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Abstract

The purpose of this study is to outline the experience of three elite, collegiate male endurance runners presenting with characteristics of a potential male version of the Female Athlete Triad and undergoing clinical treatment and intervention for bone stress injuries (BSIs) and/or hypogonadotropic hypogonadism. Using data extracted from a larger, prospective study on nutrition interventions to prevent bone stress injuries, three athletes (two presenting with BSIs and the third presenting with significant hypogonadotropic hypogonadism) were followed throughout their collegiate athletic career. Each athlete exhibited nutritional deficits and consulted with a sports dietitian to optimize their energy status and facilitate recovery from their Triadrelated injuries. This case series provides clinical evidence that male endurance runners may be susceptible to a Triad parallel to the Female Athlete Triad, with significant clinical sequelae being the development of BSIs or hypogonadism that may stem from low energy availability.

Introduction

- The Female Athlete Triad is classified as a spectrum of 3 interrelated conditions: low energy availability (LEA), functional hypothalamic amenorrhea, and osteoporosis.⁷
- A potential similar condition in male athletes exists, consisting of: LEA, hypogonadotropic hypogonadism, and osteoporosis.⁸

Low energy availability:

- Achieved through either dietary restriction (with or without disordered eating), increasing energy expenditure, or both.
- May affect leptin secretions that then alter growth hormone, insulin-like growth factor 1, luteinizing hormone, folliclestimulating hormone, etc.

Hypogonadotropic Hypogonadism:

- Can be thought of as having low serum testosterone in males
- Previous studies have reported subclinical decreases in
- testosterone in male athletes.^{1,3,5}

Osteoporosis:

- LEA and hypogonadism may contribute to loss of bone mineral density (BMD), which may result in osteoporosis
- Low BMD is a known risk factor for bone stress injuries (BSIs).^{2,4}

Bone stress injuries:

- Overuse injuries caused by inadequate bone remodelling
- Manifest most commonly as stress fractures in active individuals.⁶
- Incidence shares a dose-response relationship with Triadrelated risk factors (i.e., excessive exercising, low BMD Z-score, and low body mass index).²
- Treatment entails modified activity and gradual progression to pre-injury activity.⁹

Endurance Running:

- High caloric and nutrient needs required to sustain endurance running
- Adequate calcium and vitamin D status may attenuate BSIs and stress fracture risk.⁹

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 Case study design)
 Data collected from a larger study on preventing BSIs in collegiate endurance runners through nutrition interventions. 	
• Subjects)
 3 elite, male collegiate endurance runners 	
Procedures of the Larger Study	
 Data collection at baseline and every subsequent year 	,
 Demographic questionnaire 	
 Eating Disorders Examination Questionnaire (EDE-Q) 	
 3-day 24-hour recall or food frequency questionnaire 	_
 Exercise log or exercise patterns questionnaire] _1
 Body composition 	-1 -′
 Dual X-ray absorptiometry or air displacement plethysmography (BodPod[®]) 	Ba +2 +2
 Nutrition Intervention by the sports registered dietitian (RD) 	+3
 Team nutrition talk 	
 1-on-1 counselling sessions 	ab
 Diagnosis of a BSI or hypogonadotropic hypogonadism 	

- Further intervention as indicated by standard of care
 - Routine visits with a sports physician
 - Weekly biweekly, or monthly visits with a sports RD to optimize energy status

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Cross-training, pr	hysical therapy	y, psychological (8			Injury Description	Injury Description Treatments
Parameter	Athlete 1	Athlete 2		Athlete 3		<u> </u>		
(yrs)	20	22		22		Athlete I	Athlete I R proximal tibial reaction	Athlete I R proximal tibial reaction Cease weight-bearing activity/running Gradual progressive running as tolerated
pht (cm)	178	168		183				Cross-training
oht (ka)	66.8	62.3		63.2				Calcium & Vitamin D supplementation
ested weight (leg)	75 5	64.5		80.0				Nutrition counseling
cted weight (kg)	/5.5	04.5		80.9			Multiple subchondral pelvic fractures	Multiple subchondral pelvic fractures Cease weight-bearing activity/running
	88%	97%		78%				Gradual progressive running as tolerated Anti-gravity treadmill
$\left(\text{kg/m}^2 \right)$	21.1	22.1		18.9				Cross-training
nts/distances	800m	1500m		1500m				Non-impact bike/pool/elliptical
eage (mi/wk)	70-75	60		80				Use of mobility aids (crutches, motorized scooter)
ious history of hono inium.	$\sqrt{-75}$	$\mathbf{D} 2^{\mathrm{rd}}$ moto correct.	function	00				Bone stimulation Nutrition counseling
100s history of bone injury	Ankle Iracture	K 3 metacarpai	tracture	none	Athl	ete 2	ete 2 R 2 nd metatarsal fracture	ete 2 R 2 nd metatarsal fracture Cease weight-bearing activity/running
1. Baseline characteristics	of athletes at diag	nosis of either their f	first BSI or					Use of mobility aids (crutches, walking boot) until pain-free
onadotropic hypogonadism	,							Gradual progressive running as tolerated
								Anti-gravity treadmill Cross-training
Measure	Athlete 1	Athlete 2	Athlete 3					Non-impact bike/pool/elliptical
ion of weight ¹ Sl	lightly Overweight	Slightly Overweight	Ideal Weight					Calcium/Vitamin D supplementation
pting to lose weight?	Yes	Yes	No		Athlata 2		D A chilles tendinonathy	P A chilles tendinonathy Pest ice compression elevate (PICE)
pting to gain weight?	No	No	No		Aunete 5		K Achines tendinopatity	Cross-training
ce of excessive exercise	Yes	No	No					Full sports participation as tolerated
ating disorder diagnosis	No	No	No				Hypogonadism	Hypogonadism Nutrition counseling regarding fueling/positive energy balance
ce of disordered eating or	Yes	Yes	Yes					Obtain laboratory values
thological behavior ²					¹ Return to :		nlaw defined as the point of re-introduction	Cabergoline (prolactin inhibitor)
ed by athlete as part of EDE-Q					2 n/a: data 1	וס ויל	not applicable	not applicable
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Measure	Athlete 1	Athlete 2	Athlete 3	-
Perception of weight ¹	Slightly Overweight	Slightly Overweight	Ideal Weight	-
Attempting to lose weight?	Yes	Yes	No	
Attempting to gain weight?	No	No	No	
Presence of excessive exercise	Yes	No	No	
Prior eating disorder diagnosis	No	No	No	
Presence of disordered eating or	Yes	Yes	Yes	
\mathbf{n} nathological behavior ²				

²Disordered eating or pathological behavior defined as excessive exercise or intentional efforts to influence shape or weight, including restriction of certain foods or adhering to specific rules or limits regarding eating

Table 2. Disordered eating attitudes and behaviors of athletes in proximity to their initial injury.

ners with bone stress injury and/or male Athlete Triad: A case series. ¹, Aurelia Nattiv², Long Wang¹

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Results

2 athletes sustained BSIs (Athletes 1 & 2) while one athlete experienced significant hypogonadism (Athlete 3)

Possible disordered eating behaviors in all 3 athletes • Drive-for-thinness

All athletes had significant weight loss (1.4-5.9kg) prior to injury

Suboptimal energy intake

	Athlete 1	l	Athlete 2	Athlete 3	
Time	Weight (kg)	Time	Weight (kg)	Time	Weight (kg)
-16 mo.	69.1	-10 mo.	61.8	-12 mo.	69.1
-7 mo.	68.2	-9 mo.	63.2	-3 mo.	68.6
Baseline	66.8	-1 mo.	66.8	Baseline	63.2
+21 mo.	67.7	Baseline	62.3	+7 mo.	65.5
+24 mo.	68.2			+7.5 mo.	63.6
+36 mo.	70.0			+8 mo.	67.7
				+8.5 mo.	65.9
				+9 mo.	66.5

ble 3. Weight history of athletes in relation to their baseline injury.

• BSI treatment plans were similar between Athletes 1 & 2, which focused on optimizing nutrition • Role of a sports RD

Table 4. Prescribed treatments for an athlete's specific injury.

Limitations

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- data.





Conclusion

Discussion & Summary

• This study provides clinical evidence of a parallel Male Athlete Triad.

• Male endurance runners may be at increased risk for this parallel Triad and related injuries such as BSIs.

• Recovery necessitates a multidisciplinary care team, with a focus on optimizing energy status.

Case analysis

• Energy availability not measured

Future Research

• Prevalence of the Male Athlete Triad

• Comparing LEA and consequences between male

and female athletes

• Consequences of low testosterone on reproductive

and bone health in male athletes

• Validating the role of nutrition in preventing and/or

treating the Triad in large-sample studies

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