

## Improvement of Body Image Flexibility in Adolescent Female Athletes Undergoing Education about Nutrition and Body Image

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### Abstract

**Methods:** A pre-post study was done measuring body image flexibility in adolescent female athletes. Athletes, aged 14-18, participated in educational sessions about nutrition, body image flexibility, and RED-S (relative energy deficiency in sport). Body image flexibility was measured by the BI-AAQ (Body Image - Acceptance and Action Questionnaire).

**Results:** Increases were shown in all teams and overall. Specifically, mean BI-AAQ scores from 45.2 to 57.2 or difference of 12.0 (p-value <0.01). The cheer team showed an increase of the mean scores from 42.3 to 52.0 or difference of 9.7 (p-value 0.033). Overall scores improved from 43.6 to 54.1 or difference of 10.4 (p-value <0.01). Individual questions results shows that the cross country/track team had significant improvement in 8 of the 12 questions and the cheer team had significant improvement in 4 of the 12 questions.

**Discussion:** This pre-post study examined the efficacy of three educational sessions during the athletic season. The positive outcomes in the short educational sessions suggest that starting education early may help with the mindset of positive body image flexibility at least short term.

**Conclusion:** There was statistically significant short-term increase in body image flexibility in adolescent female athletes with education about body image, performance, and nutrition.

Registration [Clinicaltrials.gov # NCT05222360](https://clinicaltrials.gov/ct2/show/study/NCT05222360)

**Keywords:** Female; Athlete; RED-S; Eating disorder; Body image flexibility; Body image

### Abbreviations used

BI-AAQ Body Image: Acceptance and Action Questionnaire

CC Cross: Country Team

RED-s: relative energy deficiency in sport

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### Introduction

Female athletes are at risk for relative energy deficiencies, eating disorders and negative body image satisfaction. There have been several studies of incidence in young adult athletes with one showing over 60% of disordered eating among lean sport athletes [1]. However, the prevalence among

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adolescent athletes is less studied. There are studies showing that 13% of females have a threshold or subthreshold DSM-IV eating disorder by young adulthood [2]. The relationship between disordered eating and exercise dependence and low energy availability is not entirely understood [3]. Early intervention and education about nutrition and body image may be helpful in preventing disordered eating, energy deficiencies, and promote positive body image and increase sport performance. Younger athletes (15-24) have similar rates of restrictive eating and higher rates of menstrual dysfunction compared to older athletes (25-45) [4]. A review of the literature shows few studies regarding the preventative interventions for female athletes even beyond adolescence. A review paper of the few interventions suggested that offering primary interventions with interactive multimodal approaches and focus on nutrition, body image and overall health seem more effective [5]. There are programs at the young adult level, most notably, the Female Athlete Body Project, which focus on education as a key to prevention of eating disorders [6]. The Female Athlete Body Project did show a decrease in symptoms of eating disorders and a decrease in risk factors for eating disorder in athletes at the collegiate level in the United States [7]. There is one study done at the adolescent level involving female soccer players which showed that the adolescent athletes were motivated to improve nutrition with an educational intervention [8]. There is a lack of information regarding younger female or adolescent female athletes undergoing interventions, especially interventions seeking to improve body image. Starting education earlier may lead to increased body image flexibility, positivity, and decreased incidence of eating disorders. This study looks at a program designed for adolescent female athletes to improve body image flexibility. Body image flexibility was defined as the “ability to fully experience the present moment while engaging in behavior that is consistent with one's chosen values even when the present moment includes difficult emotions, thoughts, memories or body sensations [9].” Body image flexibility was used as a measurement as it has been shown that body image flexibility is associated with physiological flexibility, increased body image satisfaction and less disordered eating [10]. The objective was to evaluate the efficacy of a three session educational program in increasing body image flexibility.

## Materials and Methods

### Subjects

Eligibility consisted of a) female b) member of a high school (adolescent) team of any level c) willing and able to provide assent/consent d) able to provide parental consent if under 18 years of age, e) ability to attend sessions and f) willingness to complete questionnaires. In the interest of inclusivity, there were no exclusion criteria.

## Participant Characteristics

Athletes were females aging from 14-18. There was little diversity as 81% were Caucasian, 8% Hispanic, 7% two or more races, 3% Asian and 1% Black. Recruitment was done based on coach interest. Many teams are co-op teams with other schools and the coaches deemed logistics too difficult. Recruitment took place at pre-season meetings with parents present. Anyone wishing to participate could also meet privately with the PI at another time if they could not attend the official meeting. Athletes had the opportunity to attend sessions but opt out of the questionnaire if desired. This is similar to previous studies of a similar nature [11]. There were no consequences for not participating. Athletes filled out their questionnaires in private and could choose to hand in a blank form or no form if they had opted out of the questionnaire. There was no financial compensation for the athlete's completion of the course or questionnaires, but they did receive free samples of hand sanitizers as this was done during COVID-19. Athletes were kept in small groups (up to 10) within their own team. The study is a pre-post study done at community high schools in a suburban United States setting. This design was chosen over a randomized control trial due to the school districts approval depending on all athletes receiving the educational intervention.

## Procedure

Female athletes were asked to participate in 3 one-hour long sessions during their athletic season. All athletes on the teams were invited. There were 49 athletes from 3 different sports involved in total. This includes 22 cross country and track, 27 cheer. Questionnaires were separated by team.

The sessions were led by young adult females who had been trained on facilitating the sessions according to the session manual. Young adults were chosen to be leaders as it was felt the adolescent athletes would relate better to younger adult leaders. Each leader attended a two-hour training session and had chances to ask any questions through the course. All leaders were females who had athletic experience at the adolescent age and some as young adults. Leaders received no compensation for their efforts. The goals of the educational content of the sessions were somewhat similar to previous programs including the Female Athlete Body Project and the Healthy Weight Intervention and the education content is similar as well [12,13]. The goals were to promote sustainable instructions in nutrition for exercise and increase body image flexibility. The educational content was designed to educate about a realistic perception of female athlete bodies, healthy eating for athletic seasons, eating disorders, relative energy deficiency in sport (RED-S), sleep, and overall mental positivity.

Session one: first week of season

- Introduction Pre-project questionnaire on body image/nutrition (BI-AAQ)

- Group rules and expectations
- Defining/discussing healthy mindset and body image flexibility
- Discussing body image and societal influence on body perception
- Nutrition for the season
- Homework 1 nutrition goal and 1 mindset goal for positive change

Session two:

- Intro/ discuss previous homework
- Positive and negative self-talk and restructuring our comments
- RED-S, impact of body and mind
- Nutrition for middle of season/meets, restrictive eating
- Sleep
- Homework: Find a private spot and read aloud the positive things you wrote to yourself from last time. Write a new nutrition goal and positive body image goal.

Session three:

- Intro/discuss previous homework
- Discuss barriers to achieving positive body image and body image flexibility and how to overcome
- Discuss nutrition for the last part of the season
- Review what was learned
- Post questionnaire (BI-AAQ and perceived utility of course)

Prior to the beginning the participants completed the BI-AAQ, a validated instrument designed to measure body image flexibility, which is associated with physiological flexibility, increased body image satisfaction and less disordered eating [14]. The athletes completed the BI-AAQ after their last session at the end of their seasons. In addition to the sessions, the athletes could choose to follow the SPRING Forward for Girls instagram page @spring\_forward\_girls for posts encouraging nutrition and positive body image.

### Outcome Measures

The BI-AAQ is a validated questionnaire of body image flexibility. Each of 12 questions is scored 1-7. The questionnaire is a measure of negative body image flexibility and reverse scoring is recommended to assess positive image flexibility. Body image inflexibility has been found to be negatively related to body satisfaction. The BI-AAQ was chosen over other measurement instruments due to strong psychometric properties with regard to construct validity, incremental validity, and internal reliability and good construct validity with predicted relationships demonstrated between convergent and divergent measures. The BI-AAQ showed a strong relationship with eating disorder risk both

in combination with the AAQ-II and independently. The validation study suggests that the BI-AAQ may be more sensitive in evaluating psychological flexibility and eating disorder risk [15]. The BI-AAQ was given at the beginning of the first session and at the end of the third session. Please see table 2 for a list of the questions asked on the BI-AAQ. In addition, a qualitative questionnaire was given after the last session asking for strengths and weaknesses, if participants would recommend the sessions to a friend and if they would repeat the course.

### Intervention fidelity

To guide leaders, a session manual with questions and facilitator information was given to each of 6 leaders. Leaders attended training sessions with the same educational content. The PI was also present at every session observing and allowing each group leader to clarify any questions at the time of education. The overall goal was to facilitate discussion for the key educational items for each session. Each item also had a list of key points for the leaders to bring up if the student athletes did not. Each group completed the items in the session manual. There will be variability in the discussions as some groups were more prone to deeper discussion, but all key items were discussed in every group.

### Analysis

Overall mean scores of the BI-AAQ were analyzed using an independent T-test. The school district specifically asked for complete anonymity, so no identifying features were on the forms. The questionnaires were separated by team. Therefore, there were 4 more pretests than posttests.

### Ethical Considerations

The study identified red flag symptoms and made coaches and athletic departments aware of resources. The session leaders were made aware of red flags symptoms and a process to guide the athletes to definitive help. The schools and districts already had some plans in place and were given additional resources to use as necessary. The Institutional Review Board and school districts approved the safety guidelines for the study.

Inclusivity was a priority in this study. All athletes identifying as female were encouraged to participate. In addition, any athlete who wished to learn the information but not complete the BI-AAQ was encouraged to participate.

### Results

#### Experimental mortality

There were 4 athletes lost during the study. Two were lost because they were quarantined due to COVID exposure, 1 person sustained an injury and stopped competing and another quit the team.

## Outcomes

The overall scores of the BI-AAQ (body image flexibility) increased from a mean of 43.6 to 54.07 or 23.91% increase. The cheer team increased from a mean of 42.3 to 52.0 or 22.75% increase. The cross country team increased from a mean of 45.2 to 57.2 or 26.5% increase. Note that the BI-AAQ is a measure of body image inflexibility so, per the recommendation of the BI-AAQ creators, we used reverse scoring for the total score data.

Table 1 BI-AAQ Mean Scores Pre and Post the educational intervention. The BI-AAQ is a measure of body image inflexibility. The BI-AAQ authors recommend reverse scoring to show change in positive body image flexibility. The data here has been reverse scored. The scores of individual

questions of the BI-AAQ also showed positive change. There were significant changes in 8 out of 12 questions for the CC/ track teams and 4 out of 12 for the cheer team. The BI-AAQ is a measure of body image inflexibility and the scores in table 2 are the raw scores.

Table 2 shows the changes for each individual question of the BI-AAQ. The BI-AAQ is a measure of body image inflexibility. The BI-AAQ authors recommend reverse scoring in total scores to show change in positive body image flexibility. The data here has not been reverse scored.

## Qualitative results

In addition to the BI-AAQ, there was a qualitative evaluation for the sessions. The feedback was overall exceedingly positive. There were suggestions both for more

Team	Mean Score Pre Test	Mean Score Post Test	Increase	Percent increase	P value
Cross country/Track (N =22)	45.2	57.2	12	26.5	<0.01
Cheer (N=27)	42.3	52	9.6	22.75	0.033
Overall	43.6	54	10.4	23.91	<0.01

**Table 1:** Pre and Post Test Mean Scores and Changes in the BI-AAQ

**Table 2:** BI-AAQ Individual Question Changes Pre and Post Test

Questions	CC/ Track pretest mean	CC/ Track posttest mean	Change	p value	Cheer pretest mean	Cheer posttest mean	Change	p value
1. Worrying about my weight makes it difficult for me to live a life that I value.	3.2	2.1	1.1	<0.05	3.5	2.4	1.1	<0.05
2. I care too much about my weight and body shape.	3.7	2.6	1.1	<0.05	4.4	3.6	0.8	0.09
3. I shut down when I feel bad about my body shape or weight.	2.9	2.1	0.8	<0.05	3.6	2.7	0.9	0.08
4. My thoughts and feelings about my body weight and shape must change before I can take important steps in my life.	2.4	1.6	0.8	<0.05	2.9	2.4	0.5	0.18
5. Worrying about my body takes up too much of my time.	3.3	1.8	1.5	<0.05	3.2	2.8	0.4	0.42
6. If I start to feel fat, I try to think about something else.	3.4	3	0.4	<0.05	3.3	2.8	0.5	0.2
7. Before I can make any serious plans, I have to feel better about my body.	2.8	2.1	0.7	0.23	3.1	2.2	0.9	<0.05
8. I will have better control over my life if I can control my negative thoughts about my body.	4.7	4.1	0.6	0.33	4.1	3.3	0.8	0.06
9. To control my life, I need to control my weight.	3.2	1.5	1.7	<0.05	3.3	2	1.3	<0.05
10. Feeling fat causes problems in my life.	2.9	1.8	1.1	<0.05	3.1	2.6	0.5	0.3
11. When I start thinking about the size and shape of my body, it's hard to do anything else.	2.8	2.1	0.7	0.19	3.4	2.6	0.8	0.09
12. My relationships would be better if my body weight and/or shape did not bother me.	2.6	2.1	0.5	0.32	3.6	2.6	1	<0.05



basic nutrition information and for more in-depth nutrition information, which matched our observations that the levels of nutrition knowledge varied widely in the athletes. Most athletes followed the Instagram page associated with the program for weekly tips and many continue to comment on it regularly. The athletes also felt having the written handouts, discussion and visuals were important to sustain the knowledge. 100% of the athletes said they would recommend this course to their female athlete friends, and 98% said they would consider taking it again the next year.

### Additional data

Although originally planned to be one year, our study was done over two years due to sports being canceled or postponed due to COVID. There was one team unable to finish all sessions due to a team outbreak of COVID. Their results are not included as they only did the beginning BI-AAQ. There were 9 cross country athletes who opted to take the session two years in a row. Their results are not included in the section above as they had previously done the first year. However, it was noted their starting BI-AAQ in their second year were a mean of 56.3 and the previous year end scores were a mean of 56. This is not enough data to be significant, however it is encouraging that it would be useful to pursue longer term studies. In this small group that repeated the sessions a second year, the increase during the season in BI-AAQ was less substantial 0.7 points ( $p$  value= 0.90). This is clearly a much lower increase and it is not significant, but may suggest that the course should only be done once or that a more in-depth follow up may be needed or perhaps be suggestive of the long term ceiling impact of the program.

### Discussion

The study evaluated the increase in body image flexibility before and after the educational intervention. There were statistically significant increases in all of the sports and overall. Like the previously mentioned review article, our athletes felt having an approach that was multimedial (written, verbal discussion and visual) was helpful for learning and reinforcement [16]. Body image inflexibility is correlated with self-criticism and binge eating due to a drive to be thinner [17]. Theoretically, if adolescent female athletes can increase their body image flexibility, they may be in a better mental and physical state to avoid future disordered eating. Further research should be done to examine the longevity of the increase. Previous studies have measured eating disorder symptoms specifically, and that was not our aim, however the measurement of body image flexibility is tied to eating disorder risk. There is room for future studies on earlier interventions making positive changes in body image flexibility and possible decrease of eating disorder risks and symptoms in later adolescence/early adulthood. The change in the individual scores was encouraging. Both groups did not have significant change in questions 8 and 11.

Both of these questions deal with controlling thoughts about the athlete's body. In the future, it may be beneficial to add material on controlling negative thoughts more effectively. The groups showed significant change in questions 1 and 9. These questions deal with either worrying about or controlling weight. The change in question 9 was the largest improvement for both groups. The remaining questions had significant improvement from only one team. The cross country/ track athletes overall showed improvement in 8 of the 12 questions and the cheer team showed improvement in 4 questions. There are only two groups represented here. Further studies may be useful in determining if athletes in different sports respond to different education. For example, both of these groups of athletes complete in lean-body sports (sports where it is beneficial either performance wise or aesthetically to have a leaner body). In addition, sports such as cheer, dance or gymnastics are graded aesthetically and that could influence an athlete's willingness to change their mindset. Further studies may find that strength dependent sports attract athletes with different needs for body image flexibility education.

### Limitations

Limitations to the study were several. The demographic of the athletes was overwhelmingly Caucasian and in a suburban setting. It is known that eating disorders are present among almost every demographic [18,19]. In addition, all of the coaches choosing to have their teams participate were from lean body type sports. It is possible the results would be different from other sports. The biggest factor in coaches choosing not to participate was that this format was small discussion groups and they were concerned about COVID spread. The school district's approval depended on every willing athlete able to participate in the intervention, so we were not able to have a control group. Another limitation of our study is that although all female athletes were eligible, the researchers are only aware of cisgender female athletes participating in the educational sessions. Further research would need to be done on adolescent transgender female athletes and athletes of color and different socioeconomic status. In addition, our study does not address the long-term results of the intervention.

### Conclusion

This study showed significant improvement in body image flexibility after three education sessions about a realistic perception of female athlete bodies, healthy eating for athletic seasons, eating disorders, relative energy deficiency in sport (RED-S), sleep, and overall mental positivity.

### Declarations

#### Ethics approval and consent to participate

The IRB approval was obtained through Solutions IRB

Registration #: IORG0007116. Parental Consent and Student Assent forms were completed by the PI and participants. The school districts involved all approved the study through their respective boards.

### Availability of data and materials

The authors were unable to locate any way to share data of BI-AAQ. Our data is securely stored, in compliance with HIPPA standards at the authors institution.

### Competing interests

The authors have no conflicts of interest or competing interests to disclose

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### Conflicts of interest

The authors have no conflicts of interest to disclose

### Author Contributions

KV. Conceptualization of study, methodology, project administration, data curation, supervision, analysis, writing, review and editing

CL. Conceptualization of study, methodology, data curation, writing, review and editing

NO. Methodology, data curation, review and editing

All authors read and approved the final manuscript.

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