = 0.439 \). The coaches’ own evaluations of their knowledge about ED at pretest and posttest are presented in Table 4.

A higher prevalence of coaches at intervention schools than control schools evaluated their knowledge about ED to be “somewhat good” or better at posttest (Table 4). By including the results in a binary logistic regression analysis adjusted for pretest value, the likelihood of reporting “somewhat good” knowledge or better was seven times higher for coaches at intervention schools compared to control schools (OR = 7.1, 95% CI, 2.2–23.3, \( P = 0.001 \)).

**Compliance.** In total, 89.8% of the 49 coaches participating in the intervention completed the questionnaire test included in the coaches guide. In addition, 71.4% of the coaches at the intervention schools attended the seminar at school. Coaches were required to read and complete the test based on information contained in the coaches guide. All coaches working at the Elite Sport High Schools the day of the seminars were required to attend. However, some coaches work part time and have other employers and were not able to be at school on the day of the seminars. In addition, some coaches were away at training camps or competitions. Thus, at some schools, it was impossible to arrange the seminar at a time when every coach was available. However, both coaches participating and those who were unable to be at the seminars in person were sent information about the content of the seminar, the coaches guide, and the intervention program targeting the athletes by e-mail.

**DISCUSSION**

The purpose of this trial was to examine the effectiveness of the specific educational program designed for coaches who work with adolescent elite athletes. For coaches in the intervention group, the program included information and interactive discussions related to knowledge and strategies regarding identification, management, and prevention of ED.

Overall, coaches at intervention schools had higher index scores on total knowledge, weight regulation, and ED than coaches attending control schools at 9-month follow-up. The intervention included seminars with the opportunity to discuss ED cases, a coaches guide for self-study, and assignments related to identification and management of ED in the sport environment, as well as individualized feedback to the coaches. These findings suggest that the intervention can be an effective means by which to promote long-term retention of information (at least 9 months). In contrast, Whisenhunt et al. (38) reported that knowledge was not maintained by cheerleading coaches over an 8- to 11-month follow-up as part of a brief intervention, which included verbal and written information about ED and nutrition. Although the increased knowledge from the posttest in that study was not maintained, the coaches from the experimental group self-reported engaging in increased efforts to prevent ED on their squads as compared to control group coaches at the follow-up (38). Little is known about whether short-term increases in knowledge can affect behavior. In our trial, coaches attending the intervention also subjectively evaluated their knowledge about ED to be higher than the coaches at the control schools at 9-month follow-up. In fact, the likelihood of reporting “somewhat good” knowledge or better was seven times higher for coaches at intervention schools. However, it appears that knowledge is not the only factor that may have an effect on the coaches’ attitudes and behavior; one’s confidence in that knowledge also plays an important role (37). Interestingly, Turk et al. (37) found that although coaches may feel confident about managing or preventing ED, they may give incorrect information if they have low knowledge. Thus, low knowledge in addition to a high level of confidence may pose more threat than the combination of high knowledge and low confidence (37). This may be particularly important among coaches working with young upcoming athletes where the principles of physical growth, biological maturation, and behavioral development occur. On the other hand, if coaches in the interventions schools in our study are in fact more knowledgeable about identification, management, and prevention of ED, and believe themselves to be more knowledgeable, they will most likely be more confident in the suggestions they give, the vocabulary they

**TABLE 4. The coaches’ own description of their knowledge about ED at pretest and posttest.**

<table>
<thead>
<tr>
<th></th>
<th>Intervention, ( N = 49 )</th>
<th>Control, ( N = 27 )</th>
<th>Intervention, ( N = 49 )</th>
<th>Control, ( N = 27 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poor</td>
<td>1 (2.0)</td>
<td>1 (3.7)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Poor</td>
<td>8 (17.8)</td>
<td>4 (14.8)</td>
<td>2 (4.1)</td>
<td>3 (11.1)</td>
</tr>
<tr>
<td>Somewhat poor</td>
<td>16 (32.6)</td>
<td>8 (29.6)</td>
<td>6 (12.2)</td>
<td>11 (40.7)</td>
</tr>
<tr>
<td>Somewhat good</td>
<td>17 (37.8)</td>
<td>11 (40.7)</td>
<td>34 (69.4)</td>
<td>12 (44.4)</td>
</tr>
<tr>
<td>Good</td>
<td>3 (6.6)</td>
<td>3 (11.1)</td>
<td>7 (14.3)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Very good</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (3.7)</td>
</tr>
</tbody>
</table>

\( P \) value: pretest between intervention and control = 0.556; posttest between intervention and control = 0.002.

Values are given in absolute numbers and valid percentages (%).
use, and how to appropriately communicate with their athletes. Thus, coaches that are properly educated may feel more assured that they are offering sound advice about nutrition, weight regulation, and body composition although not negatively affecting the health and performance of the athletes.

The combination of higher knowledge score and higher subjective evaluation of ED knowledge found among the coaches at the intervention schools in our trial is of particular importance. These higher scores are likely due to the fact that coaches during our education program not only received factual information but were provided with strategies to identify, manage, and prevent ED among athletes. For instance, during the seminar at school, coaches were challenged with different cases of athletes with and without an ED, with the aim of increasing the coaches’ confidence in identifying and managing ED problems among their athletes. The reason for teaching coaches’ practical skills was to increase the coaches’ confidence in their knowledge and enable them to take an active role in the prevention and management of ED (37). We believe that the combination of higher knowledge score and higher subjective evaluation of ED knowledge among the coaches at the intervention school compared to the control schools also increased their awareness and engagement in preventing ED. It is argued that prevention efforts might be more sustainable if programming engages the social systems in which the individuals are embedded. The need to include both specific influential adult figures (e.g., parents, teachers, and coaches) in addition to community resources (e.g., school administration) is emphasized (22–24). In this connection, we would like to add the fact that none of the athletes at the intervention schools developed an ED during the study period, whereas 13% of the female athletes at the control schools did (14). In addition, at the intervention schools, a lower frequency of athletes reported symptoms associated with ED compared to the athletes at the control schools. Moreover, there was a significant reduction in dieting behavior observed for the female elite athletes attending the intervention schools with the most pronounced changes 1 yr after the intervention being especially encouraging (14).

In our trial, coaches attending the intervention also had higher knowledge scores on weight regulation and ED at posttest than coaches at control schools. Although the weight regulation index included fewer questions, this was where the highest difference between coaches at intervention and control schools was found. Thus, it appears coaches increased their knowledge most about weight regulation. Although dieting is probably not sufficient for the development of an ED (39), it is well established that frequent weight fluctuations can be a precipitating factor in the development of ED (30). Moreover, in a recent study among adolescent elite athletes, one-third of the male athletes and 13% of the female athletes who were dieting reported trying to lose weight as directed by their coach or teacher (15). Losing weight to enhance performance is one of the more common motives for dieting among athletes. Consequently, a number of extreme methods that place the athlete’s health at risk are used in an effort to achieve fast weight loss within some sports. Few question the weight loss methods used because many believe weight loss is a necessary part of the sport (10,13). Increased knowledge on both weight regulation and ED among the coaches as found in our study may thus be an important step in preventing unhealthy behavior among athletes. The combination of knowledge regarding both weight regulation and ED seems especially important because athletes can be underweight, normal weight, or overweight regardless of the presence of extreme dieting or ED (36).

Interestingly, we found no difference between coaches attending intervention schools and control schools regarding their knowledge score on nutrition. However, most of the coaches in this study are highly educated (formally with bachelor’s degree and/or sport-specific courses) and have learned some basic sport nutrition during their education in sport sciences and/or PE and other courses (Table 2). Therefore, they might be quite critical in terms of reporting “high” knowledge. Whether good nutrition knowledge among coaches and/or athletes prevents ED is not known, but our findings indicate that increased knowledge about weight regulation, body composition, and ED is not necessarily related to increased nutritional knowledge. Still, nutrition is a topic many coaches regard as important and that can be easily self-studied. It is a common misunderstanding that DE or ED is a problem of simply understanding nutrition. For instance, in a recent study among Swedish elite coaches, most of them ascribed low priority to ED information compared to nutritional information (18). In fact, many of them stated that solid knowledge of nutrition and weight regulation precluded the need for increasing athletes’ knowledge about ED (18). This suggests they assume ED can be avoided if athletes have the correct nutritional information. This further suggests that they assume ED is more about food than about complex psychological issues. Hopefully, more factual information regarding ED can increase coaches’ understanding of ED, which is critical in being able to respond to their athletes in a helpful and appropriate manner.

It has been reported that dieting athletes who do not receive guidance for weight reduction more often develop ED than those who are supervised during the weight loss period (30). Thus, one might speculate that the increased knowledge about weight regulation and body composition in the intervention group in our study could be a “preventive” factor in terms of reducing the risk of ED problems in these young athletes by coaches who could presumably more effectively advise them regarding weight regulation. Many coaches in the trial reported not having coached or did not know if they had coached an athlete with an ED, despite having coached for an average of 11–20 yr, some of which involved coaching athletes in weight-sensitive sports. Given the relatively high prevalence of DE and ED in adolescent elite athletes (15,16), it seems unlikely that these coaches have not had an athlete with an ED. It is more
likely that they have coached athletes with ED but failed to identify their disorders. Coaches who have difficulty identifying athletes with ED need more information about signs and symptoms of ED, which was an aim of the present trial.

**Strengths and limitations of the study.** Strengths of the trial include randomization of schools to avoid contamination between intervention and control groups, inclusion of the total population of coaches working with first year students at all Elite Sport High Schools in Norway, the use of a theory-based intervention, the individual feedback given to all the coaches at the intervention schools on their assignments, and the 9-month follow-up posttest.

We have considered several limitations with our design and data acquisition. The decision to only measure the interventional effect 9 months after the intervention program provides no information about the knowledge group scores immediately after the intervention among the coaches. However, measurement of knowledge following 9 months after intervention may provide a more useful learning measurement. Moreover, given that intervention effects tend to dissipate over time, a long-term follow-up is recommended (29). In addition, Whisenhunt et al. (38) found in their study among cheerleading coaches that the increases in knowledge about ED found immediately after intervention were not maintained over an 8- to 11-month follow-up. We therefore acknowledge that a posttest immediately following the intervention in addition to our 9-month follow-up would have strengthened our trial. Moreover, we must consider that simply participating in a trial may change the participant’s behavior. In our case, coaches might have positively changed their willingness to incorporate more knowledge about nutrition, weight regulation, and ED. This could artificially increase adherence among the control school coaches. If this bias existed, it would hide differences between the groups, which means that there may be a greater difference between intervention and control schools than was observed in our trial.

Our drop-out analysis did not show any difference between the coaches that participated in the trial and those who were lost to follow-up. Because 25 coaches did not participate in the posttest, we do not know if this is due to a power problem or that it actually does not represent any differences. Furthermore, because so few female coaches participated, we do not know if our results are generalizable to female coaches. Gender of coach has recently been found to affect how coaches think about and respond to DE in their athletes (12). Finally, our results are based on questionnaire screening, and we do not know if the increased knowledge in the intervention group compared to control group also changed the coaches’ behavior regarding identification, management, and prevention of ED. In future trials, it will be important to develop evaluation tools that undergo vigorous validity and reliability testing that can be shared among the scientific community along with the constructs of the intervention.

**Practical implications.** Coaches need factual information regarding the identification of ED. They also require sufficient confidence in using that information in a timely and appropriate way to increase the likelihood that the athlete will accept a referral for evaluation and treatment, if needed. Providing such information was a major goal of this trial in an effort to combat the high prevalence of DE and ED in adolescent elite athletes and decrease treatment delay and related complications. With the success of the intervention approach employed in this trial, hopefully, more coaches will have the opportunity to learn the skills needed to assist and/or prevent ED among their athletes. Future prevention studies should use the power and influence of coaches to create supportive environments regarding the prevention of ED among athletes and include education programming that targets coaches as a separate part of the intervention program for the athletes. However, it is important to remember that only programs that will be adopted by the participants, the coaches, and sporting bodies will succeed in the long run (9).

**CONCLUSION**

An intervention program developed to provide coaches with knowledge and strategies regarding identification, management, and prevention of ED produced a significant long-term effect (at least 9 months). The intervention also shows positive effects on the coaches’ subjective evaluation of their ED knowledge.

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