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Standing Heel Rise Test In College Going Students

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ABSTRACT:

Background: Standing heel rise test is used to check the strength of plantar flexors. Available literature suggests wide range of repetition of heel rise during manual muscle testing of plantar flexors. **Objective**: To estimate the average number of repetitions of complete heel rise in college going students. **Subjects**: Observational type of study was done in randomly selected 180 healthy college going students in age group of 18-22 years. **Methodology**: Subjects were in one leg standing position with trunk erect and hands clasped behind the back. The subject was asked to perform complete heel rise and number of repetitions were counted, in both legs one after the other. Any fatigue, pain or deviation in posture was considered for termination of test. Metronome was used during the procedure. The procedure was repeated three times and best of them was used for analysis. Maximum number of compete heel rise without rest and fatigue in between were determined in the subjects. Rest time between the repetitions was 5 minutes. **Analysis**: Mean, Standard deviation (SD) and median for number of complete heel rise were determined. **Results**: Mean (SD) for complete heel rise for male and female is 32.85(12.68) and 27.96(13.54) respectively. Median is 32 for males and 26 for females. **Conclusion**:-A recommendation for change in criteria for grading normal strength of plantarflexors can be made in our population.

KEYWORDS: Plantarflexors, Manual muscle testing, Standing heel Rise

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INTRODUCTION

Ankle plantarflexors are muscle of posterior compartment of leg. Gastrocnemius is the chief plantarflexor. Strength of ankle plantarflexors is important during many activities of daily living. Numerous methods are used for assessing muscle strength ranging from Manual Muscle Testing (MMT) to isokinetic dynamometry. Among these, MMT is very cheap, easy to administer and feasible, moreover it does not require use of sophisticated instrument. Though it yields very subjective data but it is very popular clinical test. MMT has been used by severe clinicians worldwide to assess the strength of Gastrocnemius, and in making the training and rehabilitation programs. Most of the grading criteria used in MMT are based on ability to move voluntarily against gravity or manual resistance added to examiner. Repeated one leg heel rise test has been proposed to assess plantarflexors strength against person's own body weight.[1,2] Performance of test can be used to assess plantarflexor strength because lifting the heel from the ground requires repeated concentric and eccentric contraction of the calf muscle, which are required in walking and running also. Standing heel rise test is found to be reliable and valid test to assess strength of plantarflexors.[3]

Various studies are performed to find out the average number of repetitions of complete heel rise. Age, sex, body mass index, activity level may affect the performance.[4] Available literature from other studies suggest wide range of repetition of complete heel rise during MMT of plantarflexion.

203 Subjects between age group of 20-59 years were recruited to measure number of standing heel rise without trick movements in upright position. The result showed average of 27.9(11.1) heel rises with no difference between both the genders. Thus, it was concluded that minimum 25 repetitions were required to grade it "normal".[5]

A study was done to estimate reference values of standing heel rise test for 600 healthy individuals among 20-81 years of age and provide its test re-test reliability. The results showed median heel rise of 24 repetitions for males and 21 repetitions for females. Excellent test re-test reliability was found for both the feet. [6]

Jan MH et al studied on effects of age and sex on strength of plantarflexors among 180 sedentary volunteers with age group between 21-80 years. They concluded that muscle strength varies with age and sex. Thus, both the factors should be considered while performing manual muscle testing of plantarflexors.[4]

So, the need was found to aim at estimating the average number of repetitions of complete heel rise in college going students.

MATERIALS AND METHOD:

Observational; cross sectional study design was conducted in 180 individuals (female- 152, male-28) in age group of 18-22 years. Sample size was decided based on previous study.[5] Subjects

were called for the study through mouth to mouth publicity. Every alternate subject who was willing to participate was enrolled. Then on the basis of inclusion and exclusion criteria final subjects participated in the study. Each subject filled out the subject information sheet and signed informed consent form (in vernacular language if needed). Demographic data such as age, gender, weight and height was taken of the subject. Weight was measured on standard weighing scale (OMRON: HN-286). Height was measured using stadiometer (Krups). Random Sampling and Blinding was done in the study. Inclusion criteria for the study was subjects with age group between 18-22 years, willingness to participate and able to understand the technique. Subjects with Low back pain, Lumbar spine surgery, Severe Kyphosis or Scoliosis and Lower limb fractures or any pathology related to lower limb and spine were excluded.

Procedure: Familiarization was done by demonstrating the technique. Subjects were asked to stand erect while flexing the knee of unsupported lower extremity and were asked to clasp hands behind at the back. Then as per metronome they were asked to perform complete heel rise and deviation in posture was responsible for termination of the test. 3 repetitions were done in same lower extremity with 5 minutes rest between each repetition. The same procedure was repeated in another lower limb and average was taken of both the lower limbs separately. Data was analyzed using SPSS version 20. Mean, Standard Deviation (SD) and median for number of complete heel rise were determined.

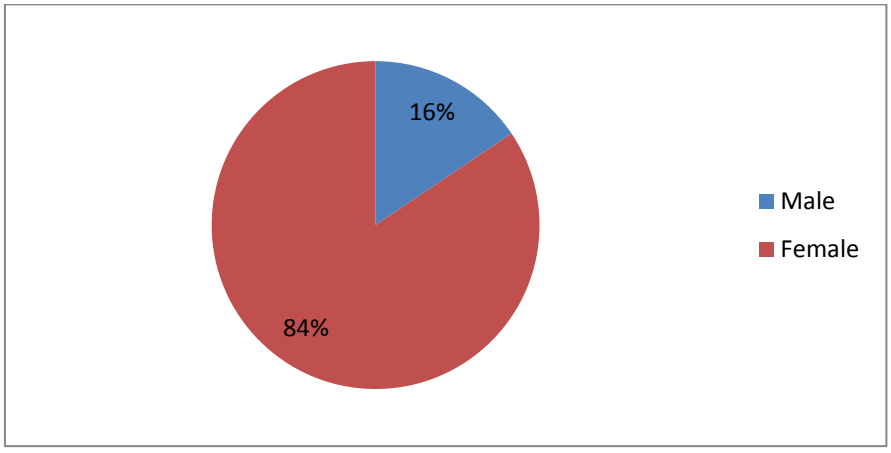
RESULTS:

Table 1: Demographic characteristics of all subjects

Gender	N	Age(yrs)	Height (meters)	Weight (Kgs)	Body Mass Index(Kg/mt^2)
Male	28	19.50(0.69)	1.60(0.09)	52.10(7.38)	20.34(3.80)
Female	152	19.15(1.17)	1.58(0.07)	53.90(11.55)	21.44(4.34)
Total	180	19.21(1.12)	1.58(0.07)	53.62(11.07)	21.27(4.27)

All data are expressed as Mean(SD), N= number of subjects

As shown in table 1, 16% males and 84% females are included in the study. Mean Body Mass Index (BMI) for males is 20.34 kg/mt^2 and females is 21.44 kg/mt^2.



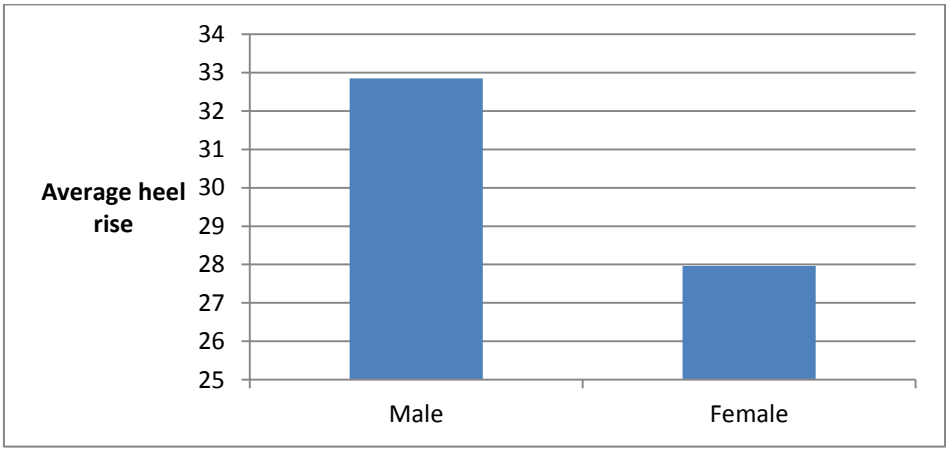
Graph 1: Gender distribution

Graph 2: Mean age and BMI of subjects

Table 2: Number of standing heel rise

	Male			Female			Total	
	Right	Left	Total	Right	Left	Total	Right	Left
Mean(SD)	34.10(13.48)	31.92(14.47)	32.85(12.68)	28.47(13.62)	27.40(13.02)	27.96(13.54)	29.35(13.71)	28.10(13.32)
Median	32.5	29.5	32	26.5	26	26	27	26
95% population	10-61	7-68	10-68	6-60	7-57	6-60	6-61	7-62

As shown in table 2, there is difference in number of standing heel rise in both genders but no difference is found between two lower limbs.



Graph 3: Average number of heel rise in males and females

DISCUSSION:

The present study was conducted on college going students to estimate the average number of repetitions of complete heel rise during standing heel rise test. The results of the study found that average number of repetitions on right and left lower limb were similar irrespective to dominancy of leg. Present study states that, in adults without known pathology or impairments, there are significant differences between genders in the strength of the plantar flexors as assessed by the standing heel-rise test. The average number of repetitions by males was 32.85 and females were 27.96. This is

supported by the notion that muscle strength of women is generally less than that of men due to the smaller physiological cross-sectional area of their muscles.

This finding is consistent with Jan et al who concluded age and gender should be considered while performing manual muscle testing of plantarflexors.[4] Whereas, results are inconsistent with those of Lunsford et al who stated that there is no difference in both the genders due to difference in body mass with male having more body weight compared to female. As the test includes performance against body weight so it would have affected.[5]

We have found that to grade normal for plantarflexors males should complete at least 10 repetitions and females should at least complete 6 on standing heel rise test. As it is found that 95%population fall within the range of 10-68 in males and 6-60 in females.

In our study position assumed by subjects was one leg standing with hands clasped behind the back and complete heel rise was counted when plantarflexion was achieved with more than 50% of range of motion. Repetition was not counted if subject did not maintained erect position.

Various criteria for testing plantarflexors as "normal" have been established. Kendall, Baesley and Daniels stated it to be 5 repetitions whereas Hislop, Lunsford and Svantesson stated it to be 20 or more repetitions. [1,2,5,6] Technique of performance differed between all of them as balance during the test was kept by touching examiner, wall or table with one or two fingers of one or both hands; even complete heel rise was considered with full range of motion of plantarflexion or more than 50% range of plantarflexion. [1,2,5,6] Ethnic difference can be responsible for the changes in criteria because the available literature is from western countries.

There are limitations associated with our study that we have included only young adult age group, not considered dominancy of lower limb, physical activity was not assessed and all subjects were college going students studying in same institute. For future studies it can be done by using sophisticated instruments such as isokinetic dynamometer, soleus and gastrocnemius can be differentiated, other age groups can be included and reference values can be generated for all age groups.

CONCLUSION:

A recommendation for change in criteria for grading normal strength of plantarflexors can be made in our population. Considering ≥ 10 repetitions for males and ≥ 6 repetitions for females as normal in college going students with age group 18-22 years.

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