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# Awareness and Comfort Treating the Female Athlete Triad and Relative Energy Deficiency in Sport among Healthcare Providers

*Bewusstsein über und Kenntnisse bei der Behandlung der „Female Athlete Triad“ und des relativen Energiedefizits im Sport*

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## Summary

- ▶ **Problem:** Awareness and knowledge of the Female Athlete Triad (Triad) among physicians and allied health professionals is well studied; however, awareness of Relative Energy Deficiency in Sport (RED-S) is largely unknown. The purpose of this study is to assess awareness and comfort in treating patients with Triad and RED-S among providers attending a sports medicine conference.
- ▶ **Methods:** Cross-sectional study of physicians and allied health professionals attending a sports medicine conference. Conference attendees (n=163, 54% female) completed a survey on awareness of and confidence in treating Triad and RED-S (response rate=42%).
- ▶ **Results:** Most participants (76%) were aware of Triad compared to fewer with awareness regarding RED-S (29%). More participants (33%) reported feeling comfortable treating athletes with the Triad compared to RED-S (13%) (p<0.001). There was no significant difference between physicians and allied health providers in outcome measures except that physicians trended towards being more likely to have heard of RED-S (p=0.07). Physicians with fellowship training in sports medicine reported greater comfort treating both Triad and RED-S compared with non-fellowship trained physicians (all p<0.05).
- ▶ **Discussion:** Knowledge in treating athletes with Triad and RED-S is low across professions, training backgrounds, and practice locations. Educational efforts are necessary for both recognition and clinical management skills.

## Zusammenfassung

- ▶ **Hintergrund:** Obwohl das Bewusstsein und die Kenntnisse über die "Female Athlete Triad" unter Ärzten und anderen Gesundheitsberufen gut untersucht sind, gibt es nur wenige entsprechende Untersuchungen zum relativen Energiedefizit im Sport (RED-S). Das Ziel dieser Studie war daher Bewusstsein und Kenntnisse über die RED-S bei Teilnehmern einer interdisziplinären Sportmedizin-Konferenz zu untersuchen.
- ▶ **Methode:** Mit Hilfe eines Fragebogens wurden Ärzte und Angehörige unterschiedlicher Gesundheitsberufe zu Ihren Kenntnissen und Therapiekompetenzen bezüglich der "Female Athlete Triad" und der RED-S befragt. Alle Teilnehmer einer Sportmedizin-Konferenz (n=163, 54% weiblich) wurden eingeladen (response rate=42%).
- ▶ **Ergebnisse:** Die meisten Teilnehmer (76%) kannten die "Female Athlete Triad", während nur wenig Bewusstsein für die RED-S (29%) berichtet wurde. Mehr Studienteilnehmer (33%) gaben an, kompetent bei der Behandlung von Sportler mit der "Female Athlete Triad" zu sein als bei der RED-S (13%) (p<0.001). Keine statistisch signifikanten Unterschiede zwischen Ärzten und anderen Gesundheitsberufen wurden gefunden, lediglich eine Tendenz für ein höheres Bewusstsein für die RED-S bei Ärzten (p=0,07). Ärzte mit einer Zusatzweiterbildung in Sportmedizin schätzten ihre Kompetenz bei der Behandlung der "Female Athlete Triad" und der RED-S höher ein als Ärzte anderer Disziplinen (jeweils p<0,05).
- ▶ **Diskussion:** Die Behandlungskompetenz in allen untersuchten medizinischen Berufen von Athleten mit der "Female Athlete Triad" und RED-S wurde insgesamt niedrig eingeschätzt. Weitere Schulungen sind sowohl für das Erkennen, als auch die Behandlung dieser Erkrankungen notwendig.

## KEY WORDS:

Treatment, Bone, Energy Availability, Menstrual Function

## SCHLÜSSELWÖRTER:

Behandlung, Knochen, Energieverfügbarkeit, weiblicher Zyklus

## Introduction

The Female Athlete Triad (Triad) was originally defined in 1992 (18). Triad currently refers to the interrelationships among energy availability, menstrual function, and bone mineral density existing on spectra of health to disease (7). A number of sports medicine professional societies have developed position statements on the Triad including the American College of Sports Medicine and the National Athletic Trainers' Association (3, 15).

Relative Energy Deficiency in Sport (RED-S) is a newer term, first introduced in 2014 by the International Olympic Committee (IOC) (13). The term RED-S recognizes the multiple health and performance consequences of low energy availability in athletes of both sexes (14). RED-S is a complex syndrome that refers to 'impaired physiological function including, but not limited to, metabolic rate, menstrual function, bone health, immunity,



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protein synthesis, and cardiovascular health caused by relative energy deficiency' (14). Triad is considered an important subset of RED-S in the IOC model. RED-S has increased interest globally including in Germany (10). One of the goals defined in the current IOC consensus statement was to stimulate advances in RED-S awareness and their clinical application (14).

Awareness and knowledge of Triad among physicians and allied health professionals has been fairly well studied (6, 11, 12, 17); however, awareness of RED-S is still largely unknown. Furthermore, differences in awareness and comfort with these diagnoses between types of providers and by training may help tailor future education and training efforts. The purpose of this study is to evaluate awareness of Triad and RED-S and the comfort with treating patients with each syndrome among attendees of a multispecialty sports medicine meeting, including physicians, physician assistants, physical therapists, nurse practitioners, athletic trainers, and trainees.

## Methods

This cross-sectional study was conducted at the 2018 Harvard Sports Medicine meeting in Cambridge, Massachusetts in May 2018. The conference included presentation on topics of RED-S and Triad. The research protocol was reviewed by Partners IRB and determined to be exempt. Participants should read „digital“ informed consent to be included in the study.

The conference was marketed to practitioners from the fields of sports medicine, physical medicine and rehabilitation, orthopedics, family medicine, internal medicine, and emergency medicine along with allied health professionals. Conference attendees included physicians, physician assistants, physical therapists, nurse practitioners, certified athletic trainers, trainees, and others. During the conference, all attendees were invited to complete a short electronic survey.

Study data were collected and managed using REDCap electronic data capture tools hosted at Partners Healthcare server (8, 9). REDCap (Research Electronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies, providing 1) an intuitive interface for validated data capture; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for data integration and interoperability with external sources. The online survey took approximately 10 minutes to complete and included questions related to sports medicine practice and education. Because the conference included presentations on topics pertinent to the survey, participants were asked to answer questions regarding their awareness and comfort levels prior to attending the conference: Participants were asked if, prior to the conference, they had previously heard of the “Female Athlete Triad” and the term “Relative Energy Deficiency in Sport”. Additionally, they were asked to respond to a statement regarding their comfort, prior to the conference, with treating athletes with the “Female Athlete Triad” and “Relative Energy Deficiency in Sport”, with response options on a five-point Likert scale: strongly disagree, disagree, neutral, agree, and strongly agree. Demographic information, including age, gender, current profession, field of medicine, training in sports medicine, and geographic location of practice was collected.

Table 1

Demographic information of survey participants (n=163). \*Includes Naturopathic doctors, certified pedorthist, medical student, and undergraduate student.

VARIABLE	N (%)
<b>Age (yrs)</b>	
20-29	33 (20%)
30-39	63 (39%)
40-49	29 (18%)
50-59	30 (18%)
60+	8 (5%)
<b>Gender</b>	
Male	74 (45%)
Female	88 (54%)
Transgender	1 (1%)
<b>Profession</b>	
Attending physician	54 (33%)
Resident and fellow physician	12 (7%)
Allied health professional	97 (60%)
Nurse practitioner	3 (2%)
Physician assistant	43 (26%)
Physical therapist	41 (25%)
Certified athletic trainer	4 (2%)
Other*	9 (4%)
<b>Years in profession</b>	
0-5	54 (33%)
6-10	39 (24%)
11-15	20 (12%)
16-20	14 (8%)
>20	27 (17%)
In training	9 (6%)
<b>Training background of physicians</b>	
Sports medicine fellowship	23 (35%)
No sports medicine fellowship	43 (65%)
<b>Location</b>	
United States – New England	72 (44%)
United States – Other	58 (36%)
International – Canada	16 (10%)
International – Other	17 (10%)

Differences in awareness of Triad and RED-S by profession and training were assessed using Chi-square analysis. Comfort with treating athletes with Triad and RED-S was determined by the following grouping: those who answered “agree” or “strongly agree” were designated as expressing comfort treating athletes with the syndrome, while those who responded “neutral”, “disagree”, or “strongly disagree” were designated as not expressing comfort. Chi-squared testing was used to assess differences in comfort treating athletes with Triad and RED-S between physicians versus other providers. We also conducted analyses on the ungrouped ordinal data using Wilcoxon rank sum to ensure lost power in detecting differences did not influence our findings. Analyses were performed in R, v 3.4.3, and RStudio, v 1.1.383. >

## Results

Of the 386 total conference attendees, 163 responded to the survey (response rate of 42%). Demographic information is shown in Table 1. Most (55%) of participants completed the survey within two days of invitation to complete the survey. The rest of the participants completed the survey within the next three, or within two days of conference completion.

Seventy-six percent of participants (n=124) had heard of Triad compared to twenty-nine percent having heard of RED-S (n=47) ( $p<0.001$ ). Thirty-three percent (n=53) agreed or strongly agreed to the statement "Prior to attending the conference, I felt comfortable treating athletes with the Female Athlete Triad" while fewer (13%, n=21) agreed or strongly agreed to the statement "Prior to attending the conference, I felt comfortable treating athletes with Relative Energy Deficiency in Sport" ( $p<0.001$ ).

Level of awareness of Triad did not significantly differ between physicians and non-physicians. There was a trend towards physicians being more likely to have heard of RED-S compared to non-physicians (36% vs. 24%,  $p=0.068$ ). Reported levels of comfort treating athletes with Triad or RED-S did not differ between physicians and non-physicians. Fellowship trained physicians in sports medicine were significantly more likely to be aware of Triad (91%) and RED-S (61%) compared to those without fellowship training (63% and 23%;  $p=0.020$  and  $p=0.0025$ , respectively). Physicians with fellowship training in sports medicine were more likely to express comfort treating athletes with Triad (57%) compared to those without fellowship training (26%,  $p=0.01$ ); however, there was no difference in the level of comfort treating athletes with RED-S. Differences between domestic (US) and internationally located practitioners in awareness of Triad (15% and 25%, respectively,  $p=0.20$ ) and RED-S (70% and 60%, respectively,  $p=0.32$ ) were not significant. There was a trend toward domestic (US) practitioners being less comfortable with treating patients with Triad compared to internationally located practitioners (39% and 62%, respectively,  $p=0.080$ ); however, differences in comfort treating patients with RED-S (42% and 55% respectively,  $p=0.35$ ) was not significant.

## Discussion

The study suggests education on Triad may have improved over time. The first study assessing knowledge of Triad was published in 2006 and found that only 9% of physicians felt comfortable treating patients with Triad (17). The current report identifies that 33% of practitioners attending a sports medicine conference were comfortable treating patients with Triad and that 67% were aware of the term Triad. In contrast, only 29% of participants were aware of the term RED-S, which was introduced just four years prior to this survey. Fewer physicians and allied health professionals expressed comfort treating patients with RED-S (13%) than treating Triad in this study (33%) or another sample of multispecialty physicians (51%) (6). Even among physicians with fellowship training in sports medicine, awareness of the term RED-S and comfort treating patients with RED-S was low. Therefore, expanding awareness of RED-S across many disciplines of sports health practitioners is important. While the Triad is described in female athletes, the latest updates of RED-S expand to include male athletes as well as other underrepresented groups in the athletic community, such as Paralympic athletes, as populations also at risk for consequences

of low EA (1, 2, 4, 5, 13, 16). This suggests importance in adding education on the internationally accepted syndrome of RED-S to medical and fellowship training as well as in the education of sports health professionals (14).

There are several limitations to this study. Study participants consisted of attendees of a sports medicine conference and may not be representative of all health professionals and all countries. Our response rate was 42%, which may have introduced selection bias towards participants being more aware of Triad and RED-S. Our sample size of different providers likely show limited ability to detect differences by specialty. Lastly, survey respondents may have overestimated their awareness or comfort with Triad and RED-S, or participants may have forgotten their level of awareness or comfort with Triad and RED-S prior to attending the conference.

In summary, awareness of both Triad and RED-S is low among sports medicine providers. Considering the multiple negative health implications of Triad and RED-S, increased education efforts are needed to improve comfort diagnosing and treating these conditions. ■

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## Conflict of Interest

*The authors have no conflict of interest.*

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