Bulletin of Pure and Applied Sciences
Zoology (Animal Science), Vol.43B, No.1s,
January-June 2024: P.860-867

Print version ISSN 0970 0765
Online version ISSN 2320 3188

Original Research Article *Content Available online at: https://www.bpasjournals.com/*

Prevalence of Medial Tibial Stress Syndrome on Young Females Wearing High Heels and Its Impact on Functional Activities

S. Haripratha[1], M. Ramanan[2], T. Murugaraj[3], Shanmugananth Elayaperumal[4]

Author's Affiliation:
1 UG Research Scholar, School of Physiotherapy, Sri Balaji Vidyapeeth (Deemed to Be University), Puducherry.
2 UG Research Scholar, School of Physiotherapy, Sri Balaji Vidyapeeth (Deemed to Be University), Puducherry.
3Assistant Professor, School of Physiotherapy, Sri Balaji Vidyapeeth (Deemed to Be University), Puducherry.
4Professor And Principal, School of Physiotherapy (Deemed to Be University), Sri Balaji Vidyapeeth, Puducherry.

ABSTRACT:

BACKGROUND: Medial tibial stress syndrome is a type of inflammation between soft tissue attachments and bony periosteum due to bodily stress reactions. It has significant biomechanical effects on high heels wearers especially during the younger age which is aggravated by many consequences.

OBJECTIVE: The main objective of the study was to assess the prevalence of medial tibial stress syndrome on young females wearing high heels and its impact on functional activities.

METHODOLOGY: It is a cross-sectional observational study. A total of 200 participants aged between 18 to 25 years females were selected randomly according to the inclusion criteria. The participants were asked to fill the numerical pain rating scale for knee region and the scoring of 3 or more were isolated and assessed with two clinical examinations. They were a navicular drop test and shin palpation test. The presence of medial tibial syndrome females were given a womac scale questionnaire to assess their impact on functional activities. The responses are documented.

RESULT: The results were statistically analyzed. Out of 200 females, 174 (87%) have knee pain. 115 (66%) females have positive navicular drop test, 157(90%) have positive shin palpation test and 113(64.9%) have positive on both naviculars drop test and shin palpation test. This study is statistically significant with ($p<0.05$) in clinical examinations. Most of the females have difficulty during functional activities such as walking (95.5%), stair climbing (83%), standing (75.7%) and heavy domestic duties (85.3%).

CONCLUSION: It was concluded that there is significant increase in the prevalence of medial tibial stress syndrome among young females wearing high heels and have greater impact on functions activities.

Key Words: Medial Tibial Stress Syndrome, High Heel Wearers, Numerical Pain Scale, Navicular Drop Test, Shin Palpation Test, Womac Scale.

How to cite this article: Preeti Jaiswal, Rakhi Gill, Pooja Rana, Pooja Sigh (2024). Prevalence of Medial

Tibial Stress Syndrome on Young Females Wearing High Heels and Its Impact on Functional Activities. *Bulletin of Pure and Applied Sciences-Zoology*, 43B (1s), 860-867.

INTRODUCTION

Medial tibial stress syndrome is a most common overuse injury that is imposed by repetitive stress and force to the anterior compartment muscles of lower extremity.[1] It is induced by weight bearing[2] and exertion activities[3]. The contributing factors of medial tibial stress syndrome are high BMI, over pronated foot type, sex, body type, age, weight bearing forces, abnormal biomechanics, footwear, physical inactivity, static positions, floor surfaces, etc.[4] Medial tibial stress syndrome is commonly develop among runners, gymnastics, football players, hockey players, dancers, physical education teachers.[5,6] Researchers from university Athens found a case of a 500- 800 year old skeletal with a cortical lesion and increased deposition of cortical tissue which concluded as a bilateral medial tibial stress syndrome.[7] Many studies have suggested that the syndrome most likely caused due to repetitive bony stress reaction of cortex of tibia which is due to bending and bowing of tibia.[8] If the bending forces increases there is gradual narrowing of the cortex of the tibia.[9]

Females are consistently found to be at greater risk for developing medial tibial stress syndrome.[10] Nowadays many females wearing high heels routinely for their daily basis. It has a increased incidence in both institutional and clinical settings.[11] Abnormalities of foot are common among females who wear fashionable high heels.[12] The high heeled wearing is an important factor for the etiology of developing certain orthopaedic and foot disorders such as sprained ankle, low backache, leg pain, knee pain, walking instability, high risk of falls, etc.[13] Medial stress syndrome is described as localized dull pain over distal two third of the posteromedial aspect of tibia and can spread over a minimum of 5centimeters distance.[14] On examination and palpation, there may be the presence of tenderness and a pitting oedema on painful or specific spots over the posteromedial surfaces.[15] Typically it is an overuse injury to the tibialis anterior muscle, which helps to dorsiflex the foot active during the push off phase of gait. The overuse is not only by running but also by muscular imbalance. The postural and muscular imbalances causes stresses on the soft tissues resulted in increasing wear and tear of structures overtime. If the tibialis anterior muscle is weak, it gets stressed and sore which results in development of this condition. With the foot in extreme plantar flexion and upward displacement of foot, displaces the centre of gravity results in low backache and increased pressure in the forefoot and in toes due to weightbearing.[16] These results in bony stress and periosteal reaction. It has an eccentric fatigue of soleus which contributes to bony overload. Repeated reaction causes the narrowing of the bone resulting in medial tibial stress syndrome.[17] Improper foot biomechanics such as increased plantar flexion of foot, increased navicular drop, over pronated foot, shortened calf muscle and Achilles tendon stiffness are associated with medial stress syndrome among female high heel wearers.[16] An adequate measures can help to prevent from risk factors. This syndrome affects the females performance and routine activities. Studying the prevalence helps to understand the frequency of conditions. Considering the above facts, in order to treat and prevent from risk factors, the present study was planned to analyze the prevalence of medial tibial stress syndrome on young females wearing high heels and its impact on functional activities.

METHODOLOGY

This is a cross sectional study. The study was carried among 200 females at Sri Balaji vidyapeeth campus. Inclusion criteria includes young females aged between 18 to 25 years, wearing high heels over 2 inches or above in height, prolonged standing for 5 hours or more, and subjects who have worn high heels for the past 6 months. Exclusion criteria includes recent history of injury or trauma,

sprain, osteoarthritis, tendonitis, foot abnormality and other co-morbid issues, male sex, sports person, high BMI, subjects who are not willing to participate. The overall data collection was completed in 4 consecutive weeks on working days. Data was collected through a randomized selection method. The study procedures were well explained to the participants and a written consent was received from subjects those willing to participate. All participants were interviewed about their general health and demographic characteristics. A measuring tape was used to measure the height of heels. It was measured vertically from floor to top of the footwear heel from behind. The people who participated in the study were informed to fill out the numerical pain rating scale.[17] the rating of 3 and above was considered as positive participants. This scale is specifically intended to assess pain in knee region. After collecting the data, the positive participants were isolated and evaluated with two clinical examinations. Firstly, the range of navicular drop was assessed by Navicular drop test.[18] The navicular drop test will be conducted in two positions, one in weight-bearing and the other in non-weight-bearing. The height of the navicular bone from the ground was measured in millimeters using a ruler scale. The amount of drop for both feet was calculated by subtracting the weight bearing and non weight bearing positions. The normal navicular drop value was 10mm. if the patient has increased navicular drop value above normal, it is considered as positive. Secondly, skin palpation test[19] is performed by palpating the posteromedial aspect of tibia along with the border. Place the fingers on skin and apply a firm and steady pressure. If there is a presence of pain, the test will be positive. The participants who were positive in any one of the clinical examinations were found to be the affected population in this study. The positive medial tibial stress syndrome participants were further given a WOMAC scale to measure the impact of functional activities. The WOMAC is a disease-specific self-report multidimensional questionnaire assessing pain, stiffness, and physical functional disability.[20] The pain category consists of five elements which inquire concerning pain during activity or rest. The stiffness domain includes two questions. The physical function domain explores the degree of difficulty in 17 activities. The responses are recorded.

STATISTICAL ANALYSIS AND RESULTS

A total of 200 participants in the age of 18 to 25 were enrolled in this study. The response of participants was 100%. None of our participants have dropped out during the course of the study. Majority of the participants were belongs to age group of 21-23(42%), followed by 24-25(33%) and 18-20(25%). In this present study, according to numerical pain rating scale, the prevalence of knee pain was 174 out of 200(i.e. 87%). (TABLE 1)

TABLE 1 Basic Characteristic

AGE GROUP	NUMBER	PERCENTAGE
18 - 20	50	25%
21 - 23	84	42%
24 - 25	66	33%
KNEE PAIN		
YES	174	87%
NO	26	13%

Out of 174(87%) young females, of which 79 were in the age group of 21 – 23, 34 and 61 were in the age group of 18-20 and 24-25. The participants of 115(66%) out of 174 have positive navicular drop test with greater of 51 in age group of 21 – 23 years, 42 in 24-25 years and 22 in age group of 18 – 20 years. 157(90%) females reported shin pain on palpation of one or both legs. About 113(64.9%) females were positive at both navicular drop test and shin palpation test. (TABLE 2)

TABLE-2 Association of Medial Tibial Stress Syndrome with Clinical Examinations

CLINICAL EXAMINATION IN ACCORDANCE WITH AGE	NAVICULAR DROP TEST		SHIN PALPATION TEST		COMBINED NAVICULAR DROP TEST AND SHIN PALPATION TEST	
	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE
18-20	22	12	32	2	22	12
21-23	51	28	70	9	50	29
24-25	42	19	52	9	41	20
MEAN±SD	38.3±14.8	19.6±8.02	51.3±19	6.67±4.04	37.6±14.2	20.3±8.50
P-VALUE	0.0499		0.0382		0.0420	

Maximum participants were positive at the age of 21-23 with a mean of (38.3±14.8) in navicular drop test and with a mean of (51.3±19) in shin palpation test at 24-25 years. Majority participants were positive on both navicular drop test and shin palpation test at the age of 21-23 years. The p value for navicular drop test (p=0.0499), shin palpation test (p=0.0382) and for combined navicular drop test and shin palpation test (p=0.0420). Thus, we found that there was a significant relationship with age and clinical findings with medial tibial stress syndrome.

TABLE 3 Distribution Of Participants Related To Womac Scale

DOMAINS	ACTIVITIES OF DAILY LIVING	NUMBER OF PEOPLE AFFECTED	PERCENTAGE %
Pain	Walking	150	95.5
	Stair Climbing	134	83
	Nocturnal	35	22
	Rest	27	17

	Weight Bearing	128	81.5
Stiffness	Morning Stiffness	20	12.7
	Stiffness Occuring Later In The Day	58	37
Physical Function	Descending Stairs	98	62
	Ascending Stairs	81	52
	Rising From Sitting	21	13.3
	Standing	119	75.7
	Bending To Floor	53	33.7
	Walking On Flat Surface	66	42
	Getting In/ Out Of Floor	35	22
	Going Shopping	105	66.8
	Putting On Socks	63	40
	Lying In Bed	31	19.7
	Taking Off Socks	29	18.4
	Rising From Bed	46	28.9
	Getting In/Out Of Bath	3	1.91
	Sitting	26	16.5
	Getting On/ Off Toilet	79	50.3
	Heavy Domestic Duties	134	85.3
	Light Domestic Duties	50	31.8

According to womac scale in TABLE 3, (95.5%) and (83%) females have pain during walking, stair climbing, (22%) have nocturnal pain, (17%) have rest pain and (81.5%) have pain during weight bearing. (12.7%) have early morning stiffness and (37%) have stiffness later in the day. Most of the females have difficulty during some physical functions such as descending stairs (62%), ascending stairs (52%), rising from sitting (13.3%), standing (75.%), bending to floor (33.7%), walking on flat surface (42%), Getting In/ Out Of Floor (22%), going shopping (66.8%), putting on socks (40%), lying in bed (19.7%), taking off socks (18.4%), rising from bed (28.9%), getting in/out of bath (1.91), sitting (16.5%), getting on/off toilet (50.3%) and heavy domestic duties (85.3%) and light domestic duties (31.8%). Thus the prevalence of medial tibial stress syndrome increasing in young females population with 55%.

DISCUSSION

Participants were involved voluntarily in this study. Prevalence of medial tibial stress syndrome was found to be increasing in young population due to wearing of high heels. Every individual female were treated separately and a unique data samples were collected based on selection criteria. This study concentrates morely about prevalence and risks of occurrence of medial tibial stress syndrome in young females. Isolation of participants from other differential conditions was accomplished by diagnosing those who tested positive in one or both clinical examinations. Many factors contribute to increased prevalence. In the analysis of medial tibial stress syndrome, it is very predominant to consider for differential diagnosis. There are certain prognoses to take into consideration while evaluating the lower leg for the presence of medial tibial stress syndrome. The major two clinical conditions[21] are tibial stress fracture[22] which differs in location and intensity of pain, chronic exertional compartment syndrome which breaks off the pain after controlling the aggravating factor whereas medial tibial stress syndrome provokes minutes to days.[21] The other conditions includes popliteal artery entrapment syndrome[23] and soleus strain in onset and location of a recognizable pain.[24] Regarding this sample size calculation, we hypothesized that the individuals with medial tibial stress syndrome have significant increase in navicular bone drop, pain with tenderness and pitting oedema along the posteromedial surface of tibia. Average range of navicular drop has been reported from 3mm to 7mm. Static eccentric contraction along with plantarflexion results in stretching of structures on the adjacent side, influences the navicular drop. The aggravating factors in young population will be prolonged high heels wearing, poor posture, gait abnormality, static plantar flexion, prolonged concentric and eccentric contraction, and stress and strain in medial structures, physical inactivity, and increased basal metabolic rate. Karrie L Hamstra-Wright et al assessed the risk factors among physically active individuals and found that increased BMI, increases overloading which led to bowing and bending forces on tibia and further contribute to risk of medial tibial stress syndrome.[25] Repeated forces results in soft tissue damage and induces pain. Moreover bone structure, mass, density differs in male and female population. During the teenagers, the female bones skeletal maturity stops which favors the development of stress on bones. The longer adaptation of high heels results in navicular bone drop which is represented as lower of the medial longitudinal arch. As the arches lowered, medial rotation of tibia decreases which increases the load on tibia. Thus the medial tibial stress syndrome mainly influenced by increased navicular drop and decreased activity of internal rotators of tibia. Prina. Y. Patel et al conducted a study among 190 recreational marathon runners found an increased prevalence in female than male.[26] the most common cause for unilateral and bilateral dysfunction is due to over action of muscles, strength imbalances and overloading of forces.[27] the symptoms experienced by participants were moderate pain with or without tenderness around the tibial bone.

The Womac scale is a widely used and well validated scale for accessing the pain, stiffness and physical activity. While there is no specific research on the reliability and validity of womac scale for young high heel wearers, it is important to note that the study is designed to be a self-reported measure of pain and functions. The impact of high heels on young females may vary depending on the participants level of experience with high heels wearing, the height and the design of heel, duration of wearing and other factors such as foot structure, body weight and gait pattern. The knee joint is particularly at risk to the effects of high heels. As the increased angle of arches in foot causes the inward tilt of knee and increasing load in joints which leads to knee pain and stiffness and in chronic cases contributes to the development of osteoarthritis.[28] According to womac scale, the pain experienced during walking, stair

climbing and weight bearing may be due to the change in normal alingnment of foot which produces more pressure on forefoot and toes and thus altering the distribution of body weight on joints. Pain during nocturnal and rest may be due to shin oedema.

RECOMMENDATION:-

This study can also be done in large and ethnic diversity to improve well-being and potential of this study. Predisposing risk factor can be added as a variable.Different functional scales can be used for precise diagnosis. A comparative study can also be conducted in various categories of high heel wearers. This emphasizes the need to a greater extent of research on the all age groups with respect to severity of this condition to improve physical health and quality of women's life.

LIMITATIONS:-

- Numerical pain rating scale is a subjective assessment tool.
- Psychological factors were not considered.
- All categories of high heel wearers were taken for this study.

CONCLUSION

The prevalence of medial tibial stress syndrome was higher with (68.75%) among young females wearing high heels.

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