


# How can we better engage female athletes? A novel approach to health and performance education in adolescent athletes

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## ABSTRACT

**Objectives** To evaluate the impact of a video series versus online pamphlets/blog posts on Female Athlete Triad (Triad) and Relative Energy Deficiency in Sport (REDs) knowledge in high school female runners.

**Methods** Runners from 10 US schools were cluster-randomised into groups to either watch videos or read pamphlets on Triad/REDs, nutrition, menstrual cycle, bone health and mental health. Changes in knowledge and interest were assessed using generalised estimating equations.

**Results** Forty-five runners were in the video intervention group (mean age=16.0) and 39 in the control (mean age=15.7). Both groups showed knowledge gains for all topics, except for mental health, where knowledge was already high. The intervention group's knowledge increase (means=75.7 and 93.3) was not significantly higher than the control's (means=77.9 and 93.6) ( $p=0.149$ ). However, the intervention group had stronger scores on behavioural impact, information novelty and interest (means=3.77, 3.93 and 4.14) compared with the control's (means=3.36, 3.48 and 3.52) ( $p\leq 0.05$ ,  $p\leq 0.05$  and  $p\leq 0.001$ ).

**Conclusion** Both videos and pamphlets improved knowledge of Triad/REDs and female athlete science, however videos had a greater influence on athletes' engagement and behavioural intentions.

## INTRODUCTION

Female athletes are still under-represented in sports research—in more than 5000 manuscripts published in six sports medicine and exercise science journals, 34% of the participants were women, and only 6% of the publications exclusively studied female athletes.<sup>1</sup> Currently, the field of female athlete research is growing, with strong efforts to counter under-representation. Similar efforts are needed to translate this growing body of research, so that athletes, parents and coaches can better access evidence-based sports science. Previous studies have shown that widespread knowledge of the Female

### WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ High school female athletes have low knowledge of the Female Athlete Triad (Triad) and Relative Energy Deficiency in Sport (REDs), and few educational interventions discuss both concepts in an engaging format driven by role models.

### WHAT THIS STUDY ADDS

⇒ Both videos and online handouts significantly increased Triad, REDs, and health and performance knowledge, however the videos better captivated the interest and engagement of high school female athletes.

### HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE, OR POLICY

⇒ Future efforts should explore engaging methods to deliver female athlete science and should consider using compelling storytelling from a diverse range of athletes and experts.

Athlete Triad (Triad) in high school athletes and coaches is low.<sup>2,3</sup>

The Triad is the inter-relationship of low energy availability with or without disordered eating, menstrual dysfunction and low bone mineral density (BMD).<sup>4</sup> When queried about the Triad across three studies, high school athletes answered less than 50% of questions correctly.<sup>3,5,6</sup> Despite low knowledge on the Triad, the Triad is a common syndrome seen in high school athletes. In a cross-sectional survey of 78 international and US high school athletes, more than 50% were categorised as moderate or high risk on the Female Athlete Triad Cumulative Risk Assessment.<sup>7</sup>

Studies are assessing ways to improve Triad knowledge through translational research. A study in female high school athletes assessed changes in Triad knowledge after participation in a 10 min video featuring expertise from registered dietitians, athletes and coaches.<sup>8</sup> In this study, postintervention Triad

knowledge was significantly higher in the intervention group compared with the control group. Studies have also examined digital interventions centred around improving knowledge on Relative Energy Deficiency in Sport (REDs), which includes multiple physical and mental health consequences related to low energy availability.<sup>9</sup> A 16-week online lecture and individual athlete-centred nutritional counselling intervention improved REDs sports nutrition knowledge in female endurance athletes compared with a control group but had weak evidence for improving dietary behaviours.<sup>10</sup>

Despite the success of prior Triad and REDs interventions, to-date, no studies have combined Triad and REDs education. Furthermore, no studies have expanded Triad and REDs education to include other important female athlete science topics such as fuelling, the menstrual cycle, bone health and mental health, presented within the context of improving performance and optimising athletic longevity. Given that understanding female athlete science is a paramount first step for preventing Triad and REDs endpoints, it is important to enhance both knowledge and behavioural patterns among high school female runners. We believe that discussing both the Triad and REDs and highlighting the relationship between Triad/REDs and female athlete science topics might help athletes grasp the importance of adequate fuelling and treating their bodies well for long-term health and performance. To test this, we designed a female athlete science educational programme that was engaging, fun and informative, using compelling storytelling from a diverse range of athletes and experts.

The aim of this study was to evaluate the role of a five-part video module series in improving Triad/REDs and female athlete science knowledge in female high school runners compared with a control group accessing online educational materials covering the same topics. The five modules covered Triad/REDs fundamentals, nutrition principles, bone health, the menstrual cycle and mental health. Each video module contained animated education sections and inspirational stories from interviews of professional athletes or role models. Our primary hypothesis was that the video intervention group would gain more knowledge than the control group and our secondary hypothesis was that the video intervention group would receive higher ratings of capturing interest, impacting behaviour and providing new information than the control group. Finally, we wanted to understand how athletes in this study were acquiring health information to determine how to best share our video module series to the general population after study completion.

## METHODS

### Study population

The study population consisted of high school varsity and junior varsity female track and field athletes. To be eligible, participants had to be 14–18-year-old gender-identifying women or nonbinary individuals enrolled in

high school and members of their high school's varsity or junior varsity cross-country teams in fall 2022.

Athletes were recruited from 10 geographically diverse high schools across the USA, which were identified through recruiting emails sent to coaching organisations including the Women's Running Coaches Collective and the Positive Coaching Alliance as well as social media recruitment on Instagram and Twitter. We worked with coaches to set up 15 min informational Zoom sessions on study procedures. Athlete and parent email addresses were obtained from the coaching staff to send out follow-up recruiting information over email. Enrolment was optional and was not required for team participation or competition. Each participant provided informed written consent. All athletes were compensated with a US\$30 gift card for participation in the study and completion of all the modules. For athletes under age 18, parents first completed the consent form, and the athlete completed the assent form. The study was approved by Stanford University's institutional review board (IRB) (IRB#62042). Participants and the public were not involved in the design, reporting or translation of this research.

### Randomisation

We used matched-pair cluster randomisation to assign participants to the intervention and control groups, with the high school serving as the unit of randomisation. Prior to recruiting athletes, we asked coaches to share the number of athletes they had on their cross-country team. We assigned high schools to intervention and control groups based on team size, matching teams with equal or relatively equal athlete numbers. After pair matching, teams were randomly assigned to either the control or intervention study arm via the REDCap randomisation tool.

### Study procedures

All study participants were assigned a study ID for deidentified engagement and completed an online Qualtrics survey at baseline. Validated surveys including the dietary restraint and pathologic behaviour sections of the Eating Disorder Examination Questionnaire<sup>11</sup> and the Low Energy Availability in Females Questionnaire<sup>12</sup> were included in the survey. Additional questions assessed injury and medical history, prior sports participation and current training regimen (online supplemental appendix 1).

### Intervention group procedures

The intervention group was assigned to watch five educational video modules over the course of a week. Participants would log into our study website with an assigned study ID/password to access the videos and could view the videos on their own schedule, including in a back-to-back format if best for their time. Participants were sent up to three reminder emails if they had outstanding readings or materials left to complete. These

videos ranged from 7 min to 10 min long and were created to educate athletes on important topics related to female athlete health and well-being. The videos contained: (1) an opening inspirational quote by a professional athlete or role model in sport to introduce the topic, (2) a lesson on the science, terminology and research on the topic from physicians and experts in the field and (3) interviews from professional athletes and role models in sport who elaborate on their own journey and experiences.

Video 1, 'The Female Athlete Triad and REDs', discusses the purpose of the modules and provides an overview of low energy availability and how it serves as the foundation of Triad/REDs outcomes, with interviews from an obstacle racer and professional chef. Video 2, 'Nutrition for Health and Performance', delves into the topic of proper fuelling and important macronutrients for athletes, with interviews from a professional mountain bike racer and an Olympic weightlifter. Video 3, 'Building Strong Bones', examines bone biology and ways to optimise bone health, with interviews from an ultramarathoner and professional track and field athlete. Video 4, 'Periods are Powerful', dives into the basics of the menstrual cycle and emphasises the importance of menstruation in development and as an indicator of energy availability, with interviews from two professional track and field athletes. Video 5, 'Mental Health and Body Image', talks openly about mental health, including resources for reaching out for help and ways to extend compassion to oneself and others, with interviews from a professional cyclocross athlete and a food and fitness blogger (Link to Videos).

### Control group procedures

The control group was assigned to view five online educational pamphlets, readings or blogs over the course of a week. These online materials covered the same five educational principles included in each of the video modules. Participants would log into the study website with an assigned study ID and password to access the educational materials by module. Participants were sent up to three reminder emails if they had outstanding readings or materials left to complete.

### Primary outcome measures

Our primary outcome measure was the change in knowledge on the five educational principles (Triad/REDs, nutrition, bone health, menstrual cycle and mental health) included in our video modules and online materials in the intervention and control groups. As part of the baseline survey, all study participants completed a knowledge assessment, with five questions per educational principle. Participants were instructed to answer questions without using the assistance of online materials, asking friends or using other methods to acquire information. After completing the assessment, participants were not provided with correct answers or their scores. After viewing each video module or accessing the

online materials, participants then repeated the same knowledge assessments with the same instructions.

### Secondary outcome measures

Our secondary outcome measures included the engagement and interest in the video modules versus online materials. After viewing individual video modules or accessing the online materials, participants completed a three-question survey assessing interest in the material, potential for the material to impact their behaviour, and whether they acquired new information from the material on a 1–5 Likert scale. In addition, we assessed how participants acquired their health information prior to the study with a survey asking them to select their top resource and top social media source for health information.

### Pilot study and sample size calculation

We conducted a pilot study and presented our videos to 34 high school female athletes to gather feedback on video design and measure prevideo and postvideo knowledge assessment to power our pair-matched cluster-randomised control study. We used the same baseline surveys and knowledge assessments incorporated in our current study. In this pilot study, mean knowledge scores across all five modules were 78.9% (SD=10.7) at baseline, which increased to 96.8% (SD=3.4) (from athletes with complete data) following the video intervention, representing a 17.9% gain. However, athletes were not compensated for participation, and 15 (44%) of athletes dropped out. We believe that the high dropout rate could be attributed to the long duration of the study (5 weeks), which took place during the summer when students were not checking their emails as regularly, and, thus, we shortened our current study to span 1 week and added compensation for completing the study. Although we did not have a control group incorporating educational pamphlets, readings or blogs in our pilot study, we hypothesised that this group would gain less knowledge and estimated a 10% gain.

Our target sample size for this study was 80 athletes with an enrolment ratio of 1:1. We determined that with 40 athletes in the intervention group and 40 athletes in the control group, we would have an 84% power to detect an 8% improvement in knowledge between the control and intervention groups. This was based on using a difference in means test for the comparison and assuming an alpha of 0.05. To account for study dropout, we used 44% as our dropout rate.

### Statistical analysis

Our primary outcome measures were the change in knowledge scores (difference from baseline to follow-up assessments) as well as the ratings of engagement and interest following the education delivery. We assessed the differences in these measures between our intervention and control groups using generalised estimating equations to account for the cluster randomisation, and thus



the correlated nature of our participants within cluster. For the health information survey, we combined intervention and control group participant data together and assessed descriptive statistics. Participants who missed  $\leq$ two total questions across all knowledge quizzes were included in the analysis and scores were determined from the per cent correct on the answered questions. Participants who failed to complete all modules were classified as drop out. Our statistical analysis and presentation are consistent with the CHAMP statement.<sup>13</sup>

Variables including online surveys and video knowledge quizzes were hosted in Qualtrics and entered and combined into a database using the secure, web-based Research Electronic Data Capture (REDCap) tools hosted at the Stanford Center for Clinical Informatics.<sup>14</sup> Deidentified variables were eventually exported and stored on Box. The data analysis for this study was generated using SAS Software University, V.9.4 (Cary, North Carolina) and Python V.3.8.3 (python.org).

### Equity, diversity and inclusion statement

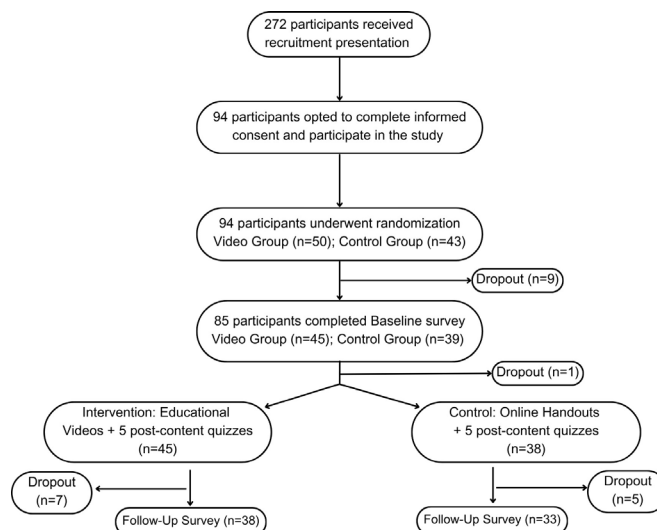
Given the gender gap in sport science research, we wanted to provide educational resources to high school female athletes to help support a parallel gap in sports science research translation. We recruited from high schools across the USA and focused on recruiting schools in different geographic regions, with diverse racial/ethnic and socioeconomic breakdowns. We hope that our research efforts will encourage future studies to investigate the value in creating videos and materials featuring role models in sport to engage young female athletes. One of our primary goals in video design was for female athletes to feel like they could see themselves in sport through the perspectives of our role models. Our videos were reviewed by a diversity consultant to make sure we were promoting inclusion in sport by representing role models with diverse racial/ethnic backgrounds, ages, sport types and body types. In the process, we also included and mentored junior researchers to help build interest in establishing careers focused on female athlete research.

## RESULTS

### Study population

Forty-five high school female runners were randomised to the intervention group and 39 were randomised to the control group. Seven participants in the intervention group (16%) and six participants in the control group (15%) completed the baseline survey but failed to complete all the modules. The remaining participants in the control group (n=33) and the intervention group (n=38) completed all the modules and assessments with the exception of three participants who missed  $\leq$ two total questions across all knowledge quizzes (figure 1).

The average age in the intervention group (mean=16.0, SD=1.4) and the control group (mean=15.7, SD=1.0) was similar. The majority of participants in the intervention (88.9%) and control



**Figure 1** Flow diagram of the progress through the two-group cluster randomised control trial.

groups (64.1%) were white, though the control group had more racial diversity (table 1). The percentage of participants with a history of diagnosed eating disorder and BMD was similar in the control and intervention groups, while the control group had more participants (24.4%) with a diagnosed bone stress injury than the intervention group (10.3%). Most participants in the intervention (68.9%) and control (59.0%) groups reported regular periods, and around 20% in both groups were unsure what constituted regular periods (table 1).

### Knowledge scores at baseline and following content delivery

Both the control group and intervention group had significant increases in knowledge from baseline to follow-up for all modules except for the mental health modules, where the mean baseline score was already high (control mean=98.5, SD=6.1; intervention mean=98.0, SD=6.8). The intervention group (baseline mean=75.7, SD=10.1; follow-up mean=93.3, SD=6.6) did not have significantly greater knowledge changes compared with the control group (baseline mean=77.9, SD=11.0; follow-up mean=93.6, SD=7.0) ( $p=0.149$ ) (table 2). Participants had the lowest baseline knowledge on the menstrual cycle and the bone health modules in both the control and intervention groups (table 2).

### Interest and impact of the educational methods

The intervention group had significantly higher mean Likert scale ratings of behavioural impact, new information and interest across all five modules compared with the control group, with a combined score of 3.77, 3.93 and 4.14 compared with the control group's combined score of 3.36, 3.48 and 3.52, respectively ( $p\leq 0.05$ ,  $p\leq 0.05$  and  $p\leq 0.01$ ). In both groups, the mental health module was rated the lowest out of the modules on information acquisition (intervention mean=3.41, control

**Table 1** Descriptive characteristics of the study population at baseline in each study phase, mean  $\pm$  SD or N (%)

Characteristic	Control group		Intervention group	
	N	Mean $\pm$ SD or %	N	Mean $\pm$ SD or %
Age (year)	39	15.7 (1.0)	45	16.0 (1.4)
Gender				
Female	38	97.4%	43	95.5%
Male	0	0%	0	0%
Other	1	2.6%	2	4.4%
Race				
White	25	64.1%	40	88.9%
Black	0	0%	0	0%
Asian	3	7.7%	1	2.2%
More than one race	8	20.5%	3	6.7%
Unknown/not reported	3	7.7%	1	2.2%
Years running track	39	3.4 (2.1)	45	3.4 (2.0)
Age menarche				
Never menstruated	1	2.6%	0	0%
11 years or younger	6	15.4%	7	15.6%
12–14 years	30	76.9%	36	80.0%
15 years or older	2	5.1%	2	4.4%
Regular periods				
Yes	23	59.0%	31	68.9%
No	8	21.1%	4	8.9%
Not sure if regular	7	18.4%	9	20.0%
Prefer not to answer	1	2.6%	1	2.2%
Oral contraceptive use				
Yes	1	2.6%	5	11.1%
No	38	97.4%	40	88.9%
Diagnosed eating disorder				
Yes	4	10.3%	5	11.1%
No	35	89.7%	40	88.9%
Diagnosed BSI history				
Yes	4	10.3%	11	24.4%
No	35	89.7%	34	75.6%
History of low BMD				
Yes	0	0%	0	0%
No	39	100%	45	100%

BMD, bone mineral density; BSI, bone stress injury.

mean=3.00), but still scored relatively high on interest (intervention mean=4.13, control mean=3.67) (table 3).

### Participants' top-ranked sources for acquiring health information

Half of all participants predominantly acquired health information from parents (24.7%) or from coaches (25.9%), whereas one-quarter of participants acquired information from online sources, including social media (12.9%) and online non-social media sources such as blog

posts or professional organisations (12.9%). Fewer participants predominantly received health information from physicians/trainers (7.1%) or from teachers (4.7%).

When queried specifically on sources of social media for acquiring health information, most participants in our cohort used Instagram (29.4%) or TikTok (20.0%). None of our participants used Facebook or Twitter and 30% of our participants did not use any form of social media for acquiring health information (table 4).

**Table 2** Knowledge scores for control and intervention groups at baseline and following content delivery

Module	Control group			Intervention group			P value
	N*	Baseline score±SD	Follow-up score±SD	N*	Baseline score±SD	Follow-up score±SD	
Triad/REDs	33	78.8 (19.9)	97.7 (7.3)	38	74.3 (26.3)	96.7 (10.4)	0.891
Nutrition	33	81.8 (21.0)	93.2 (14.4)	40	79.4 (17.8)	94.4 (13.3)	0.638
Bone health	33	75.8 (22.1)	92.4 (13.2)	39	68.6 (22.7)	94.2 (12.1)	0.371
Menstrual cycle	33	54.5 (21.2)	87.9 (18.9)	38	58.8 (24.4)	81.8 (21.0)	0.113
Mental health	33	98.5 (6.1)	97.0 (10.4)	38	98.0 (6.8)	99.3 (4.1)	0.063
Overall	33	77.9 (11.0)	93.6 (7.0)	38	75.7 (10.1)	93.3 (6.6)	0.149

P values for the change in knowledge scores from baseline to follow-up between control and intervention groups were determined by a generalised estimating equations (GEE) model to account for cluster randomisation.

\*Participants had to start all five quizzes to contribute to the overall baseline and follow-up average quiz score. Participants were categorised as missing if they skipped  $\geq 3$  quiz questions across all knowledge quizzes. Three participants who missed  $\leq 2$  total questions across all knowledge quizzes were included in the overall analysis and scores were determined from the percent correct on the answered questions. REDs, Relative Energy Deficiency in Sport.

## DISCUSSION

We found that both the five-part video module series (intervention group) and the online educational materials (control group) improved Triad/REDs and female athlete science knowledge, with no statistically significant difference in knowledge gains between groups. However, our video modules had significantly higher Likert scale ratings of behavioural impact, information acquisition and interest across all five modules compared with the control group. Although we did not find significant differences in knowledge gains between the intervention and control groups, we are encouraged that both groups gained knowledge and that participants in the intervention group had stronger engagement with the video modules as measured by Likert scale ratings. Collectively, these findings support the idea that in addition to thinking about knowledge gains on Triad/REDs and female athlete science interventions, we should also design engaging interventions featuring stories and wisdom from diverse role models to better capture the

interest of athletes. Future research should look at long-term behaviour outcomes of engaging Triad/REDs and female athlete science education interventions, including the impact on fuelling behaviours, body mindset and sport mindset.

### Impact on knowledge scores

Both the intervention and control groups increased knowledge from baseline to follow-up for all modules except for the mental health modules, where the mean baseline scores were already high. These findings parallel recent studies that used a 10 min video intervention and a 16-week digital lecture/personalised counselling intervention to significantly improve Triad and REDs knowledge, respectively.<sup>8 10</sup> However, each study used different questions and formats to assess knowledge, and to date, there are no validated Triad/REDs knowledge instruments that are used across studies. In addition, our study included the addition of more general female athlete science education.

**Table 3** Ratings on interest, potential impact on behaviour and new information from control and intervention groups following module completion

Module	Control group				Intervention group			
	N	Behaviour impact score	New information score	Interest score	N	Behaviour impact score	New information score	Interest score
Triad/REDs	33	3.21	3.70	3.27	40	3.45	3.95*	4.18***
Nutrition	33	3.64	3.39	3.52	41	3.76	3.78	4.15**
Bone health	33	3.39	3.82	3.48	39	4.00***	4.36**	4.03*
Menstrual cycle	33	3.15	3.52	3.67	40	3.78*	4.15**	4.25*
Mental health	33	3.42	3.00	3.67	39	3.90**	3.41	4.13**
<b>Overall</b>	33	3.36	3.48	3.52	38	3.77*	3.93*	4.14**

P values for the ratings between control and intervention groups were determined by a generalised estimating equations (GEE) model to account for cluster randomisation.

\* $p \leq 0.05$ , \*\* $p \leq 0.01$ , \*\*\* $p \leq 0.001$ .

REDs, Relative Energy Deficiency in Sport.

**Table 4** Participants' top-ranked sources and social media platforms for how they currently acquire health information

Health information	
Source or platform	N* (%)
Source	
Teachers	4 (4.7)
Coaches	22 (25.9)
Social media	11 (12.9)
Friends/teammates	4 (4.7)
Parent/guardian	21 (24.7)
Physician/trainer	6 (7.1)
Sports performance or strength coach	2 (2.4)
Nutritionist	2 (2.4)
Online non-social media†	11 (12.9)
Books/textbooks	1 (1.2)
Other	1 (1.2)
Social media platform	
Instagram	25 (29.4)
TikTok	17 (20.0)
YouTube	10 (11.8)
Facebook	0 (0.0)
Pinterest	2 (2.4)
Twitter	0 (0.0)
Other	5 (5.9)
None	26 (30.6)

\*Control and intervention participants are included together.  
†Includes blogs, professional organisations and online magazines.

Short, online educational interventions may provide an accessible, lower cost method for athletes across different backgrounds. We were able to consolidate and validate wisdom from professional athletes and role models in the five video modules, exposing athletes to perspectives on female athlete science that participants may not experience from interacting with teammates, peers or even coaches. In a systematic review assessing 32 nutrition education intervention studies designed to improve knowledge in athletes, studies that used online content had greater knowledge increases and stronger retention of participants compared with non-technology-based interventions.<sup>15</sup> Future research should continue to explore different methods of delivering online Triad/REDS and female athlete science education with validated and consistent knowledge assessment instruments across each study. We should also continue to assess how incorporating inspirational stories from professional athletes who have experienced Triad/REDS alongside educational principles may impact short-term and long-term knowledge gains.

We hypothesise that the high level of baseline mental health knowledge in our participants could be related to an increase in open discussion surrounding mental health on social media or in school systems. In addition, our five mental health survey questions were not validated and could have been easier for athletes to answer compared with questions with more of a Triad/REDS science focus. In contrast to our findings, research indicates that there are few well-designed programmes for mental health literacy in youth athletes, and that researchers should focus on programmes for youth athletes that involve parent and coach engagement.<sup>16</sup> Future research should prioritise addressing mental health in tandem with physical health interventions for youth athletes.

### Impact on interest

Our video modules had significantly higher Likert scale ratings of behavioural impact, information acquisition and interest across all five modules compared with the online educational material group and significantly higher ratings on acquisition of new information on three of five modules. Given that knowledge is a first step in changing behaviour and mindset but is often insufficient to do so alone, we wanted to think about the broader context of our intervention.<sup>17</sup> Outside of the research context, the higher interest ratings for the video may indicate that athletes would be more likely to engage with and act on resources that are designed to be interesting and entertaining, particularly in settings where engagement is a personal or team choice, without subsequent evaluation. We recognise that creating sustained behaviour change may require a more in-depth intervention that engages with participants individually, with goal-setting and long-term follow-up sessions. However, we were encouraged by our findings of stronger behavioural impact, information acquisition and interest in our video modules and hope that this interest may empower athletes to know how and when to ask for help or seek additional resources.

### Participants' top-ranked sources for acquiring health information

We found that half of all participants predominantly acquire health information from parents or from coaches, with less than 10% predominantly acquiring health information from physicians or trainers and less than 3% from nutritionists. This parallels studies that indicate that athletes often rely on parents and coaches for key sources of nutrition and health education,<sup>18 19</sup> given that athletes may have limited access to registered dietitians, physicians, mental health professionals or athletic trainers. Parents and coaches may not have adequate knowledge and studies show that athletes with access to sports nutritionists/registered dietitians follow more established nutrition guidelines.<sup>20</sup> We believe this finding highlights the importance of Triad/REDS and female athlete science online education interventions for high school athletes. Future research should examine



dual interventions, with parallel educational content for parents and coaches.

In addition, we found that our participants predominantly used Instagram and TikTok as social media sources for acquiring health information and that 30% of our participants did not use any form of social media for acquiring health information. We collected this information to understand how to best release our five videos poststudy to reach more high school athletes. While we plan to distribute the videos on the FASTR Instagram account, we were also encouraged to see the number of athletes stepping away from social media for obtaining health information. Studies in adolescents indicate that longer daily social media use is tied to negative mental health outcomes as well as dysfunctional eating patterns.<sup>21</sup> Thus, we aim to create an online platform with our videos and educational materials for high school athletes that is outside the scope of social media and plan for follow-up studies on this platform. In our study, all participants had access to the internet and computers for education. Future research should explore how to deliver Triad/REDs education in areas that might have more limited computer access, including through team talks and coaching education. Researchers should also assess Triad/REDs perceptions and prevalence in areas with fewer resources to inform best intervention approach.

### Limitations and strengths

There are some important limitations of our study. We assessed knowledge pre- and post-intervention using a 25-question assessment (five questions per video) that we created for this study. While we gave participants instructions to not use the internet or other sources for the assessment, we cannot control for their test-taking environment. Although we did not provide correct answers after the pretest, it is plausible that participants may improve on an assessment simply from having the opportunity to take the assessment again and recognising assessment questions. In addition, we assessed knowledge immediately postintervention—future studies should assess Triad/REDs and female athlete science knowledge at additional time points postintervention to understand how knowledge is retained in the long term.

We had significant dropout in our pilot study (44%), which improved to 16% in the intervention group and 15% in the control group in our primary study. We believe that shortening the study from 5 weeks to 1 week improved the participant retention and motivation in our primary study. However, we also added compensation for participants in our primary study. Although we had strong interest and engagement metrics in our primary study, it is also plausible that compensation impacted motivation, and that education efforts in high school athletes might be more challenging to conduct without compensation.

The strengths of our study include the development of five video modules featuring animated Triad/REDs and female athlete science education from experts, and

inspirational content from 11 different professional athletes and role models. Our use of a control group and cluster randomised control trial study design enabled us to examine the impact of the video intervention compared with online educational materials. While both our intervention and control groups had knowledge gains, our five video modules better captivated participant interest and had stronger potential for behavioural impact. When considered with how participants access health information, we believe that the continued development of diverse types of educational materials for female high school athletes might improve knowledge, capture interest and facilitate lasting impacts on positive behavioural choices and mindsets.

### CONCLUSION

This cluster randomised control trial found that both a five-part video series and online educational materials significantly improved Triad/REDs and female athlete science knowledge in high school runners. However, the five-part video series had higher ratings of interest and behavioural impact across all five modules. Future research should explore engaging and informative methods to deliver female athlete science content and should evaluate the impact of using compelling storytelling from a diverse range of athletes and experts.

X Megan Roche @meg\_runs\_happy and Emily Kraus @emilykrausmd

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#### REFERENCES

- Cowley ES, Olenick AA, McNulty KL, *et al*. "Invisible sportswomen": the sex data gap in sport and exercise science research. *Wom Sport Phys Act J* 2021;29:146–51.
- Pantano KJ. Current knowledge, perceptions, and interventions used by collegiate coaches in the U.S. regarding the prevention and treatment of the female athlete triad. *N Am J Sports Phys Ther* 2006;1:195–207.
- Brown KN, Wengreen HJ, Beals KA. Knowledge of the female athlete triad, and prevalence of triad risk factors among female high school athletes and their coaches. *J Pediatr Adolesc Gynecol* 2014;27:278–82.
- De Souza MJ, Nattiv A, Joy E, *et al*. 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. *Br J Sports Med* 2014;48:289.
- Brown KN, Wengreen HJ, Beals KA, *et al*. Effects of peer-education on knowledge of the female athlete triad among high school track and field athletes: a pilot study. *Wom Sport Phys Act J* 2016;24:1–6.
- Feldmann JM, Belsha JP, Eissa MA, *et al*. Female adolescent athletes' awareness of the connection between menstrual status and bone health. *J Pediatr Adolesc Gynecol* 2011;24:311–4.
- Wolfenden E, Olson EM, Mehta S, *et al*. The association between the female athlete triad and mental health in high school athletes. *Orthop J Sports Med* 2022;10:2325967121S0048.
- Krick RL, Brown AF, Brown KN. Increased female athlete triad knowledge following a brief video educational intervention. *J Nutr Educ Behav* 2019;51:1126–9.
- Mountjoy M, Sundgot-Borgen JK, Burke LM, *et al*. IOC consensus statement on relative energy deficiency in sport (RED-S): 2018 update. *Br J Sports Med* 2018;52:687–97.
- Fahrenholtz IL, Melin AK, Garthe I, *et al*. 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). *Nutrients* 2023;15:1082.
- Fairburn CG, Beglin SJ. Assessment of eating disorders: interview or self-report questionnaire? *Int J Eat Disord* 1994;16:363–70.
- Melin A, Tornberg AB, Skouby S, *et al*. The LEAF questionnaire: a screening tool for the identification of female athletes at risk for the female athlete triad. *Br J Sports Med* 2014;48:540–5.
- Mansournia MA, Collins GS, Nielsen RO, *et al*. A checklist for statistical assessment of medical papers (the CHAMP statement): explanation and elaboration. *Br J Sports Med* 2021;55:1009–17.
- Harris PA, Taylor R, Minor BL, *et al*. The REDCap consortium: building an international community of software platform partners. *J Biomed Inform* 2019;95:103208.
- Tam R, Beck KL, Manore MM, *et al*. Effectiveness of education interventions designed to improve nutrition knowledge in athletes: a systematic review. *Sports Med* 2019;49:1769–86.
- Diamond S, Wallace L, English M, *et al*. The impact of mental health literacy initiatives on youth elite athletes: a systematic review. *Perform Enhanc Health* 2022;10:100226.
- Arlinghaus KR, Johnston CA. Advocating for behavior change with education. *Am J Lifestyle Med* 2018;12:113–6.
- Jacob R, Couture S, Lamarche B, *et al*. Determinants of coaches' intentions to provide different recommendations on sports nutrition to their athletes. *J Int Soc Sports Nutr* 2019;16:57.
- Manore MM, Patton-Lopez MM, Meng Y, *et al*. Sport nutrition knowledge, behaviors and beliefs of high school soccer players. *Nutrients* 2017;9:350.
- Hull MV, Neddo J, Jagim AR, *et al*. Availability of a sports dietitian may lead to improved performance and recovery of NCAA division I baseball athletes. *J Int Soc Sports Nutr* 2017;14:29.
- Fiedler R, Heidari J, Birnkraut T, *et al*. Digital media and mental health in adolescent athletes. *Psychol Sport Exerc* 2023;67:102421.

# FASTR Education Study- Baseline Survey

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## Start of Block: Study ID

Q1 Please enter your 4-digit Study ID (ex. 0001)

If you forgot your Study ID, email the research team at [amcinty@stanford.edu](mailto:amcinty@stanford.edu) or [fastrprogram@stanford.edu](mailto:fastrprogram@stanford.edu)

---

## End of Block: Study ID

---

## Start of Block: Demographic Questions



Q2 What is your date of birth? (MM/DD/YYYY)

---

---

Q3 What best describes your current gender identity? (Select all that apply)

- Woman
  - Man
  - Non-binary (eg. genderqueer, gender non-conforming)
  - Prefer not to say
  - If not listed [please specify]
-

Q4 On your original birth certificate, was your assigned sex female or male? (Select one)

- Female
  - Male
  - Prefer not to answer
- 

Q5 Do you identify as transgender? (Select one)

- No, I do not identify as transgender
  - Yes, I do identify as transgender
  - I am not sure if I am transgender
  - I do not know what this question is asking
  - Prefer not to answer
- 

Q6 Are you of Hispanic, Latino/a/x, or of Spanish origin?

- No, not of Hispanic, Latino/a/x, or Spanish origin
  - Yes, Mexican, Mexican American, Chicano/a/x
  - Yes, Puerto Rican
  - Yes, Cuban
  - Yes, Another Hispanic, Latino/a/x or Spanish origin
  - Some other race, ethnicity, or origin
  - Prefer to self-describe \_\_\_\_\_
  - Prefer not to say
-

Q7 Which of the following racial designations best describes you? (Select all that apply)

- American Indian or Alaska Native
  - Asian
  - Native Hawaiian or Pacific Islander
  - Black or African American
  - White
  - More than one race
  - Prefer to self-describe
- 
- Prefer not to say
-



Q8 What races do you run in track/cross country? (select all that apply)

- 100 m
  - 200 m
  - 400 m
  - 800 m
  - 1600 m
  - 3200 m
  - 5k or 5000m (3.1mi)
  - 10,000 m
  - 110/100 m hurdles
  - 400 m hurdles
  - 4 x 100 m relay
  - 4 x 400 m relay
  - 3000 m Steeplechase
  - Other \_\_\_\_\_
-

Q9 How many years (including this year) have you been competing in track/cross country?

- 1
  - 2
  - 3
  - 4
  - 5
  - 6
  - 7+
- 

Q10 On average, how many days per week do you run?

- 0 days
  - 1 day
  - 2 days
  - 3 days
  - 4 days
  - 5 days
  - 6 days
  - 7 days
-

Q11 On average, how many miles per week do you run?

- Less than 5
  - 5-10
  - 10-20
  - 20-30
  - 30-40
  - 40-50
  - 50+
- 

Q12 On average, how many hours per week do you run?

- 1-5 hours
  - 5-10 hours
  - 10-15 hours
  - 15-20 hours
- 

Q13 Would you like to change the number of hours you train per week?

- I would like to train for fewer hours
  - I would like to train for more hours
  - I would like to train for the same number of hours as I currently do (no change)
- 

Q14 Please list what sports you have participated in other than track/cross country

---

---

Q15 Have you ever been diagnosed with a stress reaction or stress fracture by a doctor?

- Yes
- No

---

Q16 How many times have you been diagnosed with a stress reaction or stress fracture by a doctor?

- 1
- 2
- 3
- 4
- If more than 4, list how many
-



Q17 What bone(s) were injured and how were you diagnosed?

	X-ray	MRI	CT Scan	Other
Tibia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fibula	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Metatarsal(s)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Femoral neck	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sacrum	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pelvis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Navicular bone of foot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sesamoid bone of foot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (list site of injury)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q18 If diagnosed as "other," please explain method of diagnosis

---

Q19 Please select any other running-related injuries that have kept you from training in the past?

- Achilles tendinitis
  - Shin splints
  - Plantar fasciitis
  - Runner's knee/patellofemoral pain
  - IT band syndrome
  - Hamstring tendinopathy
  - Low back pain
  - Ankle injury (sprain)
  - Other \_\_\_\_\_
- 

Q20 Have you ever broken a bone from a fall (i.e. wrist, forearm, other)?

- Yes
  - No
-

Q21 Please list which bone(s) you broke

Wrist

Forearm

Leg (tibia or fibula)

Other \_\_\_\_\_

---

Q22 Have you ever been diagnosed with low bone mineral density, osteopenia or osteoporosis by getting a bone density test (DXA)?

Yes

No

---

Q23 Do you have a family history (grandparent, parent, sibling) of osteopenia or osteoporosis?

Yes

No

---

Q24 If yes, did your family member ever break a bone or have a stress fracture?

Yes

No

---

Q25 Have you incorporated strength and resistance training into your weekly workout schedule?

- Yes
  - No
- 

Q26 If yes, how many days per week do you do strength and resistance training?

- Once per week
  - Twice per week
  - 3 times per week
  - 4 times per week
  - 5 times per week
  - 6 times per week
  - Everyday
- 

Q27 If yes, how many minutes per session do you spend doing strength and resistance training?

- 0-5 minutes
- 5-10 minutes
- 10-20 minutes
- 20-30 minutes
- 30-45 minutes
- 1-2 hours
- >2 hours



---

Q28 What types of strength and resistance training do you do? (select all that apply)

- Core or Abdominal Strength
- Upper Body Strength
- Hip or Glute Strength
- Foot or Ankle Strength
- Other \_\_\_\_\_

End of Block: Demographic Questions

---

Start of Block: EDE-Q

Q29 Please read each question carefully and select the appropriate answer. All of the questions are regarding the last 28 days. Please answer all of the questions.

	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
Have you been consciously trying to restrict the amount of food you eat to influence your shape or weight?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you gone for long periods of time (8 hours or more) without eating anything in order to influence your shape or weight?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you attempted to avoid eating any foods that you like in order to influence your shape or weight?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you attempted to follow definite rules regarding your eating in order to	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

influence your shape or weight; for example, a calorie limit, a set amount of food, or, rules about what or when you should eat?

Have you had a definite desire for your stomach to feel empty?

---

Q30 Have there been times when you have eaten what most people would regard as an unusually large amount of food?

Yes

No

---

Q31 If yes, how many such episodes (of eating what most people would regard as an unusually large amount of food) have you had over the past four weeks?

- Once a week
  - 2-4 times a week
  - 4-6 times a week
  - Everyday
  - Once a month
  - Once every 2 weeks
  - Other \_\_\_\_\_
- 

Q32 During how many of these episodes of overeating did you have a sense of having lost control?

\_\_\_\_\_

---

Q33 Have you had other episodes of eating in which you have had a sense of having lost control, but have not eaten an unusually large amount of food?

- Yes
  - No
-



Q34 How many such episodes (of eating in which you have had a sense of having lost control, but have not eaten an unusually large amount of food) have you had over the past four weeks?

- Once a week
- 2-4 times a week
- 4-6 times a week
- Everyday
- Once a month
- Once every 2 weeks
- Other \_\_\_\_\_
- 

Q35 Have you ever made yourself sick (vomit) as a means of controlling your shape or weight, or to counteract the effects of eating?

- Yes
- No
- 

Q36 On how many days of the last 28 have you done this (made yourself sick as a means of controlling your shape or weight, or to counteract the effects of eating)?

\_\_\_\_\_

---

Q37 Have you taken laxatives as a means of controlling your shape or weight or to counteract the effects of eating?

- Yes
- No
-

Q38 On how many days of the last 28 have you done this (taken laxatives as a means of controlling your shape or weight or to counteract the effects of eating)?

---

Q39 Have you ever taken diet pills or diuretics (water) tablets as a means of controlling your shape or weight or to counteract the effects of eating?

Yes

No

Q40 On how many days of the last 28 have you done this (taken diet pills or diuretics as a means of controlling your shape or weight or to counteract the effects of eating)?

---

Q41 Have you ever vigorously exercised as a means of controlling your weight, altering your shape or your amount of fat, or burning off calories?

Yes

No

Q42 On how many days of the last 28 have you done this (vigorously exercised as a means of controlling your weight, altering your shape or your amount of fat, or burning off calories)?

---

Q43 Have the past four weeks been typical of the past year?

Yes

No

---

Q44 If not, how has the past year differed from the past four weeks?

---

End of Block: EDE-Q

---

Start of Block: Eating Disorder/Supplementation

Q45 Are you currently trying to lose weight?

Yes

No

---

Q46 Are you currently trying to gain weight?

Yes

No

---

Q47 Are you trying to change your body weight or body composition to improve your performance?

Yes

No

---

Q48 How do you currently consider yourself?

- Very underweight (>10 lbs)
  - Slightly underweight (5-10 lbs)
  - At an ideal weight
  - Slightly overweight
  - Moderately overweight (10-20 lbs)
  - Very overweight (>200 lbs)
- 

Q49 Have you ever been diagnosed with an eating disorder?

- Yes
  - No
- 

Q50 If yes, were you diagnosed with (check all that apply)

- Anorexia nervosa
  - Bulimia nervosa
  - Eating disorder not otherwise specified
  - Disordered eating
-

Q51 If yes to any of the above, were you ever hospitalized for this diagnosis?

Yes

No

---

Q52 Do you follow a vegetarian diet (meaning that you never eat fish, chicken, or meat, but you do eat eggs and dairy)?

Yes

No

---

Q53 Are you currently taking any form of iron supplementation?

Yes

No

---

Q54 Do you take calcium supplements or have you consistently over the past 12 months?

Yes

No

---

Q55 Do you take vitamin D supplements or have you consistently over the past 12 months?

Yes

No

---

Q56 Please list any supplements (including multivitamins or herbs) that you have consistently taken over the last 12 months

---

End of Block: Eating Disorder/Supplementation

---

Start of Block: Sleep

Q57 How many hours do you sleep in a typical night?

- <4 hours
- 5 hours
- 6 hours
- 7 hours
- 8 hours
- 9 hours
- 10 hours
- >10 hours

---

Q58 What time do you prefer to go to bed?

- 7:00 PM
- 8:00 PM
- 9:00 PM
- 10:00 PM
- 11:00 PM
- 12:00 AM
- Other \_\_\_\_\_
- 

Q59 What time do you typically wake up?

- 4:00 AM
- 5:00 AM
- 6:00 AM
- 7:00 AM
- 8:00 AM
- 9:00 AM
- 10:00 AM
- Other \_\_\_\_\_
- 

Q60 How many naps do you take in a typical week?

\_\_\_\_\_

---



Q61 What is the length of a typical nap? (minutes)

---

Q62 Are you satisfied with the amount of sleep you are getting nightly?

Yes

No

Q63 How long does it take you to fall asleep?

<5 minutes

5-15 minutes

15-30 minutes

30-45 minutes

45-60 minutes

>1 hour

Q64 Do you have trouble staying asleep?

Yes

No

Q65 Do you use any sleep medications?

- Yes
- No
- 

Q66 If so, how often (number of times per week)?

- Once per week
- Twice per week
- 3 times per week
- 4 times per week
- 5 times per week
- 6 times per week
- Everyday
- 

Q67 Do you feel alert in the morning?

- Yes
- No
- 

Q68 Do you snore or gasp while sleeping?

- Yes
- No
-

Q69 Does travel for your sport disturb your sleep?

- Yes
- No
- 

Q70 How many times per week are your daytime activities affected by lack of sleep?

- 0 days per week
- Once per week
- Twice per week
- 3 times per week
- 4 times per week
- 5 times per week
- 6 times per week
- Everyday

End of Block: Sleep

---

Start of Block: SATAQ-4

Q71 Please read each of the following items carefully and indicate the answer that best reflects your agreement with the statement

	Definitely Disagree	Mostly Disagree	Neither Agree Nor Disagree	Mostly Agree	Definitely Agree
It is important for me to look athletic.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think a lot about looking muscular.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want my body to look very thin.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want my body to look like it has little fat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think a lot about looking thin.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I spend a lot of time doing things to look more athletic.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think a lot about looking athletic.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want my body to look very lean.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think a lot about having very little body fat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I spend a lot of time doing things to look more muscular.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q72 Answer the following questions with relevance to your FAMILY (including parents, brothers, sisters, relatives):

	Definitely Disagree	Mostly Disagree	Neither Agree Nor Disagree	Mostly Agree	Definitely Agree
I feel pressure from family members to look thinner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel pressure from family members to improve my appearance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Family members encourage me to decrease my level of body fat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Family members encourage me to get in better shape.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

---

Q73 Answer the following questions with relevance to your PEERS (including close friends, classmates, and other social contacts):

	Definitely Disagree	Mostly Disagree	Neither Agree Nor Disagree	Mostly Agree	Definitely Agree
My peers encourage me to get thinner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel pressure from my peers to improve my appearance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel pressure from my peers to look in better shape.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I get pressure from my peers to decrease my level of body fat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

---

Q74 Answer the following questions with relevance to the MEDIA (include television, magazines, the internet, movies, billboards, and advertisements):

	Definitely Disagree	Mostly Disagree	Neither Agree Nor Disagree	Mostly Agree	Definitely Agree
I feel pressure from the media to look in better shape.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel pressure from the media to look thinner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel pressure from the media to improve my appearance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel pressure from the media to decrease my level of body fat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: SATAQ-4

Start of Block: DERS-18



Q75 Please select the appropriate answer for the questions below.

	Almost Never (0-10%)	Sometimes (11-35%)	About Half the Time (36- 65%)	Most of the Time (66- 90%)	Almost Always (91- 100%)
I pay attention to how I feel.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have no idea how I am feeling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have difficulty making sense out of my feelings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am attentive to my feelings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am confused about how I feel.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I'm upset, I acknowledge my emotions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I'm upset, I become embarrassed for feeling that way.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I'm upset, I have difficulty getting work done.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I'm upset, I become out of control.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I'm upset, I believe that I will remain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

that way for a long time.

When I'm upset, I believe that I'll end up feeling very depressed.

When I'm upset, I have difficulty focusing on other things.

When I'm upset, I feel ashamed with myself for feeling that way.

When I'm upset, I feel guilty for feeling that way.

When I'm upset, I have difficulty concentrating.

When I'm upset, I have difficulty controlling my behaviors.

When I'm upset, I believe that wallowing in it is all I can do.

When I'm upset, I lose control over my behaviors.

End of Block: DERS-18

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Start of Block: LEAF-Q

Q76 Have you had absences from your training, or participation in competitions during the last year due to injuries?

- No, not at all
  - Yes, once or twice
  - Yes, three or four times
  - Yes, five times or more
- 

Q77 How many days were you absent from training or participation in competition due to injuries in the last year?

- 1-7 days
  - 8-14 days
  - 15-21 days
  - 22 days or more
- 

Q78 What kind of injuries have you had in the last year?

---

Q79 Comments or further information regarding injuries?

---

Q80 Do you feel gaseous or bloated in the abdomen, when you do not have your period?

- Yes, several times a day
  - Yes, several times a week
  - Yes, once or twice a week or more seldom
  - Rarely or never
- 

Q81 Do you get cramps or stomach ache which cannot be related to your menstruation?

- Yes, several time a day
  - Yes, several time a week
  - Yes, once or twice a week or more seldom
  - Rarely or never
- 

Q82 How often do you have bowel movements on average?

- Several times a day
  - Once a day
  - Every second day
  - Twice a week
  - Once a week or more rarely
-

Q83 How would you describe your normal stool?

- Normal (soft)
  - Diarrhoea-like (watery)
  - Hard and dry
  - Comments regarding gastrointestinal function:  
\_\_\_\_\_
- 

Q84 Do you use oral contraceptives?

- Yes
  - No
- 

Q85 If yes, what is the primary reason you use oral contraceptives?

- Contraception
  - Reduction of menstruation pains
  - Reduction of bleeding
  - To regulate the menstrual cycle in relation to performances ect..
  - Otherwise menstruation stops
  - Other \_\_\_\_\_
-

Q86 If no, have you used oral contraceptives previously?

Yes

No

---

Q87 If yes, when and for how long?

---

Q88 Do you use any other kind of hormonal contraceptives? (e.g. hormonal implant or coil)

Yes

No

---

Q89 If yes, what kind?

Hormonal patches

Hormonal ring

Hormonal coil

Hormonal implant

Other \_\_\_\_\_

---

Q90 How old were you when you had your first period?

- 11 years or younger
  - 12-14 years
  - 15 years or older
  - I don't remember
  - I have never menstruated
- 

Q91 Did your first menstruation come naturally (by itself)?

- Yes
  - No
  - I don't remember
- 

Q92 If no, what kind of treatment was used to start your menstrual cycle?

- Hormonal treatment
  - Weight gain
  - Reduced amount of exercise
  - Other \_\_\_\_\_
-



Q93 Do you currently have normal menstruation?

- Yes
  - No
  - I don't know
- 

Q94 When was your last period?

- 0-4 weeks
  - 1-2 months ago
  - 3-4 months ago
  - 5 months ago or more
- 

Q95 Are your periods regular? (Every 28th to 34th day)

- Yes, most of the time
  - No, mostly not
- 

Q96 For how many days do you normally bleed?

- 1-2 days
- 3-4 days
- 5-6 days
- 7-8 days
- 9 days or more

---

Q97 Have you ever had problems with heavy menstrual bleeding?

- Yes
- No
- 

Q98 How many periods have you had during the last year?

- 12 or more
- 9-11
- 6-8
- 3-5
- 0-2
- 

Q99 If no, when did you have your period last?

- 2-3 months ago
- 4-5 months ago
- 6 months ago or more
- I'm pregnant and therefore do not menstruate
-

Q100 Have your periods ever stopped for 3 consecutive months or longer (besides pregnancy)?

- No, never
- Yes, it has happened before
- Yes, that's the situation now
- 

Q101 Do you experience that your menstruation changes when you increase your exercise intensity, frequency or duration?

- Yes
- No
- 

Q102 If yes, how? (check one or more options)

- I bleed less
- I bleed more
- I bleed fewer days
- I bleed more days
- My menstruation stops

End of Block: LEAF-Q

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Start of Block: CBIQA

Q103 The next questions deal with how satisfied you are with your body and your appearance. There are no true or false answers. Do not think too long about your answers and do not skip any questions.

In daily life,...or Concerning my sport,...

	Very ugly	Ugly	Somewhat ugly	Neither ugly, nor beautiful	Somewhat Beautiful	Beautiful	Very beautiful
I think my appearance is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think my appearance compared to others is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Others think my appearance is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q104 In daily life, ... or Concerning my sport, ...

	Much too thin	Too thin	Somewhat too thin	Neither too thin, nor too fat	Somewhat too fat	Too fat	Much too fat
I think my body shape is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think my body shape compared to others is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Others think my body shape is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

-----

Q105 In daily life, ... or Concerning my sport, ...

	Much too unmuscular	Too unmuscular	Somewhat too unmuscular	Neither too unmuscular, nor too muscular	Somewhat too muscular	Too muscular	Much too muscular
I think the muscularity of my body is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think the muscularity of my body compared to others is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Others think the muscularity of my body is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

-----

Q106 In daily life, ... or Concerning my sport, ...

	Much too low	Too low	Somewhat too low	Neither too low, nor too high	Somewhat too high	Too high	Much too high
I think my body weight is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think my fat percentage is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think my body weight compared to others is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think my fat percentage compared to others is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Others think my body weight is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Others think my fat percentage is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: CBIQA

Start of Block: Female Athlete Mindset

Q150 Instructions: Please rate the extent to which you agree or disagree with the below statements. There are no right answers. Please answer as honestly as you can what you believe to be true, not what you think is right or what you think you should believe.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Somewhat agree (4)	Agree (5)	Strongly agree (6)
The body should be appreciated and treated with care	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The body will inevitably get weaker with time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The body will inevitably let you down.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The body never ceases to be amazing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The body has remarkable self-healing properties.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The body is capable of handling an illness/injury.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The body is particularly vulnerable to getting injured.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The body will fail you in times of need	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The body is frail and	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

weak

The body is strong and resilient

---

Q107 The purpose of playing sports is:

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Somewhat agree (4)	Agree (5)	Strongly agree (6)
To build friendships	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To win competitions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To enjoy yourself/have fun	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To become your best self physically	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To look good physically (strong, thin, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To be popular/well-liked/admired	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To become a better person socially/emotionally	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To become more resilient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To be a life-long athlete	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Female Athlete Mindset

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Start of Block: Knowledge Questions



Q108 Answer the following knowledge based questions to the best of your ability without outside help.

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Q109 What are the components of the Female Athlete Triad?

- Impaired cardiovascular health, mental health, and low energy availability (disordered eating/eating disorders)
  - Low energy availability (disordered eating/eating disorders), menstrual dysfunction, impaired bone health
  - Hormonal dysfunction, impaired bone health, impaired cardiovascular health
  - Hormonal dysfunction, mental health, menstrual dysfunction
- 

Q110 What process is at the foundation of both the Female Athlete Triad and RED-S?

- Bone Health
  - Low energy availability
  - Menstrual dysfunction
  - Cardiovascular health
- 

Q111 True or False: Low energy availability is always intentional.

- True
  - False
-

Q112 True or False: Low energy availability can impact growth and development in adolescent athletes.

- True
- False
- 

Q113 What are the three phases of the menstrual cycle, in order?

- Follicular, ovulatory, luteal
- Luteal, ovulatory, follicular
- Ovulatory, luteal, follicular
- Progesterone, luteal, estrogen
- 

Q114 What is secondary amenorrhea?

- When an individual has not had a menstrual cycle by age 15
- When a menstrual cycle stops for one month or more
- When a regular menstrual cycle stops for more than three months, or an irregular menstrual cycle stops for more than six months
- When an individual has heavy periods
- 

Q115 True or False: Even though athletics may feel more challenging, performance is not usually impacted on the period.

- True
- False
-

Q116 True or False: If you are experiencing amenorrhea (primary or secondary) or significant changes to your menstrual cycle it's okay to wait and see how it progresses before talking to a doctor, parent, or coach.

- True
- False
- 

Q117 What are two key nutrients for strong bone health?

- Iron and Vitamin B12
- Calcium and Vitamin A
- Magnesium and Vitamin B12
- Vitamin D and Calcium
- 

Q118 What is the relationship between the menstrual cycle and bone health?

- Regular menstrual cycles indicate that levels of iron and Vitamin B12 are optimized
- Losing the menstrual cycle may mean estrogen levels are not high enough to support strong bone remodeling
- Losing the menstrual cycle is not related to bone health
- Regular menstrual cycles indicate that osteoblasts and osteoclasts are not optimized
- 

Q119 True or False: Our bones are constantly remodeling and adapting to stress.

- True
- False
-

Q120 True or False: Adolescence is a time-period of peak bone building.

- True
- False
- 

Q121 \_\_\_\_\_ are the building blocks of muscle tissue and \_\_\_\_\_ can help boost immunity

- Proteins; Fats
- Fats; Fluids
- Carbohydrates; Fluids
- Fats; Proteins
- 

Q122 What are the five components of a performance plate?

- Fluids, sugars, starches, grains, meats, and dairy
- Dairy, starches, grains, fruits, and fats
- Whole grains, proteins, fruit, vegetables, fats, and fluids
- Proteins, whole grains, dairy, meat, and pancakes
- 

Q123 True or False: Protein, fat, and carbohydrates are important components of the performance plate on every training day and every rest day

- True
- False
-

Q124 True or False: Low-normal iron levels, even in the absence of anemia, won't impact performance.

- True
- False
- 

Q125 True or False: More than 30% of college and elite athletes experience mental health conditions

- True
- False
- 

Q126 True or False: A helpful way to extend compassion to yourself is to be highly critical, with harsh self-talk.

- True
- False
- 

Q127 True or False: Shared vulnerability often deepens relationships and allows other to feel comfortable sharing their own stories.

- True
- False
-

Q128 True or False: What “strong” looks like for each athlete is profoundly different and can be highly dependent on genetics

- True
- False

End of Block: Knowledge Questions

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Start of Block: Health Information

Q153 Have you previously seen any of the FASTR Educational Videos?

- Yes
- No

Q154 If yes, where did you see them? (ie. social media, coaches, etc)

---

---

Q155 Where do primarily you get your health information? (ie. general health, bone health, menstrual cycle, mental health, etc)

- Teachers
  - Coaches
  - Social Media
  - Friends/Peers/Teammates
  - Parent/Guardian
  - Physician/Athletic Trainer
  - Sports Performance/Strength Training Coach
  - Nutritionist
  - Online- other than social media (ie. blog posts, professional organizations, magazines)
  - Books/Textbooks
  - Other
- 

Q158 If other, where do you access health information?

---

Q156 What social media platform do you primarily get health information from?

- Instagram
- TikTok
- YouTube
- Facebook
- Pinterest
- Twitter
- Other
- None

---

Q162 If other, please specify what social media platform you use to access health information

---



Q157 What TWO places do you primarily get your sports performance information? (ie. sports nutrition, strength training, sport specific training, etc)  
Please only select TWO options.

- Teachers
- Coaches
- Social Media
- Friends/Peers/Teammates
- Parent/Guardian
- Physician/Athletic Trainer
- Sports Performance/Strength Training Coach
- Nutritionist
- Online- other than social media (ie. blog posts, professional organizations)
- Books/Textbooks
- Other

---

Q161 If other, where do you access sports performance information?

---

Q160 What social media platform do you primarily get sports performance information from?

- Instagram
  - TikTok
  - YouTube
  - Facebook
  - Pinterest
  - Twitter
  - Other
  - None
- 

Q159 If other, please specify what social media platform you use to access sports performance information

---

**End of Block: Health Information**

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