

Prevalence of Gastrocnemius Tightness and Its Impact on Balance Performance Among Young Female Adults - A Cross-Sectional Study

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ABSTRACT

Background: Gastrocnemius muscle tightness has been associated with various common foot and ankle pathologies. The symptoms can be mild, leading patients to overlook or delay seeking treatment. Static balance can be explained as the ability to maintain a base of support with minimal movement on one or both legs, while dynamic balance is the ability to perform an active task while maintaining a stable position. Calf muscle tightness may compromise balance and gait. Our study aims to discover the prevalence of gastrocnemius tightness in young female adults and its impact on balance performance.

Method: A cross-sectional study was used. A convenient sample method, composed of 180 young female adults of age 18 to 25 years who are students of Medical Trust Institute of Medical Sciences, Ernakulam. The participants were selected according to inclusion and exclusion criteria. The outcome measures used were Silfverskiöld Test for assessing gastrocnemius tightness, Single Leg Stance test for assessing static balance and Y Balance test for assessing dynamic balance.

Results: 180 subjects who fulfilled the inclusion criteria participated in this study. In

accordance with statistical analyses there is prevalence of gastrocnemius tightness in 39% (71) of individuals had gastrocnemius tightness in the right leg and 34% (61) had gastrocnemius tightness in the left leg. The impact of gastrocnemius tightness on balance performance is statistically not significant.

Conclusion: The study revealed that gastrocnemius tightness is present among young female adults, but its association with balance performance was very weak. Understanding the prevalence of gastrocnemius tightness can help in preventive training and the development of strategies to reduce the occurrence of musculoskeletal diseases.

Keywords: Gastrocnemius tightness, Static balance, Dynamic balance, Silfverskiöld Test, Single Leg Stance test, Y Balance test, BMI

INTRODUCTION

Musculoskeletal health is essential for preserving functional mobility, postural stability, and general quality of life, especially in young adults. Despite the fact that musculoskeletal diseases are frequently linked to advanced age, research indicates that postural complaints and muscular tightness are quite prevalent among college students and young people, with prevalence

varying from 32% to 89% in various populations.¹

The maintenance of functional mobility and balance depends on the calf muscles.² The gastrocnemius muscle, which has a Medial and Lateral head-along with the soleus and plantaris muscle, makes up majority of the calf. Mobility-related impairments were found to be considerably impacted by higher BMI.³ Examining these interrelated factors is crucial given the increasing prevalence of muscle tightness, balance issues, lifestyle-related risk factors, and the particular vulnerability of young female adults as a result of hormonal laxity, inactivity patterns, and footwear choices.

One prevalent clinical musculoskeletal condition that is thought to be a risk factor for muscle injury is muscular tightness.⁴ The inability of a muscle or set of muscles to move through a joint's whole range of motion is known as muscle tightness.⁵ Sedentary lifestyles and insufficient or low levels of physical exercise can promote muscular tightness by reducing the muscle's capacity to deform, which in turn reduces the range of motion (ROM) at the joint where the muscle operates.⁶

The ability of the body to keep its centre of gravity above its base of support is known as balance. Postural control can be divided into two categories: dynamic balance and static balance. The capacity to keep one's posture steady when the body is at rest or in a fixed position is known as static balance. The ability to remain stable when the body is moving or changing postures is known as dynamic balance.⁷

Women are specifically selected in this study since prior research has shown that women are more likely than men to experience muscle stiffness.⁸ According to a study, women are more likely to have muscle tightness because they frequently wear high-heeled shoes, which shortens the gastrocnemius-soleus complex and reduces ankle dorsiflexion.⁹ The aim of this study is to find the prevalence of gastrocnemius tightness and its impact on balance performance among young female adults.

MATERIALS & METHODS

METHODOLOGY

- Study setting: Medical Trust Institute of Medical Sciences, Ernakulam
- Study design: Cross sectional study
- Sampling technique: Convenient sampling
- Study duration: 3 months
- Sample population: Young female adults
- Sample size: 180

OUTCOME MEASURES

- Silfverskiöld test
- Single leg stance test
- Y balance test

INCLUSION CRITERIA

- Female participants between 18 and 25 years
- Sedentary individuals
- Subjects who are willing to participate

EXCLUSION CRITERIA

- Individuals with any known neurological or musculoskeletal disorders
- Individuals with history of lower limb injuries and surgeries in the past six months
- Individuals who are practicing specialized stretching or flexibility training programme (e.g.: Pilates, yoga practitioners, gym goers)

Procedure

We collected our data from Medical Trust Institute of Medical Sciences, Ernakulam. The subjects were carefully selected based on the inclusion and exclusion criteria, and the respondent provided consent to participate in the study. We introduced ourselves individually and briefly discussed the goal of the study to the subjects who fit the criteria. The individuals were initially requested to fill out a demographic questionnaire (including average daily sitting time and type of footwear worn most often. Prior to testing, clear instructions and demonstrations were provided for each test, and participants were

given a practice trial to ensure understanding. The outcome measures include; Silfverskiöld Test to assess the gastrocnemius tightness, Single Leg Stance test to assess static balance and Y Balance test for dynamic balance.

The present study was designed to determine the prevalence of gastrocnemius tightness and its impact on balance performance among young female adults using EXCEL.

STATISTICAL ANALYSIS AND RESULT

DEMOGRAPHIC DATA

Total number of participants = 180

BODY MASS INDEX

TABLE-1: BMI of participants in the study

BMI	UNDERWEIGHT	NORMAL	OVERWEIGHT	OBESITY
FREQUENCY	54	108	17	1
PERCENTAGE	30%	60%	9.5%	0.5%

PREVALENCE OF GASTROCNEMIUS TIGHTNESS AMONG YOUNG FEMALE ADULTS(RIGHT)

TABLE-2: Prevalence of gastrocnemius tightness among young female adults (right)

GASTROCNEMIUS TIGHTNESS	POSITIVE	NEGATIVE
FREQUENCY	71	109
PERCENTAGE	39%	61%

The above table shows the prevalence of gastrocnemius tightness in young female adults. 39% had tightness and 61% had flexibility.

PREVALENCE OF GASTROCNEMIUS TIGHTNESS AMONG YOUNG FEMALE ADULTS(LEFT)

TABLE-3: Prevalence of gastrocnemius tightness among young female adults (left)

GASTROCNEMIUS	POSITIVE	NEGATIVE
FREQUENCY	61	119
PERCENTAGE	34%	66%

The above table shows the prevalence of gastrocnemius tightness in young female adults. 34% had tightness and 66% had flexibility.

CORRELATION BETWEEN GASTROCNEMIUS TIGHTNESS AND STATIC BALANCE (RIGHT)

TABLE-4: Correlation between gastrocnemius tightness & static balance(right)

VARIABLES	N	PEARSON CORRELATION	LEVEL OF SIGNIFICANCE
Gastrocnemius tightness and static balance	180	r=-0.0761	P>0.05

According to statistical analysis there is very weak negative correlation between duration of static balance and score of gastrocnemius tightness with r=-0.0761 and is statistically not significant (P>0.05).

CORRELATION BETWEEN GASTROCNEMIUS TIGHTNESS AND STATIC BALANCE (LEFT)

TABLE-5: Correlation between gastrocnemius tightness & static balance(left)

VARIABLES	N	PEARSON CORRELATION	LEVEL OF SIGNIFICANCE
Gastrocnemius tightness and static balance	180	r= -0.03498	P>0.05

According to statistical analysis there is very weak negative correlation between duration of static balance and score of gastrocnemius tightness with $r=-0.03498$ and is statistically not significant ($P>0.05$).

CORRELATION BETWEEN GASTROCNEMIUS TIGHTNESS AND DYNAMIC BALANCE (RIGHT)

TABLE-6: Correlation between gastrocnemius tightness & dynamic balance (right)

VARIABLES	N	PEARSON CORRELATION	LEVEL OF SIGNIFICANCE
Gastrocnemius tightness and static balance	180	r= 0.089691	P>0.05

According to statistical analysis there is very weak positive correlation between duration of dynamic balance and score of gastrocnemius tightness with $r=0.089691$ and is statistically not significant ($P>0.05$).

CORRELATION BETWEEN GASTROCNEMIUS TIGHTNESS AND DYNAMIC BALANCE (LEFT)

TABLE-7: Correlation between gastrocnemius tightness & dynamic balance(left)

VARIABLES	N	PEARSON CORRELATION	LEVEL OF SIGNIFICANCE
Gastrocnemius tightness and static balance	180	r= -0.02444	P>0.05

According to statistical analysis there is very weak negative correlation between duration of dynamic balance and score of gastrocnemius tightness with $r=-0.02444$ and is statistically not significant ($P>0.05$).

CORRELATION BETWEEN GASTROCNEMIUS TIGHTNESS AND BMI (RIGHT)

TABLE-8: Correlation between gastrocnemius tightness & BMI (right)

VARIABLES	n	PEARSON CORRELATION	LEVEL OF SIGNIFICANCE
Gastrocnemius tightness and BMI	180	r= 0.058655	P>0.05

According to statistical analysis there is very weak positive correlation between score of BMI and score of gastrocnemius tightness with $r= 0.058655$ and is statistically not significant ($P>0.05$).

CORRELATION BETWEEN GASTROCNEMIUS TIGHTNESS AND BMI (LEFT)

TABLE-9: Correlation between gastrocnemius tightness & BMI (left)

VARIABLES	n	PEARSON CORRELATION	LEVEL OF SIGNIFICANCE
Gastrocnemius tightness and BMI	180	r= 0.129303	P>0.05

According to statistical analysis there is very weak positive correlation between score of BMI and score of gastrocnemius tightness with and is $r = 0.129303$ statistically not significant ($P > 0.05$).

DISCUSSION

Gastrocnemius tightness was measured using the Silfverskiöld Test¹⁰, static balance was evaluated with the Single Leg Stance test¹¹ and dynamic balance was evaluated using the Y Balance test.¹²⁻¹⁴ The study revealed a prevalence of gastrocnemius tightness of 39% (71 participants) in the right leg and 34% (61 participants) in the left leg, indicating that this condition is relatively common among 180 young female adults. However, the correlation between gastrocnemius tightness and balance performance was found to be very weak. Specifically, a very weak negative correlation was observed between gastrocnemius tightness and static balance in the right leg ($r = 0.0761$) and a very weak negative correlation in the left leg ($r = 0.035$). Dynamic balance showed a very weak positive correlation in the right leg ($r = 0.0897$) and a very weak negative correlation on the left leg ($r = 0.0244$). Variations in calf muscle flexibility between two legs may be the cause of different dynamic balancing correlations seen on the study, with very weak negative correlation in the left leg and very weak positive correlation in the right. Less flexibility or shortness in the calf muscles may increase ankle stiffness and stability, which could improve performance on dynamic balance tests like the BESS and SEBT. This would result in a positive correlation on one leg and a weaker negative correlation on the other leg, according to Marcio Dos Santos et al. (2025).¹⁵ This is also demonstrated in the study on the effects of leg dominance on postural control by Arunee Promsri et al., 2023¹⁶, where balancing on the dominant leg increased the efficiency of postural control.

In addition, a correlation between Body Mass Index (BMI) and gastrocnemius tightness was also analyzed. The results showed a very

weak positive correlation for the right leg ($r = 0.0586$) and very weak positive correlation for the left leg ($r = 0.1293$). This suggests that higher BMI values might have a minimal influence on the development of gastrocnemius tightness.

Although a significant correlation between gastrocnemius tightness and balance was not established, the prevalence observed in this study suggests that maintaining adequate calf flexibility should not be overlooked. From a physiotherapy perspective, early assessment and appropriate intervention can contribute to better functional outcomes and overall lower limb health. Physiotherapy interventions could help enhance flexibility, prevent compensatory movement patterns, support better postural control and may help promote long-term musculoskeletal well-being in young adults.

CONCLUSION

The study found a noticeable prevalence of gastrocnemius tightness among young female adults, but its relationship with balance performance was weak. The findings suggest that gastrocnemius tightness alone may not significantly affect static or dynamic balance in this population. However, understanding the prevalence of gastrocnemius tightness can help in preventing training and the development of strategies to reduce the occurrence of musculoskeletal diseases. Further studies with larger sample sizes and additional functional parameters are recommended to better understand this relationship.

Declaration by Authors

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