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## Impact of an educational intervention on female athlete triad knowledge in female athletes

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### Abstract

The purpose of the study was to determine if an educational intervention for female athletes can improve knowledge of the female athlete triad. The participants of the study were 100 female collegiate athletes from Sports Authority of India, Lakshmbai National College of Physical Education Trivandrum. They were randomly assigned to an experimental group (N=50) and control group (N=50). BMI and hours of training per week was recorded. The Triad Knowledge Questionnaire (TKQ) was distributed to each of them. After completing the TKQ, the experimental groups received the randomly assigned interventions. The experimental group received an educational intervention session in the form of a PowerPoint presentation and handout while the control group did not receive the educational intervention. The TKQ was administered again following four weeks to determine if there was a difference in female athlete triad knowledge in the intervention group. The results of the study indicated that 42% of them were underweight and 45% of them were training 25-30 hours per week. Significant differences were seen between groups on TKQ posttest performance. The mean and SD of TKQ for Experimental Group for pretest and posttest was  $4.82 \pm 2$  and  $11.08 \pm 1.59$  and control group  $5.02 \pm 1.99$  and  $5.02 \pm 1.99$  respectively. Overall, the findings of this study revealed that an educational intervention for female collegiate athletes improved knowledge of the female athlete triad.

**Keywords:** Disordered eating, educational intervention, female athlete triad (Triad)

### Introduction

The number of women participating in State and National competitions has increased. Optimal nutrition intake is needed to fuel this physical activity and to maximize performance and recovery (American College of Sports Medicine, American Dietetic Association, & Dietitians of Canada, 2009) [2]. However, female athletes may intentionally or unintentionally restrict their caloric intake or over train in an effort to excel at their sport or to achieve a lean physique (Pantano, 2006) [7]. This may result in an energy deficit which puts these female athletes at risk of the female athlete triad, also referred to as the triad.

The female athlete triad is a syndrome that consists of three interconnected components: energy availability, menstrual function, and bone mineral density, which encompasses a range from optimal health to disease (Nattiv *et al.*, 2007) [6]. At the severest end of the spectrum, clinical conditions including eating disorders, functional hypothalamic amenorrhea (absence of menses), and osteoporosis (low bone density) may be present (Nattiv *et al.*, 2007) [6].

Education is essential to the prevention of the female athlete triad (Miller *et al.*, 2012; Nattiv *et al.*, 2007; Staurowsky *et al.*, 2009) [5, 6, 8]. Female athletes who do not understand the connection between the components of the triad may not realize they have the syndrome until they have a stress fracture, a common first symptom (Sundgot-Borgen & Torstveit, 2003) [9]. Lack of outward signs could indicate that female athletes may disregard the severity of low energy availability and amenorrhea. This supports the importance of educating female athletes about the triad in order to prevent its occurrence.

Furthermore, there is hardly any study being conducted in the India to examine if an educational intervention can improve knowledge of the female athlete triad. Therefore, it is imperative to determine the impact of education on female athletes and their knowledge of the female athlete triad

The purpose of the study were: (a) to educate female collegiate athletes about the triad, making use of an educational presentation and handout; and (b) to assess BMI and hours of training of the athlete.

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**Methods**

**Participants**

One hundred female Athletes between the age group of 15 to 28 years from Sports Authority of India, Lakshmbai National College of Physical Education Trivandrum were selected as subjects for the study. Female athletes from football, basketball volley ball, hockey, taekwondo, swimming, badminton participated in the study. They were randomly assigned to an experimental group (N=50) and control group (N=50).

**Measurement Instrument**

Body mass Index (BMI) was calculated using the measurement of height and body weight.

Athletes' knowledge of the female athlete triad was measured using a Triad Knowledge Questionnaire (TKQ).

Height and Body Weight was recorded to calculate the BMI. Hours of training per week was also recorded. The TKQ was distributed to each of them. After completing the TKQ, the experimental groups received the randomly assigned interventions.

**Intervention**

The two groups were classified as presentation only (PO), and control (CT). The PO group received an educational intervention session in the form of a PowerPoint presentation (Appendix A). This 15 minute presentation was developed after an extensive review of the literature related to the female athlete triad. It focused on defining the female athlete triad and how the three components are interconnected. The presentation also covered risk factors and signs and symptoms of the female athlete triad. Special attention was given to the importance of optimal nutrition intake in order to prevent the occurrence of the triad. The presentation also included a list of people an athlete can approach if she is experiencing any signs or symptoms of the female athlete triad. The CT group received no intervention. These interventions were intended to improve knowledge about the female athlete triad. Low Energy Availability in Female (LEAF-Q) was distributed to determine athletes energy availability.

The Low Energy Availability in Females Questionnaire (LEAF-Q), which comprised questions regarding Injuries which includes three questions (a) absences from training during last year due to injuries (b) days of absence from training due to injuries previous year and (c) what kind injuries had in last year. Gastrointestinal function includes four questions (a) do you feel gaseous or bloated in abdomen, also when you do not have your periods (b) do you gets cramps or stomach ache which cannot be related to your menstruation (c) how often do you have bowel movements on average (d) how would you describe your normal stool and Menstrual function includes eleven questions. (a) How old were when you had your first period? (b) Did your first menstruation come naturally (by itself)? (c) Do you have normal menstruation?(d) If yes, when was your last period? (e) If yes, are your periods regular? (Every 28th to 34th day) (f) If yes, for how many days do you normally bleed? (g) : If yes, have you ever had problems with heavy menstrual bleeding? (h) If yes, how many periods have you had during the last year? (i) Have your periods ever stopped for 3 consecutive months or longer (besides pregnancy)?(j) Do you experience that your menstruation changes when you increase your exercise intensity, frequency or duration? (k) If yes, how.

The experimental research study used a two group pretest-posttest design. The effectiveness of an educational intervention was measured by retesting both the groups after a period of four weeks. The independent variable was the educational intervention and the dependent variable was athletes' knowledge about the female athlete triad

**Statistical Analysis**

Frequencies and percentages was calculated for assessment of BMI and training hours per week. Wilcoxon signed rank test was used for finding the effectiveness of presentation and handout knowledge of female athlete triad. A significance level of  $p < .05$  was set.

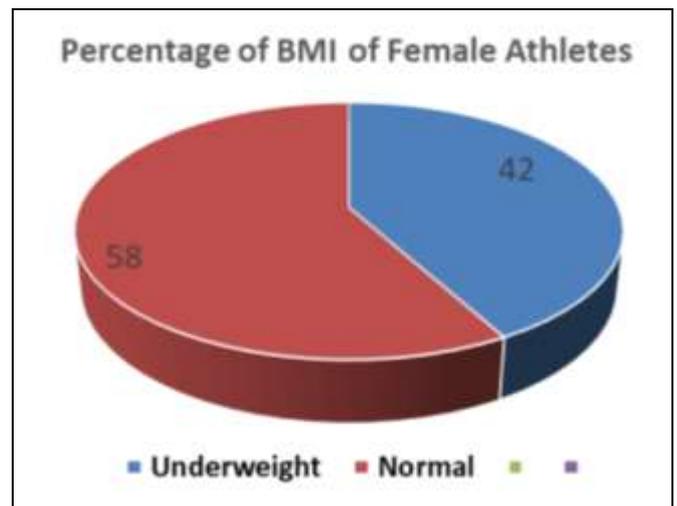
**Results**

Frequency and Percentage distribution of female athlete based on BMI is presented in Table 1.

**Table 1:** Frequencies and percentages of subject with respect to BMI.

BMI	Frequency	percentage
Under weight	42	42.0
normal	58	58.0
total	100	100.0

Table 1 revealed that 42% of female athlete had less than 18.5 BMI, 42% of athletes were under weight while 58% of athletes had normal BMI and majority of female athlete were in normal BMI category.

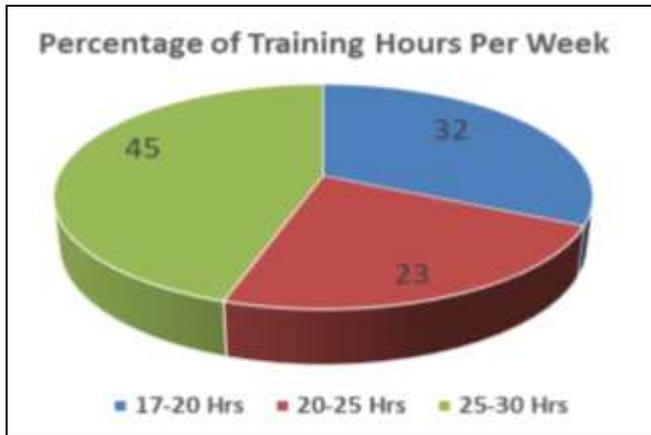


**Fig 1:** The diagrammatic representation of distribution of female athlete based on BMI

**Table 2:** Distribution of sample with respect to training hours per week.

Training hours per week	frequency	Percentage	Cumulative percentage
17-20 hours	32	32.0	32.0
20-25 hours	23	23.0	55.0
25-30 hours	45	45.0	100.0
total	100	100.0	

Table 2 revealed the distribution of sample with respect to training hours per week. 32% of female athlete trained train 17-20 hours per week, 23% trained 20-25 hours per week while 45% of them trained 25-30 hours a week.



**Fig 2:** Distribution of sample with respect to training hours per week.

**Findings Related To Triad Knowledge**

**Table 3:** Descriptive statistics on knowledge score before the intervention for Experimental and Control Group

Knowledge	No of subjects	minimum	maximum	mean	S.D
Pre test	100	.00	9.00	4.8700	2.033

**Table 4:** Effectiveness of Intervention (presentation and hand out) On Knowledge of Female Athlete Triad

knowledge	No of subjects	mean	SD	% gain	Z score	p-value
Pre test	50	4.82	2.11	1.29	-6.18	*0.000
Post test	50	11.08	1.58			

**Findings related to injuries**

Response to the question “have you had absences from training or participation in competitions during last year due to injuries “is shown in table 4.3

**Table 5:** sample wise response for the question: have you had absences from training, or participation in competitions during the last year due to injuries?

Response	Subjects(N=100)	
	frequency	%
no, not at all	44	44.0
yes, once or twice	44	44.0
yes, three or four	10	10.0
yes, five times or more	2	2.0

**Table 6:** sample wise response for the question how many days absence from training during last year due to injuries.

Response	Subjects(N=100)	
	frequency	%
1-7 days	22	22.0
8-14 days	25	25.0
15-21days	33	33.0
22days	20	20.0

**Table 7:** sample wise response for the question: do you feel gaseous in abdomen, when you do not have period?

Response	Subjects(100)	
	frequency	%
Rarely or never	49	49.0
Once or twice a week	7	7.0
Several times a week	26	26.0
Several times a day	18	18.0

**Table 8:** Athletes responses for the question: do you get cramps or stomach ache which cannot be related to your menstruation?

Response	Subjects(N=100)	
	Frequency	%
Rarely or never	52	52.0
Once or twice a week	18	18.0
Several times a week	12	12.0
Several times a day	18	18.0

**Table 9:** Athletes response for the question: how often do you have bowel movements on average?

response	Subjects(N=100)	
	frequency	%
Once a day	40	40.0
Several times a day	7	7.0
Every second day	13	13.0
Twice a week	12	12.0
More rarely	28	28.0

**Table 10:** Athlete’s responses for the Question: how would you describe your normal stool?

Response	Subjects (N=100)	
	Frequency	%
Normal	58	58.0
Diarrhea-like	17	17.0
Hard and dry	25	25.0

**Table 11:** Athletes responses to the question: how old were when you had first period?

Response	Subject(N=100)	
	frequency	%
12 to 14 years	75	75.0
15 years or older	25	25.0

**Table 12:** Sample wise response for the question: Do you have normal menstruation?

Response	Subjects(N=100)	
	Frequency	%
Yes	84	84.0
I don’t know	3	3.0
No	13	13.0

**Table 13:** sample wise response for the question: when was your last period?

Response	Subjects (N=100)	
	Frequency	%
0-4 weeks ago	67	67.0
1-2 months	17	17.0
3-4 months	10	10.0
5 months or more	6	6.0

**Table 14:** Sample wise response for the question: are your periods normal? (Every 28<sup>th</sup> to 34<sup>th</sup> day).

Response	Subjects (N=100)	
	Frequency	%
Yes, most of the time	75	75.0
No, mostly not	25	25.0

**Table 15:** sample wise response for the question: For how many days do you normally bleed?

Response	Subjects (N=100)	
	Frequency	%
1-2 days	38	38.0
3-4 days or more	62	62.0

**Table 16:** sample wise response for the question: have you ever had problems with heavy menstrual bleeding?

Response	Subjects (N=100)	
	Frequency	%
No	63	63.0
Yes	37	37.0

**Table 17:** sample wise responses for the question: Have your periods ever stopped for 3 consecutive months or longer?

Response	Subjects(N=100)	
	Frequency	%
No, never	99	99.0
Yes, it has happened before	1	1.0

**Table 18:** sample wise responses for the question: do you experience that your menstruation changes when you increase your exercise intensity, frequency or duration?

response	Subjects(N=100)	
	Frequency	%
Yes	34	34.0
No	66	66.0

**Table 19:** sample wise response for the question: what are the changes occur in menstruation due to increase in frequency and intensity?

Response	Subjects(N=100)	
	Frequency	%
I bleed more	30	30.0
I bleed less	33	33.0
My menstruation stops	37	37.0

## Discussion

The analysis of the result revealed that in case of BMI of athletes, 42% of them had less than 18.5 BMI score which falls in the underweight category, one of the reason could be the duration of training hours, because 45% of these athletes were training for 25-30 hours per week. Female athlete tend to focus more on being thin or slim and, may eat too little or exercise too much

With regard to injuries, most of the athletes experience more than two times injuries in a year due to which more than 44% of athletes failed to participate in competition during previous year and 33% of athletes were absent for 15 to 21 days from training too.

In terms of findings related to gastro intestinal function 26% of athletes had gaseous problem several times a week and 18% of athletes experienced several times a day, 7% of them had once or twice a week in abdomen, 18% of athletes experienced cramps and stomach ache once or twice a week, which is not related to menstruation.

On an average day 40% of female had normal bowel movements, 58% of athletes have normal stool 17% and 25% of them have diarrhea like and hard and dry stool.

In terms of findings related to menstrual functions 75% of female athletes had first time menstruation between the ages of 12-14 years. Only 3% of athlete doesn't know about their normal menstruation among 100 athletes 13% of athletes did not have normal menstruation while majority of the athletes had normal menstrual cycle. 67% athletes had last period 0-4 weeks ago.

Study also revealed that 75% of athletes had menstrual periods on 28<sup>th</sup> to 34<sup>th</sup> days only 25% of athletes did not get it on time.

Normally 62% of athletes bleed for 3-4 days which is very common among women's and it was found that 37% of

athletes had problems with heavy menstrual bleeding, 64% of athletes had 12 or more times period during last year which is normal in all women.

Among 100 athletes 1% had experienced stopping of periods for 3 consecutive month or longer, 90% of them had regular period every months. It was also found that 34% of athletes experienced changes in their menstruation pattern when there was increase in exercise intensity and frequency due to increase in intensity of exercise 30% of them bleed more some said they bleed less and in the case of 37% of athletes menstruation will be stopped for some time.

The study investigated the effectiveness of educational interventions for female athletes on knowledge of the female athlete triad. The results of this study demonstrated that there was an increase in female athlete triad knowledge scores from pretest to posttest. The results further revealed that female athlete triad knowledge is lacking in this sample of female athletes. However, the increase in TKQ scores attests to the effectiveness of an educational intervention for female athletes. Although this is the pilot educational intervention for the female athlete triad among female athletes, other studies have shown that interventions are effective at improving nutrition knowledge among this population (Abood *et al.*, 2004; Collison *et al.*, 1996; Kunkel *et al.*, 2001) <sup>[1, 3, 4]</sup>. Female athletes appear to be receptive to education interventions. Therefore, the sports departments should invest time in educating their athletes in order to keep them healthy and thus, at their peak performance.

There was a significant difference between the two groups in TKQ scores. The PO group mean knowledge score for the pretest and the posttest increased from 4.82±2. to 11.08± 1.59 with the percentage of 1.29 and In control group the mean score is same in pretest and post test 5.02±1.99 and 5.02±1.99 so there is no changes in score.

## Limitations

There were limitations to this study such as the small sample size. Another limitation of this study is that the measurement instrument was un-validated. Currently, there is not a survey that scores female athlete triad knowledge. Therefore, the TKQ used in this study is the first to be created.

## Applications

The data suggests the importance of providing education to female athletes in order to increase their awareness of the female athlete triad. The findings of the study are beneficial to coaches, resources for female athlete triad information and support. Sports departments should consider providing educational interventions to female athletes in order to prevent the occurrence of the female athlete triad. A nutritionist could give a presentation to the athletes at the start of each season.

## Recommendations for Future Research

Additional research is needed to test the effectiveness of an educational intervention for a larger sample of female athletes. The study should include female athletes from a variety of sports and across different geographical areas

## Conclusion

The results of this study indicate that an educational intervention is effective at improving knowledge of the female athlete triad. Since education is considered essential to the prevention of the female athlete triad (Miller *et al.*, 2012; Nattiv *et al.*, 2007; Staurowsky *et al.*, 2009) <sup>[5, 6, 8]</sup> these

findings suggest that female athletes may benefit from an educational program. The lack of knowledge of the female athlete triad demonstrated in this study attests to the need for educational interventions among the female athletic population.

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