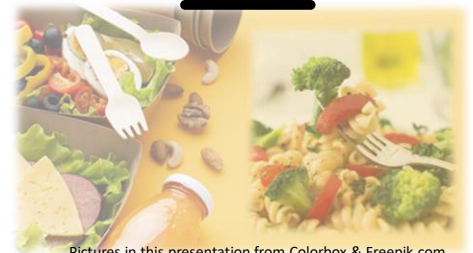
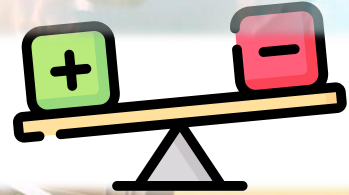


# Avoiding the REDs card

*The potential impact of Relative Energy Deficiency in Sports on athletic health and performance*



Pictures in this presentation from Colorbox & Freepik.com

MONICA KLUNGLAND TORSTVEIT

Professor in Sports Science

University of Agder, Department of Sport Science and Physical Education

The Norwegian Olympic Sports Centre, Region South

 UiA Department of Sport Science and Physical Education

NORGE

Olympiatoppen  
Ser

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## My agenda

### • **WHAT** is LEA and REDs? **Some updates**

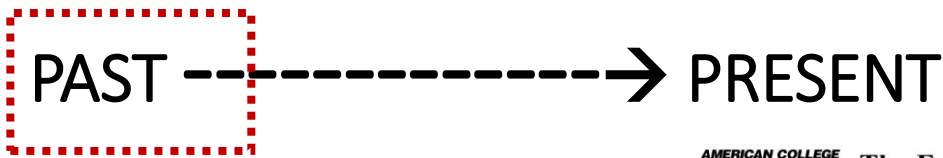
- Historical overview
- Definitions, risk factors, prevalence
- Health and performance consequences

### • **HOW** can we **prevent** REDs?

- Can sports nutrition interventions be useful?

**-> TAKE HOME!**

2



COMMENTARY

**The female athlete triad: disordered eating, amenorrhea, osteoporosis MSSE 1993**

KIMBERLY K. YEAGER, ROSEMARY AGOSTINI, AURELIA NATTIV, and BARBARA DRINKWATER

Review > Clin Sports Med. 1994 Apr;13(2):405-18. **CSM 1994**

**The female athlete triad. The inter-relatedness of disordered eating, amenorrhea, and osteoporosis**

A Nattiv<sup>1</sup>, R Agostini, B Drinkwater, K K Yeager

ACSM POSITION STAND: THE FEMALE ATHLETE TRIAD

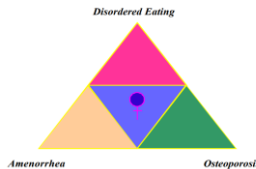
**ACSM Position Stand: The Female Athlete Triad**

Otis, Carol L. M.D., FACSM, (Chair); Drinkwater, Barbara Ph.D., FACSM; Johnson, Mimi M.D., FACSM; Loucks, Anne Ph.D., FACSM; Wilmore, Jack Ph.D., FACSM

Medicine & Science in Sports & Exercise 29(5):p i-ix, May 1997. **MSSE 1997**

**IOC Consensus Statement on the Female Athlete Triad IOC 2005**

Committee Members: Barbara L. Drinkwater, Ph.D., FACSM, Anne Loucks, Ph.D., FACSM, Roberta T. Sherman, Ph.D., FAED, Jorunn Sundgot-Borgen, Ph.D., FACSM, Ron A. Thompson, Ph.D., FAED

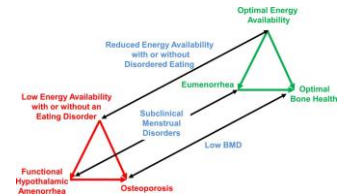


**AMERICAN COLLEGE OF SPORTS MEDICINE The Female Athlete Triad**

POSITION STAND

This pronouncement was written for the American College of Sports Medicine by Aurelia Nattiv, M.D., FACSM (Chair); Anne B. Loucks, Ph.D., FACSM; Melinda M. Manore, Ph.D., F.I.D., FACSM; Charlotte F. Sanborn, Ph.D., FACSM; Jorunn Sundgot-Borgen, Ph.D.; and Michelle P. Warren, M.D.

**MSSE 2007**



Consensus statement

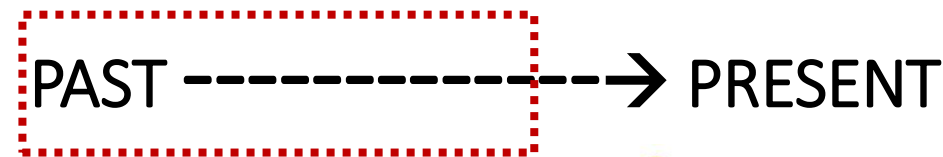
**2014 Female Athlete Triad Coalition Consensus Statement on Treatment and Return to Play of the Female Athlete Triad:**

1st International Conference held in San Francisco, California, May 2012 and 2nd International Conference held in Indianapolis, Indiana, May 2013

Mary Jane De Souza,<sup>1</sup> Aurelia Nattiv,<sup>2</sup> Elizabeth Joy,<sup>3</sup> Madhusmita Misra,<sup>4</sup> Nancy I Williams,<sup>5</sup> Rebecca J Mallinson,<sup>1</sup> Jenna C Gibbs,<sup>3</sup> Marion Olmsted,<sup>5</sup> Marc Goolsby,<sup>7</sup> Gordon Matheson,<sup>8</sup> Expert Panel

**BJSM 2014**

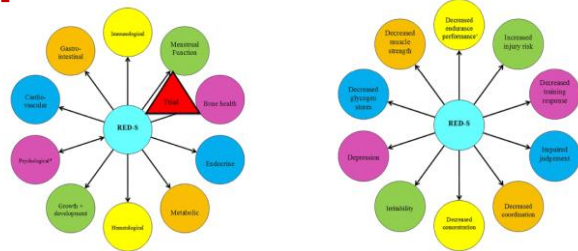
3



Consensus statement

**The IOC consensus statement: beyond the Female Athlete Triad—Relative Energy Deficiency in Sport (RED-S) BJSM 2014**

Margo Mountjoy,<sup>1</sup> Jorunn Sundgot-Borgen,<sup>2</sup> Louise Burke,<sup>3</sup> Susan Carter,<sup>4</sup> Naama Constantini,<sup>5</sup> Constance Lebrun,<sup>6</sup> Nanna Meyer,<sup>7</sup> Roberta Sherman,<sup>8</sup> Kathrin Steffen,<sup>2,9</sup> Richard Budgett,<sup>9</sup> Arne Ljungqvist<sup>9</sup>



Consensus statement

**IOC consensus statement on relative energy deficiency in sport (RED-S): 2018 update BJSM 2018**

Margo Mountjoy,<sup>1</sup> Jorunn Kaiander Sundgot-Borgen,<sup>2</sup> Louise M Burke,<sup>3,4</sup> Kathryn E Ackerman,<sup>5,6</sup> Cheri Blauwet,<sup>7</sup> Naama Constantini,<sup>8</sup> Constance Lebrun,<sup>9</sup> Bronwen Lundy,<sup>3</sup> Anna Katarina Melin,<sup>10</sup> Nanna L Meyer,<sup>11</sup> Roberta T Sherman,<sup>12</sup> Adam S Tenforde,<sup>13</sup> Monica Klungland Torstveit,<sup>14</sup> Richard Budgett<sup>15</sup>

Table 1 Relative Energy Deficiency in Sport risk assessment model for sport participation (modified from Skårved et al)<sup>16</sup>

Red triangle: relative energy deficit	Red triangle: relative energy deficit	Red triangle: relative energy deficit
<ul style="list-style-type: none"> <li>Anorexia nervosa and other serious eating disorders</li> <li>Other serious medical (psychological and physiological) conditions related to low energy availability</li> <li>Extreme weight loss techniques leading to dehydration, reduced haemoglobin, irritability and other life-threatening conditions</li> </ul>	<ul style="list-style-type: none"> <li>Prolonged abnormally low % body fat measured by DXA or anthropometry using the International Society for the Advancement of Kinanthropometry (ISAK)<sup>17</sup> or non-ISAK approach<sup>18</sup></li> <li>Substantial weight loss (5–10% body mass in 1 month)</li> <li>Attenuation of expected growth and development in adolescent athletes</li> </ul>	<ul style="list-style-type: none"> <li>Healthy eating habits with appropriate energy availability</li> </ul>
<ul style="list-style-type: none"> <li>Abnormal menstrual cycle: Risk amenorrhea &lt;4 months</li> <li>Menarche &gt;16 years</li> <li>Abnormal hormonal profile in men</li> <li>Reduced BMD (either from lumbar measurement or Z score &lt; -1 SD)</li> <li>History of 1 or more stress fractures associated with hormonal/menstrual dysfunction and/or low EA</li> </ul>	<ul style="list-style-type: none"> <li>Normal hormonal and metabolic function</li> </ul>	<ul style="list-style-type: none"> <li>Healthy BMD as expected for sport, age and ethnicity</li> <li>Healthy musculoskeletal system</li> </ul>
<ul style="list-style-type: none"> <li>Athletes with physiological/psychological complications related to low EA/disordered eating: ECG abnormalities; Laboratory abnormalities</li> <li>Prolonged relative energy deficiency</li> <li>Disordered eating behaviour negatively affecting other team members</li> <li>Lack of progress in treatment and/or non-compliance</li> </ul>		

BMD, bone mineral density; DXA, dual-energy X-ray absorptiometry; EA, fuel-energy X-ray absorptiometry; ECG, electrocardiogram; ISAK, International Society for the Advancement of Kinanthropometry

4

PAST -----> PRESENT

**2018-2023:**  
**>170 original research publications**

**... featuring ~23,822 participants (80% female)**

**... ~62% cross-sectional, ~14% longitudinal observational,  
 ~12% longitudinal intervention**

Consensus statement

2023 International Olympic Committee's (IOC) consensus statement on Relative Energy Deficiency in Sport (REDs)

Margo Mountjoy <sup>1,2</sup>, Kathryn E Ackerman <sup>3</sup>, David M Bailey <sup>4</sup>, Louise M Burke <sup>5</sup>, Naama Constantini <sup>6</sup>, Anthony C Hackney <sup>7</sup>, Ida Alisa Heikura <sup>8,9</sup>, Anna Melin <sup>10</sup>, Anne Marte Pensgaard <sup>11</sup>, Trent Stellingwerf <sup>12,8,9</sup>, Jorunn Kaiander Sundgot-Borgen <sup>12</sup>, Monica Klungland Torstveit <sup>13</sup>, Astrid Uhrenholdt Jacobsen <sup>14</sup>, Evert Verhaagen <sup>15</sup>, Richard Budgett <sup>16</sup>, Lars Engebretsen <sup>16</sup>, Ugur Erdener <sup>17,18</sup>  
 @Monica K. Torstveit

5



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Contents Volume 57 Issue 17 | BJSM September 2023

**Warm up**  
 1063 Avoiding the 'REDs Card'. We all have a role in the mitigation of REDs in athletes  
*M Mountjoy, K E Ackerman, D M Bailey, L M Burke, N Constantini, A C Hackney, I A Heikura, A Melin, A M Pensgaard, T Stellingwerf, J Sundgot-Borgen, M K Torstveit, A U Jacobsen, E Verhaagen, R Budgett, L Engebretsen, U Erdener*

**Editorials**  
 1065 REDs and the lactating athlete: an evidence gap  
*R E Deering, M L Mountjoy*  
 1066 REDs alert: male athletes be wary and scientists take action!  
*A C Hackney, A K Melin, K E Ackerman, M K Torstveit, L M Burke, M L Mountjoy*

1068 International Olympic Committee Relative Energy Deficiency in Sport Clinical Assessment Tool 2 (IOC REDs CAT2)

**Consensus statement**  
 1073 2023 International Olympic Committee's (IOC) consensus statement on Relative Energy Deficiency in Sport (REDs)  
*M Mountjoy, K E Ackerman, D M Bailey, L M Burke, N Constantini, A C Hackney, I A Heikura, A Melin, A M Pensgaard, T Stellingwerf, J K Sundgot-Borgen, M K Torstveit, A U Jacobsen, E Verhaagen, R Budgett, L Engebretsen, U Erdener*

**Reviews**  
 1098 Mapping the complexities of Relative Energy Deficiency in Sport (REDs): development of a physiological model by a subgroup of the International Olympic Committee (IOC) Consensus on REDs  
*L M Burke, K E Ackerman, I A Heikura, A C Hackney, T Stellingwerf*

1109 Review of the scientific rationale, development and validation of the International Olympic Committee Relative Energy Deficiency in Sport Clinical Assessment Tool: V2 (IOC REDs CAT2)—by a subgroup of the IOC consensus on REDs  
*T Stellingwerf, M Mountjoy, W TP McCluskey, K E Ackerman, E Verhaagen, I A Heikura*

1119 Primary, secondary and tertiary prevention of Relative Energy Deficiency in Sport (REDs): a narrative review by a subgroup of the IOC consensus on REDs  
*M K Torstveit, K E Ackerman, N Constantini, B Holzman, K Koehler, M L Mountjoy, J Sundgot-Borgen, A Melin*

1127 Intersection of mental health issues and Relative Energy Deficiency in Sport (REDs): a narrative review by a subgroup of the IOC consensus on REDs  
*A M Pensgaard, J Sundgot-Borgen, C Edwards, A U Jacobsen, M Mountjoy*

1136 Methodology for studying Relative Energy Deficiency in Sport (REDs): a narrative review by a subgroup of the International Olympic Committee (IOC) consensus on REDs  
*K E Ackerman, M A Rogers, I A Heikura, L M Burke, T Stellingwerf, A C Hackney, E Verhaagen, S Shiley, G H Saville, M Mountjoy, B Holzman*  
 @Monica K. Torstveit

1148 Best practice recommendations for body composition considerations in sport to reduce health and performance risks: a critical review, original survey and expert opinion by a subgroup of the IOC consensus on Relative Energy Deficiency in Sport (REDs)  
*T F Mathisen, T Aklund, L M Burke, N Constantini, J Hauslim, L S Macintosh, N L Meyer, M Mountjoy, G Slater, J Sundgot-Borgen*



An update on REDs: 2023 IOC Consensus Statement



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6

Review

Mapping the complexities of Relative Energy Deficiency in Sport (REDs): development of a **physiological model** by a subgroup of the International Olympic Committee (IOC) Consensus on REDs

Louise M Burke ●<sup>1</sup> Kathryn E Ackerman ●<sup>2,3,4</sup> Ida A Heikura ●<sup>5,6</sup> Anthony C Hackney ●<sup>7</sup> Trent Stellingwerf ●<sup>5,6</sup>

**REDs alert: male athletes be wary and scientists take action!**

AC Hackney ●<sup>1</sup> Anna K Melin ●<sup>2</sup> Kathryn E Ackerman ●<sup>3</sup> Monica Klungland Torstveit ●<sup>6</sup> Margo L Mountjoy ●<sup>6</sup>

Review

Intersection of **mental health issues** and Relative Energy Deficiency in Sport (REDs): a narrative review by a subgroup of the IOC consensus on REDs

Anne Marte Pensgaard ●<sup>1</sup> Jorunn Sundgot-Borgen,<sup>2</sup> Carla Edwards,<sup>3</sup> Astrid Urenholdt Jacobsen,<sup>4</sup> Margo Mountjoy ●<sup>5,6</sup>

Review

Review of the scientific **rationale, development and validation** of the International Olympic Committee Relative Energy Deficiency in Sport Clinical Assessment Tool: V.2 (**IOC REDs CAT2**)—by a subgroup of the IOC consensus on REDs

Trent Stellingwerf ●<sup>1,2</sup> Margo Mountjoy ●<sup>3,4</sup> Walter TP McCluskey,<sup>1</sup> Kathryn E Ackerman ●<sup>5</sup> Evert Verhagen ●<sup>6</sup> Ida A Heikura ●<sup>1,2</sup>

Review

Best practice recommendations for **body composition considerations** in sport to reduce health and performance risks: a critical review, original survey and expert opinion by a subgroup of the IOC consensus on Relative Energy Deficiency in Sport (REDs)

Therese Fostervold Mathisen ●<sup>1</sup> Timothy A Naama Constantini ●<sup>2</sup> Judith Haudum,<sup>3</sup> Li Nanna L Meyer ●<sup>7</sup> Margo Mountjoy ●<sup>8,9</sup> Jorunn Sundgot-Borgen ●<sup>11</sup>

Review

Primary, secondary and tertiary **prevention** of Relative Energy Deficiency in Sport (REDs): a narrative review by a subgroup of the IOC consensus on REDs

Monica Klungland Torstveit ●<sup>1</sup> Kathryn E Ackerman ●<sup>2</sup> Naama Constantini ●<sup>3</sup> Bryan Holtzman,<sup>2</sup> Karsten Koehler ●<sup>4</sup> Margo L Mountjoy ●<sup>5</sup> Jorunn Sundgot-Borgen ●<sup>6</sup> Anna Melin ●<sup>7</sup>

Review

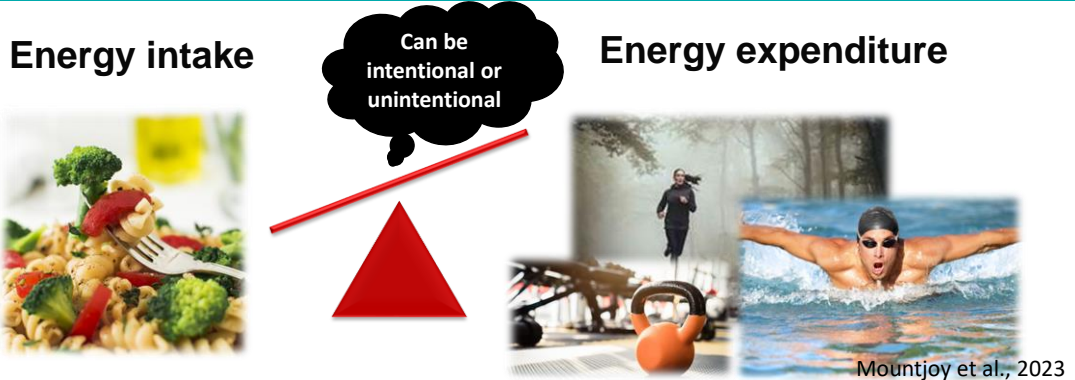
**Methodology** for studying Relative Energy Deficiency in Sport (REDs): a narrative review by a subgroup of the International Olympic Committee (IOC) consensus on REDs

Kathryn E Ackerman ●<sup>1</sup> Margot Anne Rogers ●<sup>2,3</sup> Ida A Heikura ●<sup>4,5</sup> Louise M Burke ●<sup>6</sup> Trent Stellingwerf ●<sup>4,5</sup> Anthony C Hackney ●<sup>7</sup> Evert Verhagen ●<sup>8</sup> Stacey Schley ●<sup>1</sup> Grace H Saville ●<sup>1</sup> Margo Mountjoy ●<sup>9,10</sup> Bryan Holtzman<sup>11,12</sup>

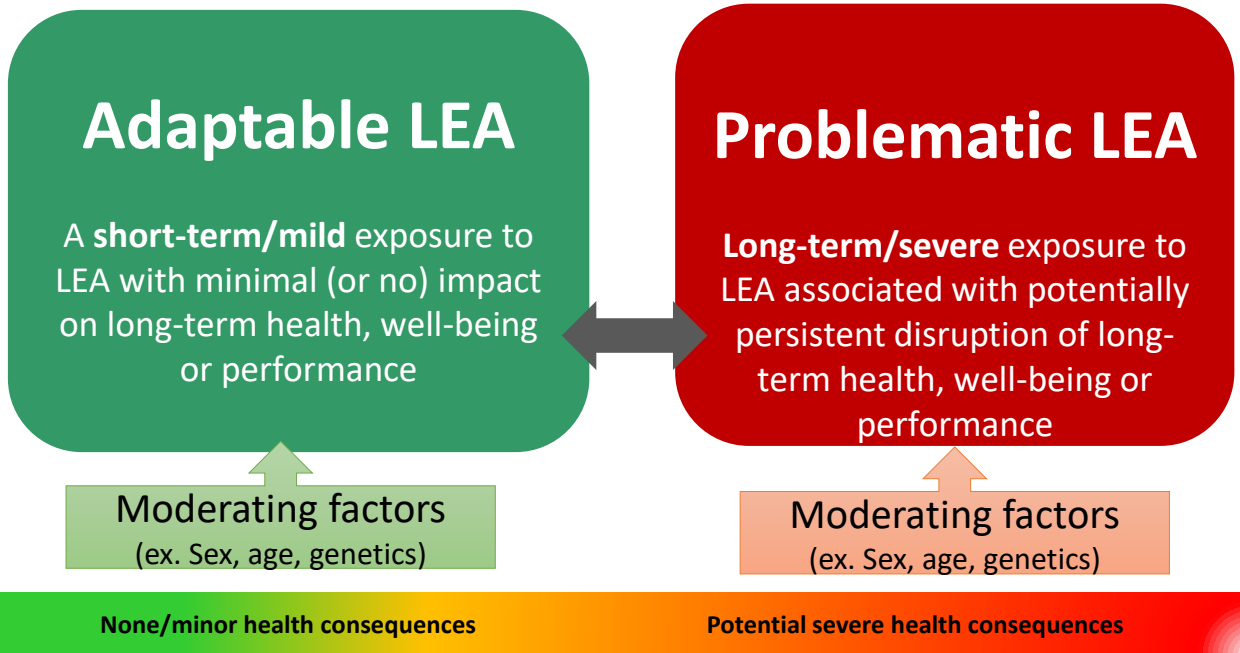
7

## Low Energy Availability (LEA)

LEA is a **mismatch** between EI & EEE that leaves the body's total energy needs unmet, i.e., there is **inadequate energy to support the functions required** by the body to maintain optimal health and performance

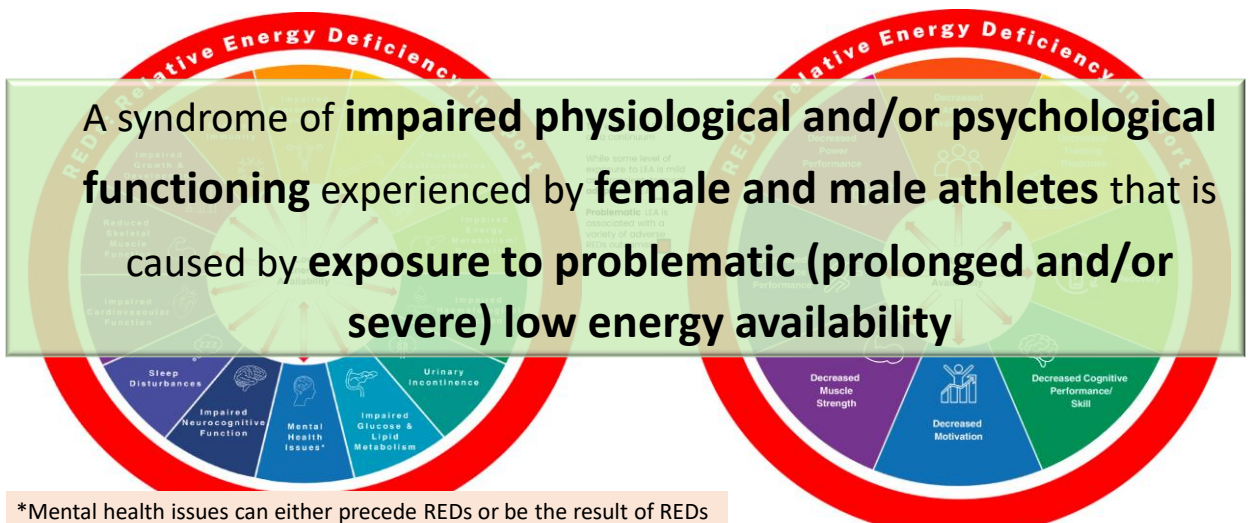


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9

## Relative Energy Deficiency in Sport (REDs) Conceptual models

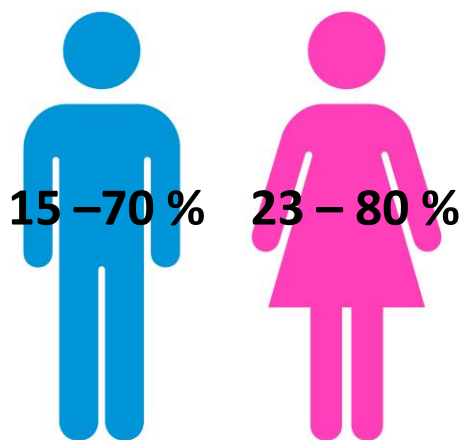


### Potential health- and performance aspects of LEA

Mountjoy et al., 2023

10

## High prevalence of LEA/REDs indicators!



Increased risk:  
Endurance sports,  
aesthetical sports,  
weight-class sports

(BUT – we find it also in ball  
game sports, technical sports  
and power sports)

*... across a variety of sports due to the lack of a singular definitive diagnosis, mistaken use of LEA and REDs as interchangeable terms, lack of standardisation and accuracy of research methodologies, variation in physiological demands among the study populations and participant study volunteering biases*

Mountjoy et al., 2023

11

Received: 23 December 2022 | Revised: 27 January 2023 | Accepted: 1 February 2023  
DOI: 10.1111/sms.14327

SPECIAL ISSUE ARTICLE

WILEY

#### 4 | CONCLUSION

### Direct and indirect impact of low energy availability on sports performance

Anna K. Melin<sup>1</sup> | José L. Areta<sup>2</sup> | Ida A. Heikura<sup>3,4</sup> | Trent Stellingwerf<sup>3,4</sup> |  
Monica Klungland Torstveit<sup>5</sup> | Anthony C. Hackney<sup>6</sup>

**IMPAIRED PERFORMANCE!**

In conclusion, more research needs to be done to fully understand the effects of LEA on different physiological systems and how the interplay of these may ultimately affect physical capacity and athletic performance. Severe LEA exposure has the potential to be a serious problem leading to impaired sports performance, most likely mediated through direct/indirect health effects, hormonal alterations, and suboptimal levels of energy substrate (i.e., muscle glycogen). Therefore, athletes who desire to optimize BM and body composition (and use LEA to achieve those goals) to improve competitive performance should emphasize the use of well-planned and supervised gradual weight-loss methodologies with moderate LEA exposure to maintain health and performance. These athletes should also have baseline medical and psychological assessment to ascertain whether there is undue risk to even undertake BM or body composition changes. That said, the coach and athlete support team (e.g., physiotherapist, physician) must remain vigilant of the athletes' responses and health status to ensure the prevention of REDs.

12

**Of note 1:****Time Course**

- Muscle glycogen
- Protein synthesis
- Bone metabolic markers
- LH pulsatility
- T3
- RMR
- Mood and sleep disturbances
- Drive for thinness

**Short-term**  
(days to weeks)

**Medium-term**  
(weeks to months)

- Haemoglobin mass
- Training adaptation/performance
- Menstrual disturbances
- Total and LDL cholesterol
- GI dysfunction
- Reduced well-being
- DE behaviour

- Low BMD
- Increased frequency and risk of BSI
- Exercise dependence
- EDs
- Depressive symptoms

**Long-term**  
(months to years)

LEA origin, duration, dose and presence of moderating factors: sex, age, medical history, carbohydrate intake, nutritional status etcetera are likely to amplify or diminish the response

Mountjoy et al. 2023; Slide Anna Melin

13

**Of note 2:**

## The magnifying impact of LCA (Low Carbohydrate Availability) in the context of REDs

- ✓ Six studies since 2019 have shown an energy independent and/or magnifying impact of LCA in the accelerated development of REDs outcomes

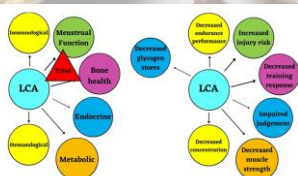


Figure 2. Low carbohydrate availability (LCA) has independent and/or compounding effects on these health (left) and performance (right) consequences, illustrated in the RED-5 model, due to LEA.



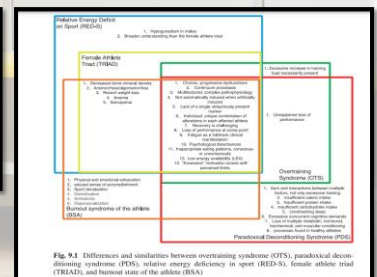
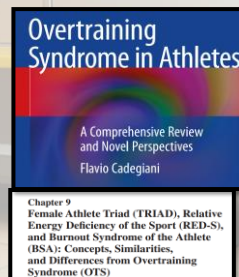
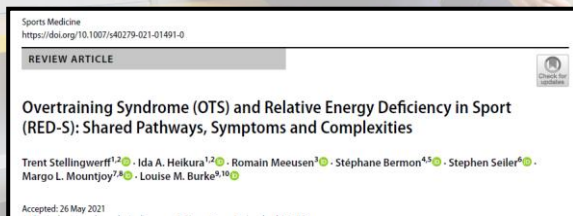
@Monica K. Torstveit

14

## Of note 3:

### Symptomology overlap between REDs and OTS (overtraining syndrome)

- ✓ REDs and OTS are syndromes involving the HPA axis and have no single validated diagnostic biomarker; they feature a complex overlap of symptoms



@Monica K. Torstveit

15

## My agenda

### • **WHAT** is LEA and REDs? **Some updates**

- Historical overview
- Definitions, risk factors, prevalence
- Health and performance consequences

### • **HOW** can we **prevent** REDs?

- Can sports nutrition interventions be useful?

**-> TAKE HOME!**

16



# Primary, secondary and tertiary prevention of Relative Energy Deficiency in Sport (REDs): a narrative review by a subgroup of the IOC consensus on REDs

Monica Klungland Torstveit <sup>1</sup>, Kathryn E Ackerman <sup>2</sup>, Naama Constantini <sup>3</sup>,  
 Bryan Holtzman <sup>2</sup>, Karsten Koehler <sup>4</sup>, Margo L Mountjoy <sup>5</sup>,  
 Jorunn Sundgot-Borgen <sup>6</sup>, Anna Melin <sup>7</sup>

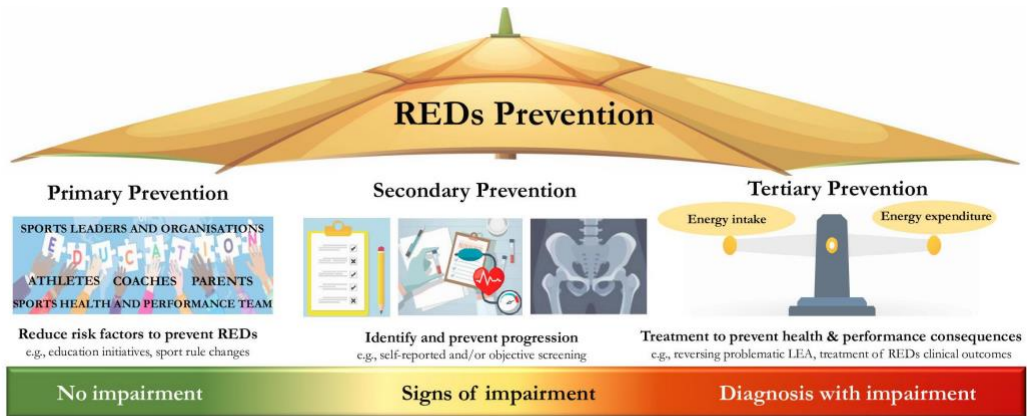
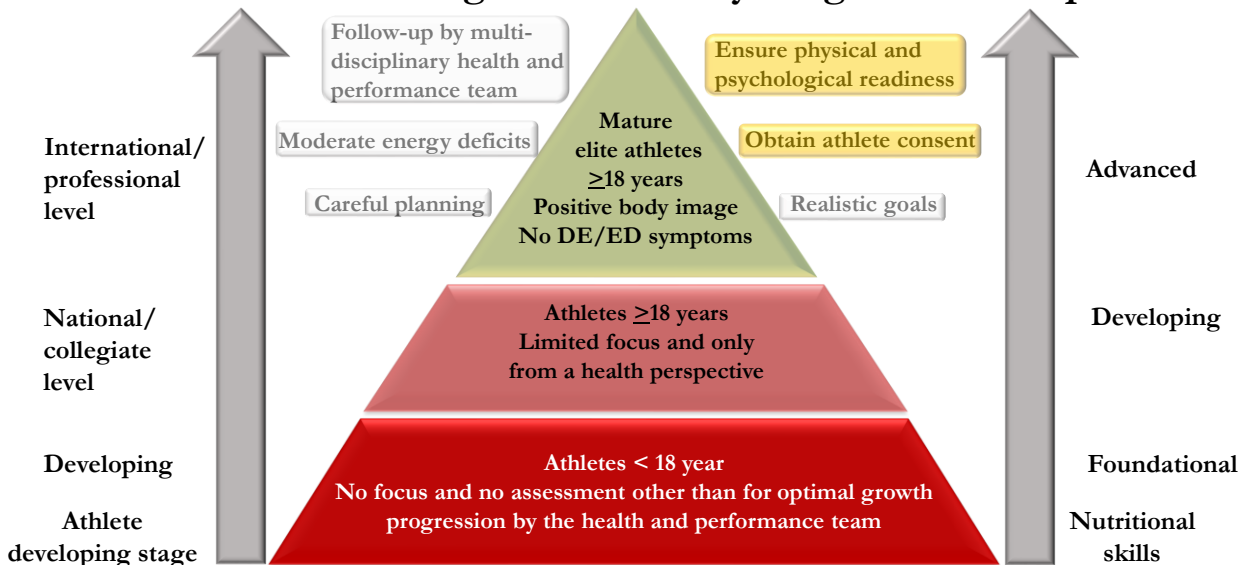


Figure 1 A primary, secondary and tertiary prevention model of Relative Energy Deficiency in Sport (REDs). Pictures from pixabay.com. @Monica K. Torstveit

17

## Assessment and management of body weight and -composition

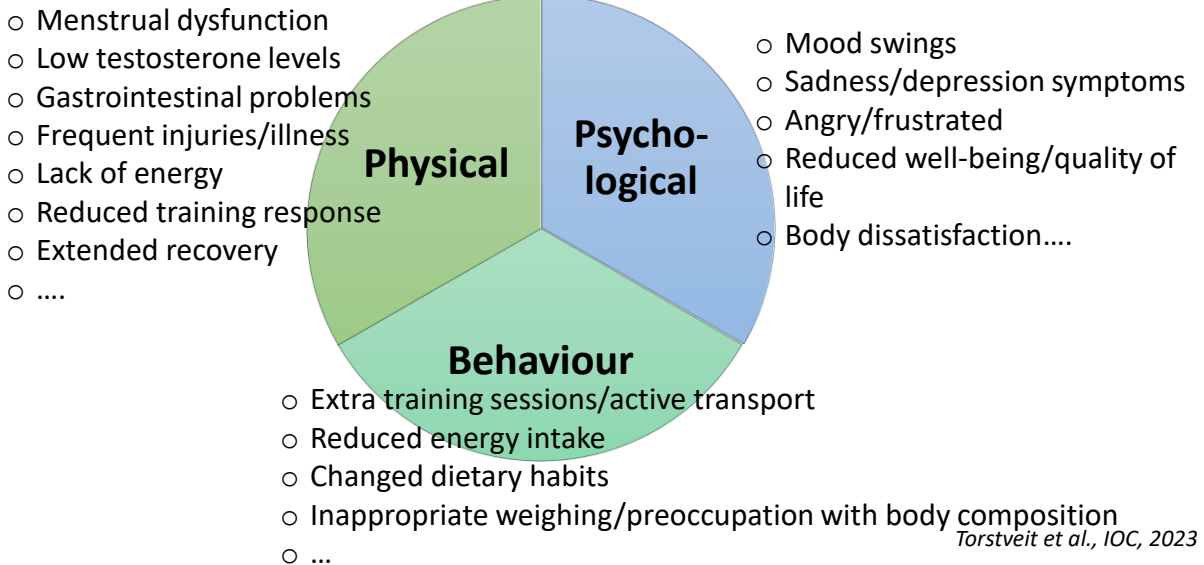


Torstveit et al. Br J Sports Med 2023; Mathisen et al. Br J Sports Med 2023, Mountjoy et al. Br J Sports Med 2023

Slide: Anna Melin

18

# What should I look for?



19

## Treatment of problematic LEA

**Increase energy intake and/or decreasing exercise energy expenditure**

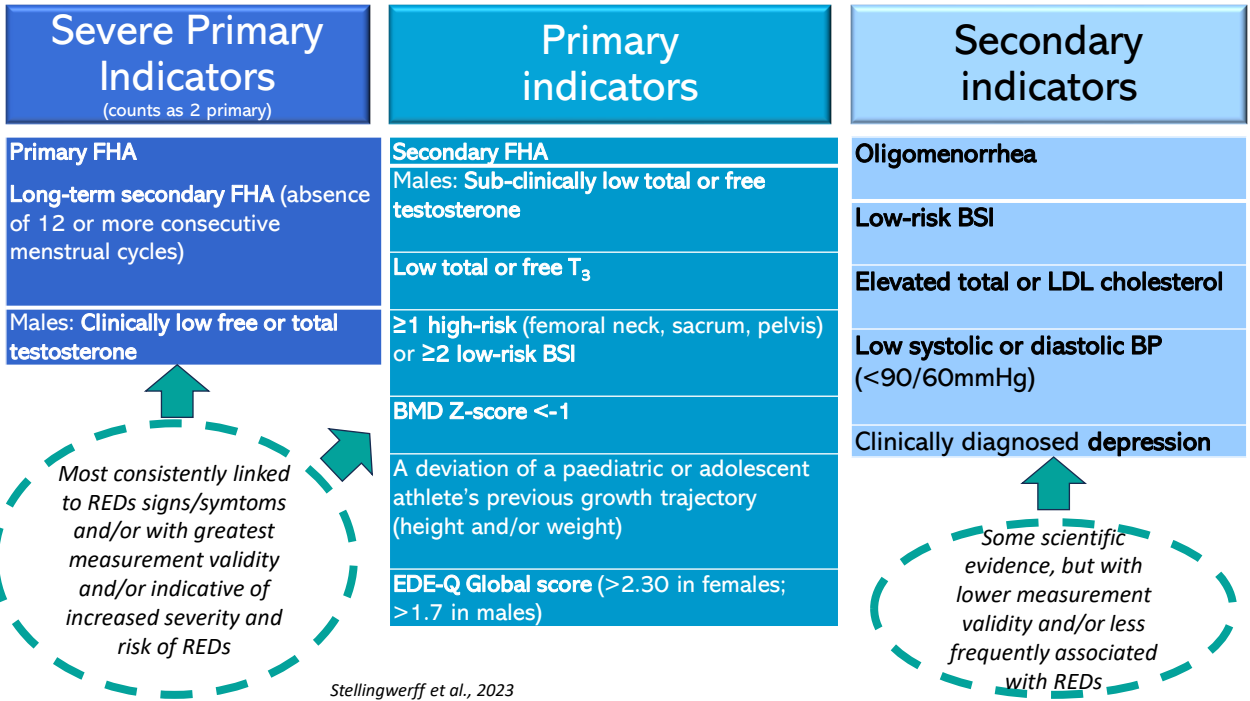
- Eating practices that meet the athletic **physical and mental health needs**
- Increased **energy density**
- Improved **within-day energy balance, timing of meals and macronutrients**
- **Flexibility** around eating and thoughts about food
- Ability to **eat socially**
- **No restrictive or rigid behaviours**; avoidance of food groups etc.



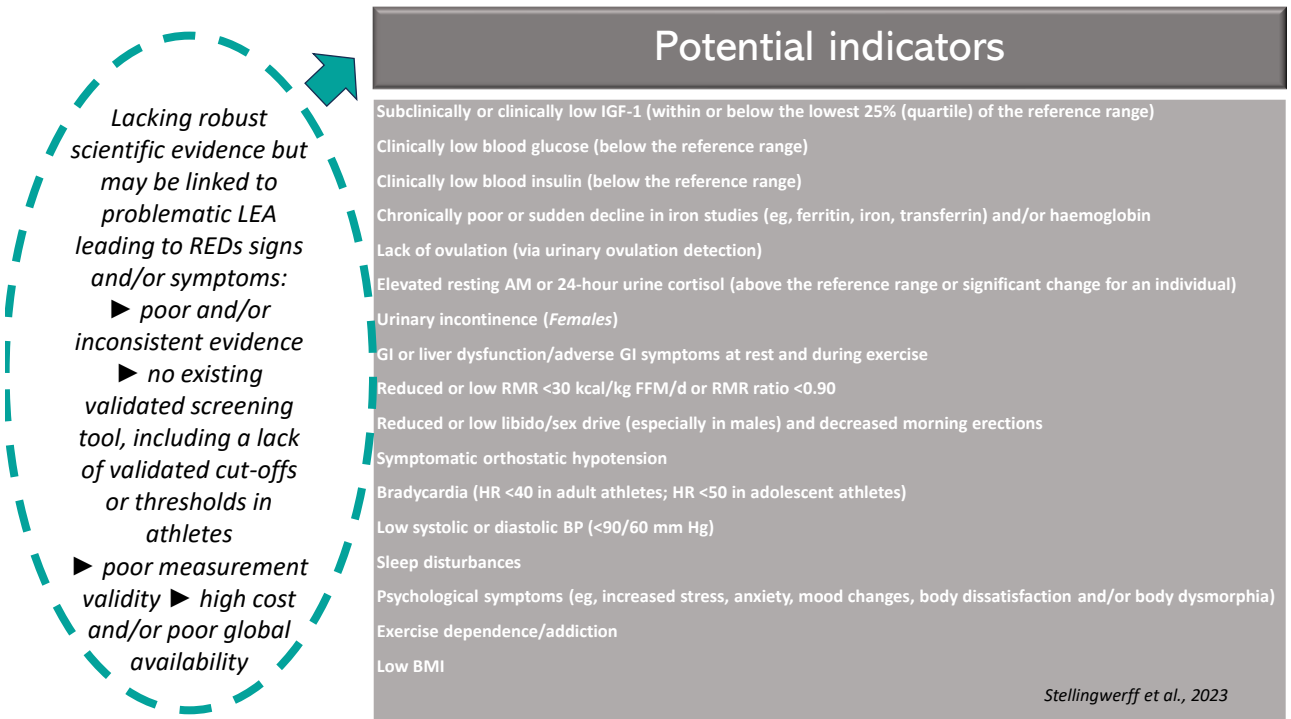
e.g., Melin et al., 2015; Fahrenhotz et al., 2017; Wells et al., 2020

Slide: Anna Melin

20



21



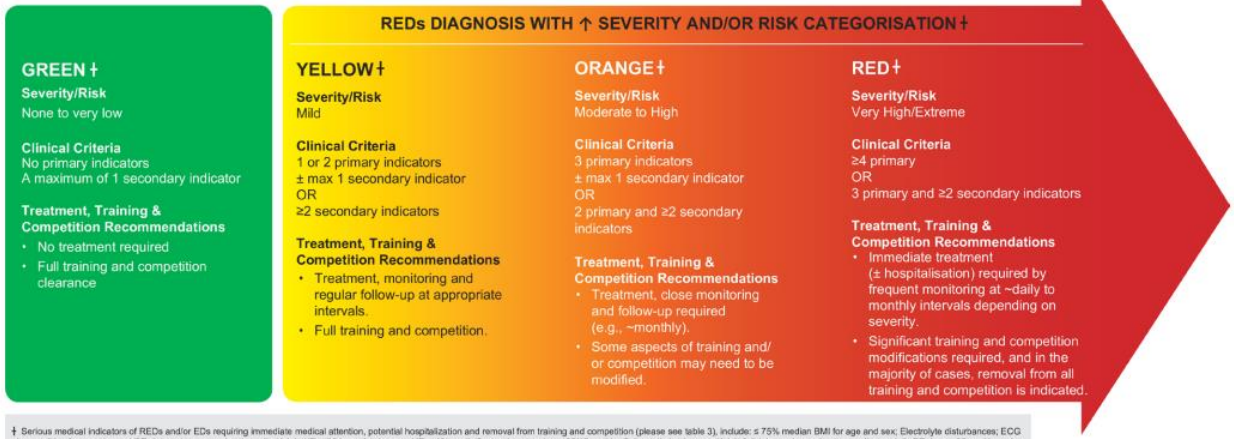
22

# IOC REDs CAT2 Severity/Risk stratification with sport participation guidelines



For use by medical professional only

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Examiner: \_\_\_\_\_



Mountjoy et al., 2023; Stellingwerff et al., 2023

23

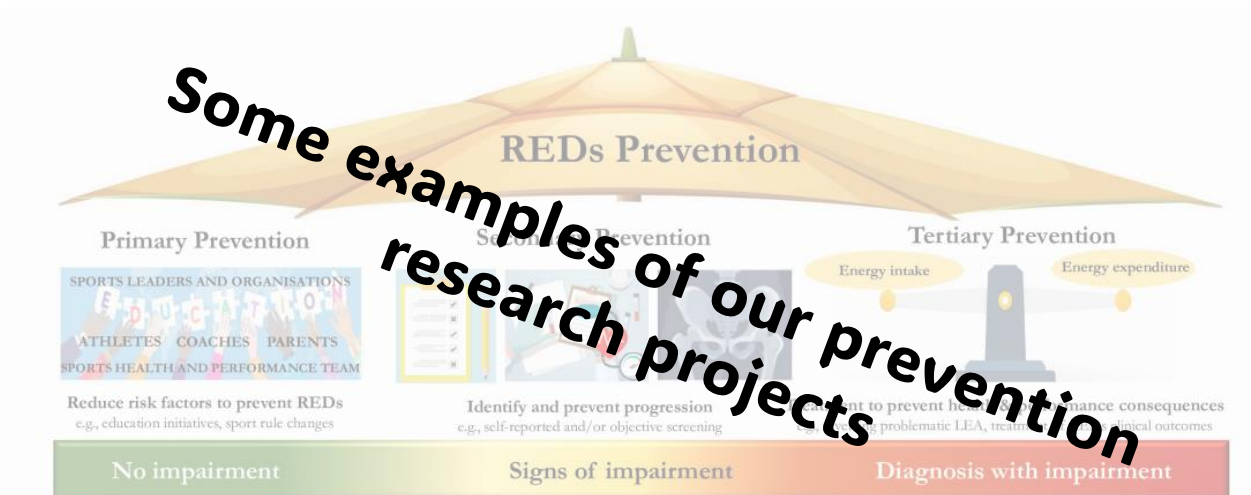
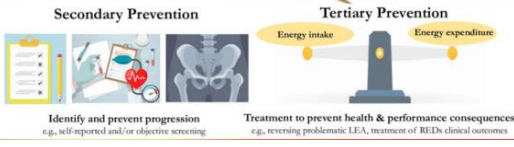


Figure 1 A primary, secondary and tertiary prevention model of Relative Energy Deficiency in Sport (REDs). Pictures from pixabay.com.

24



**Aim:** To develop and evaluate a 16-week **sports nutrition education and counselling program** aiming to improve nutrition knowledge, energy availability and REDs outcomes in well-trained female endurance athletes with risk of REDs

**FUEL** Food and nUtrition for Endurance athletes – a Learning program  
@Monica K. Torstveit

25

<p><b>Ida Lysdahl Fahrenholtz</b></p> <p>PhD student, University of Agder FUEL coordinator</p>	<p><b>Monica Klungland Torstveit</b></p> <p>Overall project leader &amp; main supervisor, University of Agder/Olympiatoppen region South</p>	<p><b>Ina Garthe</b></p> <p>Co-supervisor and responsible for execution of the Norwegian intervention, Olympiatoppen</p>	<p><b>Anna K. Melin</b></p> <p>Co-supervisor and responsible for the Swedish cohort, Linnæus University</p>				
<p><b>Bård Erlend Solstad</b></p> <p>Responsible for the qualitative part, University of Agder</p>	<p><b>Siri Marte Hollekim-Strand</b></p> <p>Responsible for developing the nutrition counselling, FUEL counsellor, NTNU/Olympiatoppen</p>	<p><b>Karsten Köhler</b></p> <p>Responsible for the German cohort, Technical University of Munich</p>	<p><b>Paulina Wasserfurth</b></p> <p>Responsible for the German cohort, FUEL counsellor, Technical University of Munich</p>	<p><b>Sharon Madigan</b></p> <p>Responsible for the Irish cohort, FUEL counsellor, Sport Ireland Institute</p>	<p><b>Danielle Logue</b></p> <p>Responsible for the Irish cohort, FUEL counsellor, Sport Ireland Institute</p>	<p><b>Maria Gråfnings</b></p> <p>Responsible for the recruitment of Swedish participants, Dalarna University</p>	
<p><b>Finn Skårderud</b></p> <p>Medical responsible, Villa sult/University of Agder</p>	<p><b>Ingvild Brattekleiv</b></p> <p>Master student, University of Agder</p>	<p><b>Miriam Myhren Bouchleh</b></p> <p>Master student, University of Oslo</p>	<p><b>Kristin Lundestad</b></p> <p>FUEL counsellor, Olympiatoppen</p>	<p><b>Heidi Holmlund</b></p> <p>FUEL counsellor, Olympiatoppen</p>	<p><b>Josefine Dahlqvist</b></p> <p>FUEL counsellor, sports dietitian</p>	<p><b>Petra Lundström</b></p> <p>FUEL counsellor, sports dietitian</p>	<p><b>Sara Rang</b></p> <p>FUEL counsellor, sports dietitian</p>

26

# Participants

**Competitive female endurance athletes, 18-35 y, LEAF-Q  $\geq$  8**

- ✓ training  $\geq$  5 times a week (tier 3-4)
- ÷ eating disorders
- ÷ chronic disease
- ÷ hormonal contraceptives

All educational material translated into the four languages

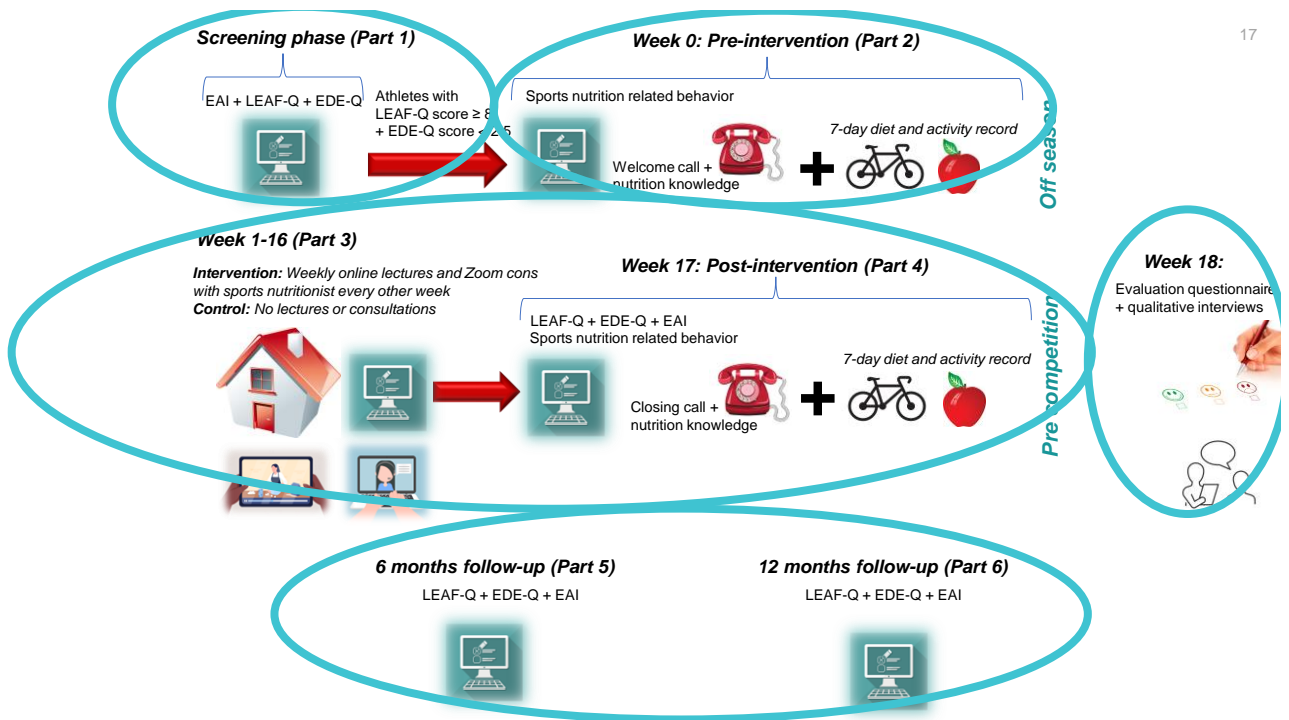
N= 33 athletes



Fahrenholtz et al. 2022

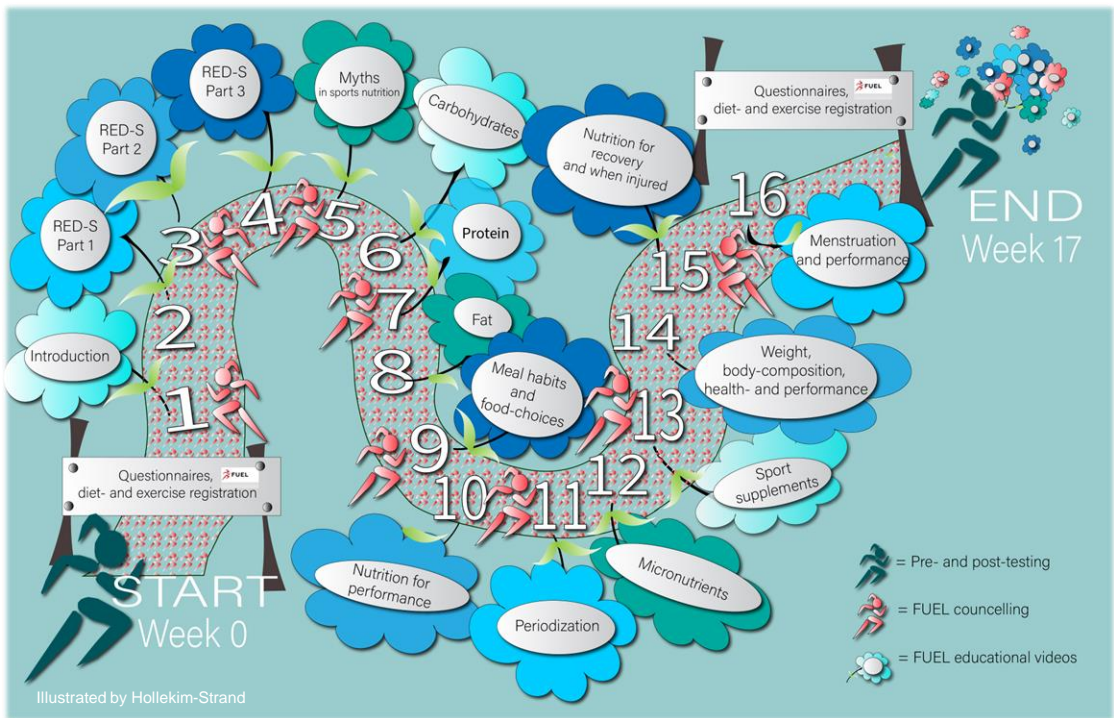
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27



17

28



29

**nutrients** MDPI

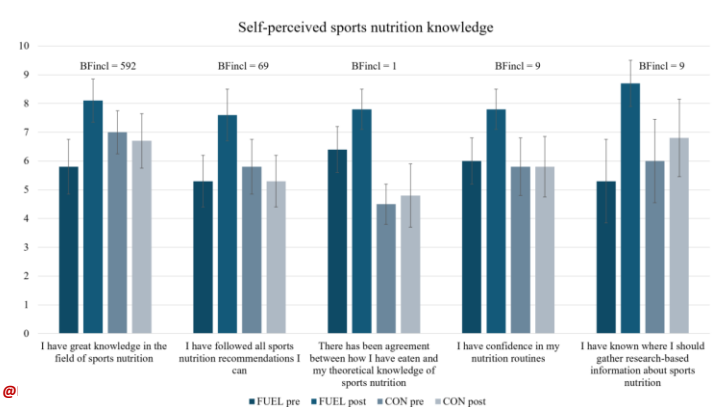
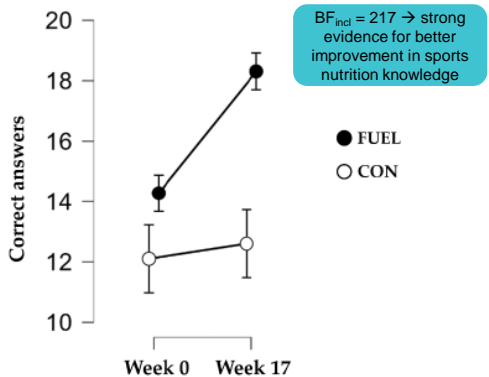
Article  
**Effects of a 16-Week Digital Intervention on Sports Nutrition Knowledge and Behavior in Female Endurance Athletes with Risk of Relative Energy Deficiency in Sport (REDS)**

Ida L. Fahrenholtz <sup>1,\*</sup>, Anna K. Melin <sup>2,†</sup>, Ina Garthe <sup>3</sup>, Siri Marte Hollekim-Strand <sup>4</sup>, Andreas Ivarsson <sup>1,5</sup>, Karsten Koehler <sup>4</sup>, Danielle Logue <sup>7</sup>, Petra Lundström <sup>8,9</sup>, Sharon Madigan <sup>7</sup>, Paulina Wasserfurth <sup>6</sup> and Monica K. Torstveit <sup>1</sup>

**Strong evidence that the FUEL intervention improved sports nutrition knowledge**

**Modest improvements in dietary behavior**

**Conclusion: the FUEL intervention shows promise as a foundation for behavior change in female endurance athletes at risk of REDS**



30

# In this group of endurance athletes, participating in the FUEL intervention implies long-term improvement of REDs related symptoms, including menstrual function

In addition, we found moderate evidence for improved disordered eating and strong evidence for improved exercise addiction symptoms

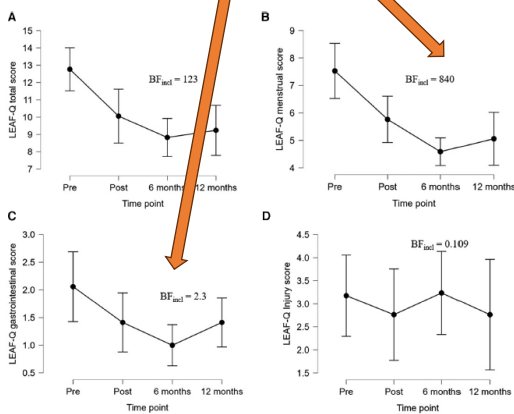


FIGURE 3 Changes in LEAF-Q (A) total score, (B) menstrual score, (C) gastrointestinal score, and (D) injury score for the FUEL athletes at pre- and post-intervention, and at 6- and 12-months follow-up. Data are presented as mean and 95% credible intervals.  $BF_{incl}$ , bayes factor for inclusion of time interaction; LEAF-Q, low energy availability in females questionnaire.

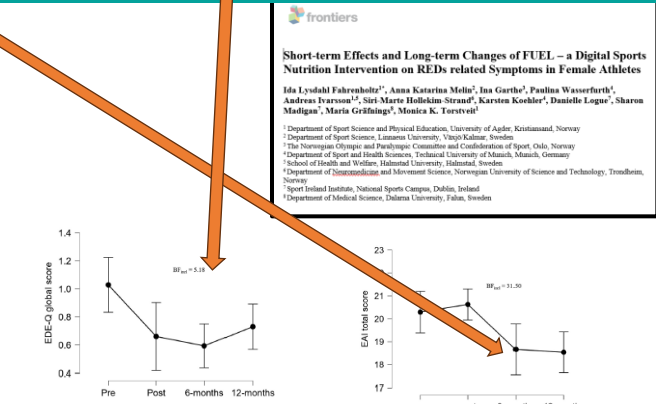


FIGURE 4 Eating disorder examination questionnaire global score for the FUEL athletes at pre- and post-intervention, and at 6- and 12-months follow-up. Data are presented as mean and 95% credible intervals.  $BF_{incl}$ , bayes factor for inclusion of time interaction; EDE-Q, eating disorder examination questionnaire.

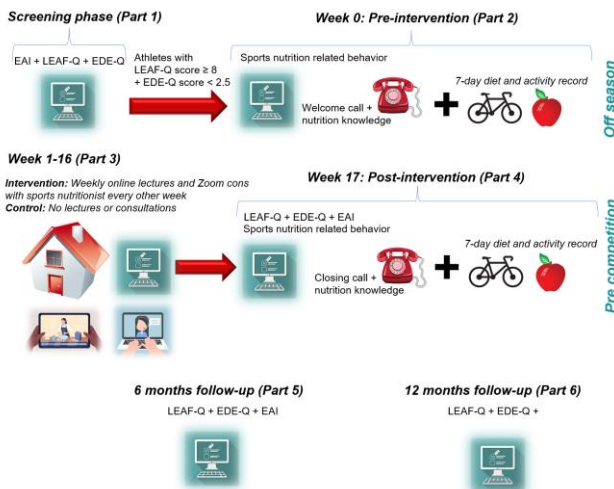
FIGURE 5 Exercise addiction inventory total score for the FUEL athletes at pre- and post-intervention, and at 6- and 12-months follow-up. Data are presented as mean and 95% credible intervals.  $BF_{incl}$ , bayes factor for inclusion of time interaction; EAI, exercise addiction inventory.

frontiers  
**Short-term Effects and Long-term Changes of FUEL – a Digital Sports Nutrition Intervention on REDs related Symptoms in Female Athletes**  
 Ida Lydahl Fahrenholtz<sup>1</sup>, Anna Katarina Melin<sup>2</sup>, Ina Garthe<sup>3</sup>, Paulina Wasserfirth<sup>4</sup>, Andreas Ivarsson<sup>5</sup>, Siri Marie Holvikim Strand<sup>6</sup>, Karsten Koehler<sup>7</sup>, Danielle Logue<sup>8</sup>, Sharon Madigan<sup>9</sup>, Maria Grönblom<sup>1</sup>, Monica K. Torstveit<sup>1</sup>

<sup>1</sup> Department of Sport Science and Physical Education, University of Agder, Kristiansand, Norway  
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<sup>3</sup> The Norwegian Olympic and Paralympic Committee and Confederation of Sport, Oslo, Norway  
<sup>4</sup> Department of Sport and Health Sciences, Technical University of Munich, Munich, Germany  
<sup>5</sup> School of Health and Welfare, Halmstad University, Halmstad, Sweden  
<sup>6</sup> Department of Neuroanatomy and Movement Science, Norwegian University of Science and Technology, Trondheim, Norway  
<sup>7</sup> Sport Ireland Institute, National Sports Campus, Dublin, Ireland  
<sup>8</sup> Department of Medical Science, Dalarna University, Falun, Sweden

31

39



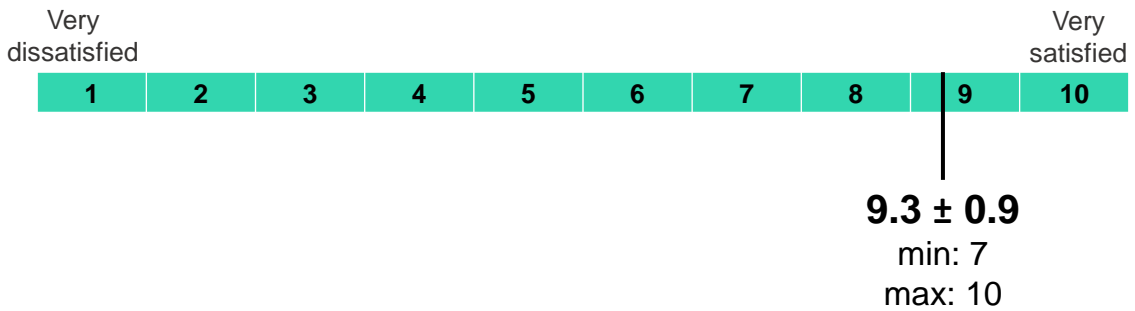
Solstad, B.E., Fahrenholtz, I.L., Melin, A., Garthe, I., Torstveit, M.K.  
**Participants' Experiences of an Online Nutrition Intervention Designed for Female Endurance Athletes with risk of Relative Energy Deficiency in Sport: A Mixed Method Assessment. Soon to be submitted**



32



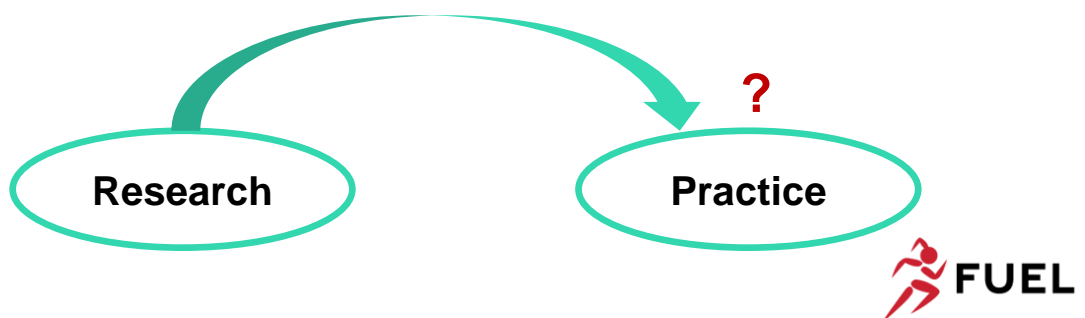
## Overall satisfaction for participating in FUEL



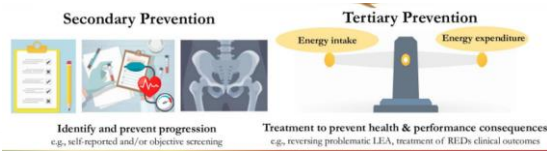
33

Would you recommend the FUEL program to other female endurance athletes?

→ All participants answered YES



34



Maria Gräfings



PhD student, University of Basel

**Supervisors:**  
Arno Schmidt-Trucksäss,  
Anna Melin &  
Monica K Torstveit

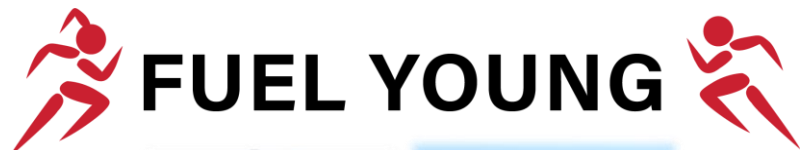


## Aims:

1. To implement and evaluate whether the FUEL 2.0 will change sports nutrition knowledge, nutrition behavior, and health- and performance aspects among **female and male elite biathletes, cross-country skiers and ski jumpers** with or without REDs
2. To evaluate whether the educational sports nutrition program will change sport nutrition knowledge and prevention strategies related to REDs among the participating athletes' **coaches, medical doctors, and physiotherapists**

**Status:** FUEL 2.0 has been successfully implemented in the biathlon, cross-country skiing and ski jumping national teams

35



*A pilot project*

**Aim:** To develop and evaluate an **8-week e-learning program** aiming to **improve sport nutrition- and recovery knowledge, and well being and performance** in high-school athletes

**Status:** Data from 106 adolescent athletes have been collected and are currently being analyzed

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36

## Take home messages

- Problematic LEA often leads to REDs
- All athletes, independent of sex, age, sport or disability can develop LEA and REDs
- LEA is difficult to measure
- REDs often manifests as cluster of symptoms
- Carbohydrates may play a role
- Important to distinguish between OTS and REDs
- REDs CAT 2 is a relevant tool for diagnosing REDs
- Primary, secondary and tertiary prevention is key!
  - Sport nutrition interventions may be one tool in the toolbox

