

Original Research Article

Analysis of female athlete triad in adolescent female Bharatanatyam dancer using low energy availability questionnaire

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ABSTRACT

Background: The aim of this study was to assess adolescent Bharatanatyam female dancers for female athlete triad (FAT) which includes low energy availability (LEA), musculoskeletal injury profile, gastrointestinal function and menstrual dysfunction using in females LEAF questionnaire.

Methods: The approval was taken from the institutional review board of K. J. Somaiya college of physiotherapy. A pre-designed, pre-validated, questionnaire was distributed in the google form layout, among population according to the inclusion and exclusion criteria; asking for consent to confirm their willingness to participate voluntarily. After confirmation, the participants were directed to complete the LEAF questionnaire, maintaining their confidentiality. Data collected was analyzed using descriptive statistics.

Results: A total of 82 participants took part in this study. The cumulative incidence of musculoskeletal injuries is about 50%. 35.4% of population experienced gaseous or bloated abdomen apart from menstrual function and 32.9% experienced cramps or stomach ache which were not related to menses. 7.3% of population reported primary amenorrhea, 35.8% reported secondary amenorrhea and 18.6% reported oligomenorrhea. Thus, overall, 34.5% population reported all the components of FAT.

Conclusions: Prevalence of LEA in Bharatanatyam female dancers was reported amongst which prevalence of musculoskeletal injuries was high amongst the participants followed by menstrual dysfunction. LEA might have been interpreted as a usual or needed procedure to achieve better performance in past, but now it is recognized that it may lead to several negative consequences. Therefore, timely screening of dancers along with adequate training protocol will help alleviate LEA.

Keywords: FAT, Bharatanatyam dancers, Injury, Menstrual dysfunction, Gastrointestinal function

INTRODUCTION

Bharatanatyam is one of the seven classical dance forms originated in Tamil Nadu, having genesis in 'Devadasi' who were known for their sculptural postures, precise techniques, rhythm and expressions. Adavus are the building blocks of the dance. These are the special type of exercises which focuses on attending required postures that boosts the body to adopt the dance style i.e., extreme sideways bending and body flexibility. From a

physiological point of view, regular training in Bharatanatyam dancing is anticipated to serve as a good exercise having potential beneficial effects in maintaining favorable body structure.¹

To attend this favorable body structure, dancers tend to either exercise more than required, reduce food intake and skip meals. Restricted eating behavior is practiced by dancer's emphasis on leanness of special concern.² LEAF undermines bone health and development indirectly by eliciting amenorrhea and directly by suppressing the

hormones that promote bone formation.² These three components of low energy availability, menstrual dysfunction, bone mineral density is referred to as FAT by the American college of sports and medicine.

Aesthetic goals remain of utmost importance for dancers but even they remain subject to the unyielding physical levels as athletes.³ FAT has an impact on athletes at all experience levels, from recreational to elite.²

The low energy availability in females questionnaire (LEAF-Q), focuses on physiological symptoms of insufficient energy intake. It contains questions regarding injuries, gastrointestinal and reproductive function.⁴

As explained about the components of fat, objectives of this study are similar; to analyze low energy availability with/without menstrual dysfunction in dancers, along with studying musculoskeletal injury profile in dancers. And also, to analyze gastrointestinal function. This will help to early detection of risk of the fat in the dancers.

METHODS

Study design and setting

This observation descriptive study was conducted among adolescent Bharatanatyam female dancers, who are professionally pursuing Bharatanatyam as well as dancers who are pursuing junior college, under graduations studies academically.

Data measurement methods

A pre-designed, pre-validated, questionnaire was distributed in the google form layout, among population in the period of six months according to the inclusion and exclusion criteria in K. J. Somaiya college of physiotherapy within the time period of six months (December 2020 to June 2021).

Sampling technique and sample size

The sample size was calculated from openepi free source calculator where the anticipated average prevalence of dancers as per the article “The LEAF questionnaire: a screening tool for the identification of female athletes at risk for the female athlete triad” by Melin et al was 21.13%, absolute precision being 9%, design effect 1%, confidence level: 95%, level of significance: 5% and the minimum obtained sample size was 82.

Survey instrument

The approval was taken from the Institutional review board of K. J. Somaiya college of physiotherapy. The questionnaire was distributed in the google form layout. The consent was taken by asking the participants to answer a ‘yes/no’ to confirm their willingness to participate voluntarily. After confirmation of the

question, the participants were directed to complete the LEAF questionnaire. Confidentiality was ensured for all participants enrolled in this study.

The LEAF-Q is a brief questionnaire which can be considered for use to identify female athletes at risk of the triad. It is a 25-item questionnaire having 78% of sensitivity and 90% of specificity rate in order to correctly classify current energy availability and/or reproductive function and/or bone health.

Inclusion and exclusion criteria

Eligible dancers including professional and non-professionals living in Mumbai, Maharashtra who have started their Bharatanatyam training from past four years and are currently practicing for 2 hours/week successfully submitted their responses were included in the study. Dancers who were not willing to give consent for the study and those who have taken gap from their practice were excluded from the present study.

Statistical methods

The data was entered using Microsoft excel and analyzed using SPSS statistical software. Percentages, tables, bar diagrams, pie charts were used for data summarization and presentation. Descriptive statistical analysis was carried out and results depicted as categorical measurements in percentage.

RESULTS

Demographics

Out of the total 82 participants, 86.6% population was between 17-20 years, 11% being 14-16 years old and rest 2.4% is 10-13 years old (Figure 1). 46.3% are pursuing under graduation studies academically, 24.4% are learning Bharatanatyam professionally, 20.7% are in junior college and 8.5% are currently in their secondary schooling. Table 1 depicts that 57.3% of population undergo aerobic, resistance and flexibility protocol for their training with varying number of hours per week, 20.73% follow the protocol for 8-12 hours/week, 15.85% follow for 13-18 hours/week.

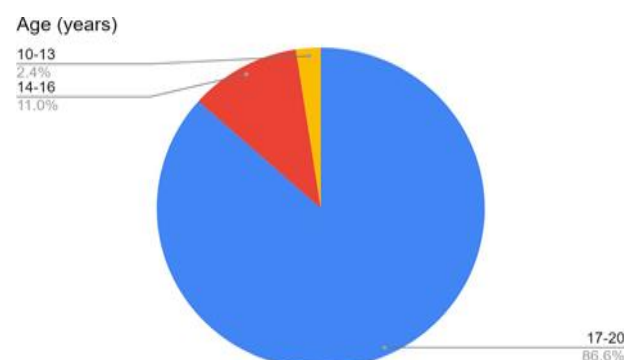


Figure 1: Age.

Table 1: Type of training.

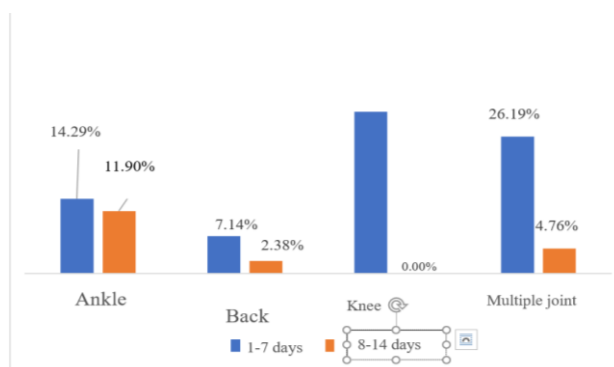
Type of training	Training hours/week (%)					Grand total (%)
	2-4	5-7	8-12	13-18	19-24	
Unknown	4.88	4.88	--	--	--	9.76
Resistance	--	--	1.22	--	--	1.22
Cross-fit	--	1.22	--	--	--	1.22
Aerobics	12.2	4.88	7.32	1.22	--	25.6
Aerobics, resistance and flexibility	8.54	8.54	20.7	15.8	3.6	57.3
Aerobics and flexibility	--	1.22	--	1.22	--	2.44
Aerobics and resistance	1.22	1.22	--	--	--	2.44
Grand Total	ND	21.9	29.2	18.2	3.6	100

Musculoskeletal injury profile

As summarized in Table 2, a total of 50% absenteeism was reported last year from study from which 81% were absent for 1-7 days from their practice; 9% would not attend practice for 8-14 days. Participants acclaimed various reasons for their absenteeism which included 31.7% knee injuries and involvement of musculoskeletal pain each, 26.83% had ankle injuries and merely 9.76% reported back injuries as cause of absenteeism (Figure 2).

Table 2: Absent days.

No. of absentees	Type of injury	Once or twice	3 or 4 times
1-7 days	Multiple joint	10.98	2.44
	Knee	15.85	--
	Back	3.66	--
	Ankle	7.32	--
8-14 days	Multiple joint	2.44	--
	Back	1.22	--
	Ankle	3.6	2.44
Total		45.12	4.88


Figure 2: Region affected.

Gastrointestinal function

Another component of FAT consists of the gastrointestinal function. The questionnaire covers the gastrointestinal function apart from the menstrual cramps and bloating which is shown in Table 3.

Table 3: Gastrointestinal function.

Variables	Rarely or never	Once or twice a week	Several times a week	Several times a day
Cramps and stomach ache	47.56	17.07	32.93	2.44
Gaseous and bloating	35.37	25.61	32.93	6.10
Bowel movements	Every 2 day	Once a week	Once a day	Several times a day
	19.51	10.98	65.85	2.44
Type of stool	Diarrhea-like	Hard and dry	Normal (soft)	
	1.22	19.51	76.83	

About 35.4% of population experienced gaseous or bloated abdomen several times a week while 23.2% experienced it once/twice a week only. Another problem faced by participants was cramps and stomach ache which was not related to menstrual cycle was experienced by 32.9% of which 17.1% reporting for once/twice a week and 2.4% reporting it as several times a day.

Majority of population had normal bowel movements (66.7%), 19.8% reported bowel movements every 2 days, 11.1% for once a week and 2.5% for several times a day.

When asked about type of stool passed 79.3% reported as normal (soft stools), 19.5% said it is often hard and dry and only 1.2% mentioned it as diarrhoea-like.

Menstrual dysfunction

In this study, 7.3% dancers reported experiencing primary amenorrhea (Figure 3). Moreover, nearly 18.6% reported being oligomenorrheic, 32.93% reported experiencing secondary amenorrhea (Table 4 and Figure 4).

It is worth mentioning that 65.87% reported using medications apart from oral contraceptive to regulate or even maintain menstruation. 40.7% were using hormonal supplements and 59.3% use homeopathy medicines for regulating and maintain menses (Figure 5-6).

Also, a total of 29.3% reported usage of oral contraceptive medicines of which 88% accounting for reduction of menstrual pain; 32% each for reduction in bleeding and to regulate menstrual cycle and rest 28%

said if medications not used, menstruation stops.

According data collected through the questionnaire, 36% reported they bleed more as an effect of exercises. From 82 participants that took part in this study, 34.5% population reported all the components of FAT.

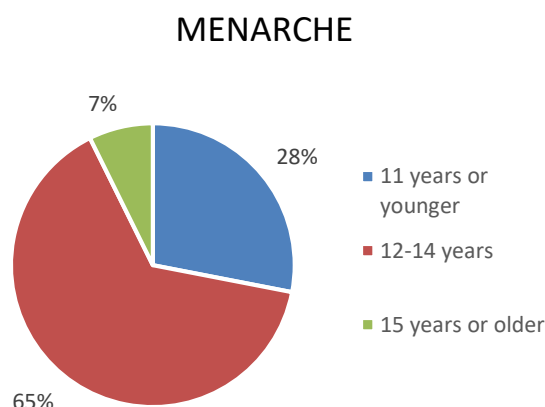


Figure 3: Menarche.

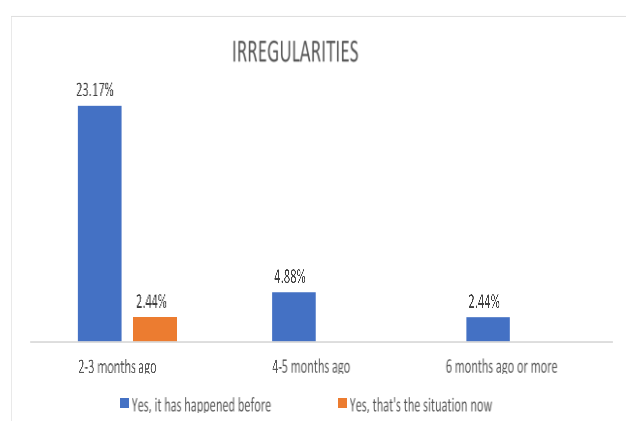


Figure 4: Secondary amenorrhea.

Table 4: Oligomenorrhea.

Regularity of menses	Length of menses, days (%)			Grand total (%)
	3-4	5-6	7-8	
0-4 weeks ago,	32.93	25.61	1.22	59.76
No, mostly not	1.22	--	--	1.22
Yes, most of the time	31.71	25.61	1.22	58.54
1-2 months ago,	2.44	6.10	--	8.54
No, mostly not	1.22	3.66	--	4.88
Yes, most of the time	1.22	2.44	--	3.66

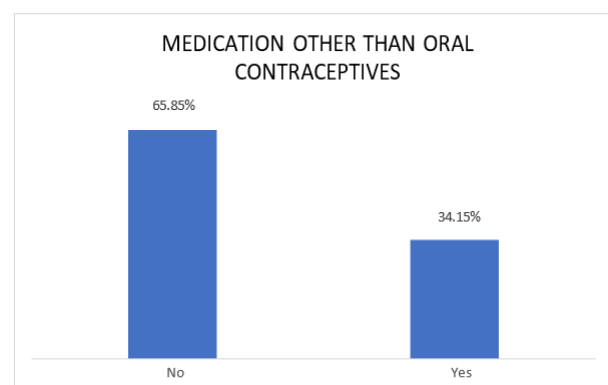


Figure 5: Medications other than oral contraceptives.

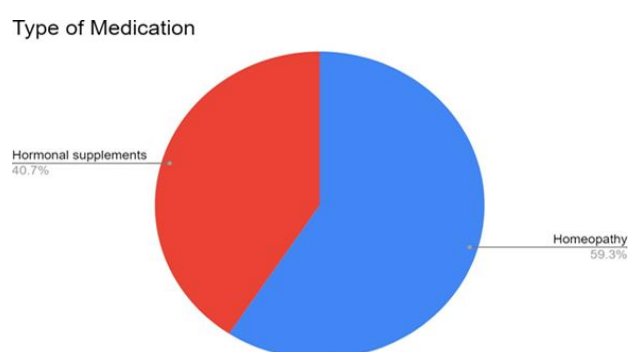


Figure 6: Type of medications.

DISCUSSION

This study was carried out to study occurrence of female athlete triad in Bharatanatyam dancers. As this dance form involves tremendous training routine for dance practice. There has been limited research on female athlete triad in classical dancers.

The constant load on the of foot during attainment of various postures have made the dancers vulnerable to various musculoskeletal injuries mainly knee injuries and multiple soft tissue injuries from Table 2. The tapping of foot on hard surface in this dance form places stresses on the joints of the lower extremity. This may change the structural integrity of the foot leading to microtrauma of the soft tissue, joints and ligaments. The abnormally high loading may be due to 4 to 5 times the ground reaction force that is experienced on the foot while dancing.

However, these changes develop over a period of time due to years of dancing leading to cumulative trauma making them prone to injuries.⁶

Hincapie with his colleagues did a study on musculoskeletal injuries and pain in dancers which reported there is high prevalence and incidence of lower extremities and back injuries with soft tissue and overuse injuries predominating. Dancers develop injuries over a

period of time than spontaneous.⁷ Due to cumulative microtrauma and degenerative changes these dancers could develop various balance and overuse injuries if appropriate warm and stretching exercises are not performed before and after a dancing session.⁸ Research done by Lambert and colleagues reported that musculoskeletal health may be affected by energy balance and overtraining.⁹

Musculoskeletal injuries occur frequently among fitness program. The same parameters of exercises (intensity, duration and frequency) determine positive fitness and health of physical training also appear to influence the risk of injuries.¹⁰ However, no studies have been identified for reporting a possible association between low BMD and dance injuries. Therefore, it is only said that the dance injuries are probable risk factors for low BMD.

The second component of FAT is gastrointestinal function. In order to retain a favorable body structure in dancers body weight targets are normally fulfilled by low energy intake below 70%-80% of the recommended allowance of energy intake.¹¹ This low energy intake may be attributed to disordered eating/ eating disorders. The prevalence of eating disorder was 16.4% in dancers, 14.9% for anorexia, 2% for bulimia nervosa, and 14.9% for eating disorders otherwise specified.¹²

Energy restriction has been suggested to reduce bowel movements and to cause unfavorable changes to the gut microbiota, as well as diminished intestinal function and morphologic changes to the gastrointestinal tract.^{13,14} In fact, gastrointestinal symptoms have been linked to athletes with LEA and some other conditions such as disordered eating.¹²

As mentioned above female athletes with low energy availability reported a higher degree of gastrointestinal symptoms. An energy insufficiency can lead to a reduction of the mucosal tissue in the intestine, which could partly explain the problems. With low energy availability and diet there are gastrointestinal symptoms such as flatulence, diarrhoea, cramps, constipation, etc. Athletes suffering from these symptoms should focus on increased energy intake which could help to alleviate gastrointestinal symptom.

Exercise induced amenorrhea is hypothalamic in origin, with clear perturbations of normal pulsatile secretion of GnRH and LH causing hypoestrogenia. Disruption of hypothalamic-pituitary-ovarian axis depends on recognition of energy imbalance caused due to lack of compensatory caloric intake.¹⁵

Menstrual dysfunction is common in adolescents who are involved in intensive athletic activity or who are limiting their nutritional intake excessively.¹⁴ It was noted that while circulating the questionnaire many of the dance teachers were hesitant to circulate the questionnaire

among their students as they had a tabu in their mind regarding answering questions based on menstruation but this was overcome by explaining the need of study and sample could be collected.

For the resumption of menses usage of combined oral contraceptives should be avoided. Unless a spontaneous resumption of menses occurs (i.e., without the use of contraceptives), exogenous hormones may cause bleeding which has deleterious effects of menstrual disruption, such as decreased bone health, continue. Hence, the use of hormonal contraceptives may worsen the global situation by 'masking' the continuous decrease of bone mineral density.¹² A mindset of the dancers towards healthy and positive body goals would be developed with regular screening and training.

Limitation

Presence of FAT differed with the attributed level of experience of the dancers.

CONCLUSION

This study concluded that there is significant amount of occurrence of female athlete triad in Bharatanatyam female dancers. Prevalence of injury was high amongst the participants. Also, gastrointestinal impairment, with a longer-than-expected transit time was noticed. Menstrual dysfunction was noticeable in the dancers. Low energy availability might have been interpreted as a usual or needed procedure to achieve better performance in past, but now it is recognized that it may lead to several negative consequences. Therefore, timely screening of dancers along with adequate training protocol will help alleviate LEA.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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