

Correlation of Stature with Thickness of Tendo Achilles in Adult Bangladeshi

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Abstract:

Context: The tendoachilles is a vital structure in the bipedal system of human propulsion. It maintains the posterior morphological trail of the foot. The tendon plays an important role in reducing the energy cost of locomotion by storing energy elastically and releasing it at a subsequent point in the gait cycle and based on that it forms the elastic component of the triceps surae musculotendinous unit. So measurement of tendon and detection of size is an important tool for assessment of tendon. The aim of the study was to correlate thickness, of tendo achilles with stature in several age groups of sedentary people as measured by ultrasonography. All the measurement of tendo achilles vary with different factors such as age, sex, stature, physical activities, dominance of ankle, race and ethnicity.

Materials and Methods: This is a cross sectional analytical type of study conducted in the Department of Anatomy Dhaka Medical College from July 2013 to June 2014. The present study was performed on 200 tendo achilles of 100 people (Among them 50 were male and 50 were female). They were randomly selected from the patients who came to the Radiology Department of Dhaka Medical College Hospital for ultrasonography of any regions of their body other than leg.

Result: In this study thickness of tendo achilles was measured in both legs of adult people and correlated with stature. Highly significant correlation was found between the thickness, of tendo achilles with stature ($p < 0.001$).

Conclusion: The information obtained from the present study may provide a better understanding of the morphologic characteristic of normal tendoachilles, which may help physiotherapists, radiologists, sports professionals, ortho-surgeons in making a more accurate diagnosis.

Key words: Thickness of tendoachilles, stature, ultrasonography.

Introduction:

The tendo achilles is the largest, thickest and strongest tendon of the human body that transmit the force of powerful calf muscle to foot facilitating walking and running¹. The tendon can receive a

load stress 3.9 times body weight during walking and 7.7 times body weight when running². It provides elastic energy storage in hopping, walking and running³. However it is the most common site of injuries⁴. Tendo achilles injuries are usually related to poor ankle flexibility and strength and to overuse. Elderly people are also subjected to tendon rupture, which may be due to the degeneration of tendon structure⁵. In addition chronic renal failure, rheumatoid arthritis and thyroid disorders may also be correlated with tendon degeneration and rupture⁶.

Although some studies found that the thickness of tendo achilles was correlated with rupture and tendon abnormalities⁷ but stature related changes were seldom reported. It has been reported that

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the length of tendo achilles would be changed in patient with long term diabetes mellitus or other diseases⁵.

High-resolution sonography is a useful imaging tool for the assessment of achilles tendons because of its high image quality for accurate assessment and measurement of the tendons¹. It has been reported that sonography has high reliability in measurements of achilles tendons¹. Ultrasound also has the advantage of allowing the study of tendons in a real-time dynamic mode. Other ultrasound advantages are: low cost, easy available and the fact that, usually, during the examination, the comparison with the opposite side can be found.

Materials and Methods:

Subjects: In vivo thickness of tendo achilles were measured among adult Bangladeshi. In the present study 200 tendo achilles of 100 people, aged between 20 to 50 years or above were taken from Radiology department of Dhaka Medical College Hospital. Study subjects of the present study were students of different colleges or universities and sedentary workers of small entrepreneur and third or fourth class employee of government and non government organization. To obtain accurate results, subjects with infrequent exercise (i.e., who did not take part in any sort of physical exercise regularly or attended the gymnasium or sports club routinely) were included in the present study.

They were assigned in four groups. Table 1 shows the study population that were classified into four groups to describe the various changes in relation to age⁹.

Methods: All ultrasonographic examinations were performed by using the high resolution B-mode ultrasound machine HITACHI EUB -7000HV and with a 7.5 MHz linear array transducer (probe).

Operational definitions: a) Linear array transducer- the linear array transducer produces sound waves parallel to each other and produces a rectangular image. The width of the image and number of scan lines are the same at all tissue levels. This has the advantage of good near field

resolution. It is often used with high frequencies ie. 7.5 MHz's. can be used for viewing superficial structure like tendon. Its disadvantage is artifacts when applied to a curved part of the body creating air gaps between skin and transducer.

b) Longitudinal and transverse evaluation: The tendo achilles can be easily seen when the transducer (probe) is placed in the transverse plane, longitudinal to the tendon fibers. The probe is moved proximally from the insertion site at the calcaneal tuberosity to the myotendinous junction. For evaluation in the longitudinal plane the transducer turned 90 degrees.

The subjects were examined in a prone position with the ankles extended beyond the examination bed. Each ankle was just positioned at 90° such that the foot was dorsi-flexed. This position was chosen to facilitate contact between the probe and the tendon and to avoid anisotropy effect which can occur if the tendon was not taut¹⁰. A small layer of ultrasound gel used as a medium for propagation of sound¹¹. The probe was placed in the transverse plane, longitudinal to the tendon fibers at the insertion site at calcaneal tuberosity. Then it was turned 90 degrees for evaluation in the longitudinal plane. The normal tendo achilles had an echogenic pattern of parallel fibrillar lines in the longitudinal plane and an echogenic round to ovoid shape in the transverse plane¹². Tendon thickness was routinely measured at a point 1 cm above the superior calcaneal surface. This site was chosen for measuring tendon thickness as it was the most frequent site for pathology³. Thickness was measured in millimeters (mm). Both the right and left tendo achilles were examined by using ultrasonography.

Ethical Clearance:

The study was approved by the Ethical Review Committee of Dhaka Medical College, Dhaka.

Result:

Thickness of tendo achilles (both right and left leg) were compared with stature and the r value was $r=+0.295$ and $+0.326$ respectively (Table II). There was highly significant correlation ($p<0.001$) between the thickness of tendo achilles of right and left leg with stature (Fig 1).

Table I
Grouping of study subjects of the present study (n=100)

Group	Age Range	Number of Study Subjects	
		Male	Female
A	20-29	10	11
B	30-39	18	16
C	40-49	10	09
D	50-65	12	14

Table-II
Correlation of stature with thickness, of tendo achilles of right and left leg in male and female (n=100).

Variables	Right leg		Left leg%	
	r	P	r	P
Thickness	+0.295	0.003**	+0.326	0.001**

Pearson's correlation coefficient (r) test was performed to compare relationship between parameters, ** = significant at P<0.01, *** = significant at P<0.001.

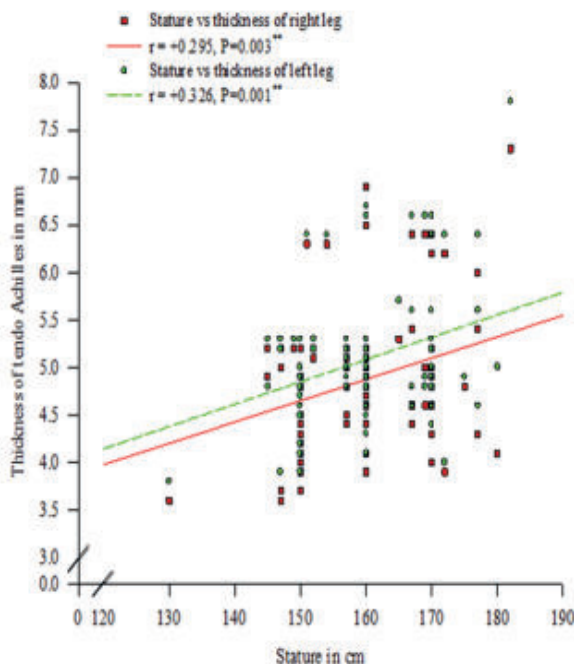


Fig. 1 Correlation of stature with thickness of tendo achilles of right and left leg of male and female

Discussion:

A comparative discussion of the thickness of the tendo achilles of present study with that of different authors and researchers of other countries are mentioned here. It was observed by reviewing the available literature that few works have been conducted on the measurements of tendo achilles in children, adult and sportsman in other countries. But so far it is known, there is no published work on ultrasonogram based measurements of tendo achilles and its variations with age, stature and dominance of ankle of adult people of Bangladesh. So the findings of the present study could not be compared with any previous similar study on adult population of Bangladesh.

In the present study there were highly significant correlation of thickness of tendo achilles with stature (p<0.001). Ying M¹ conducted a study on 80 tendo achilles of 40 subjects (14 men and 26 women) of different age groups belonging to Hong Kong. Ying M showed that the differences in the tendon thickness in different stature was not statistically significant (p>0.05). Findings of the present study showed dissimilarities with the findings of Ying M study (p<0.001) though he worked in same sub-continental area and subjects of same occupation but his sample size were only 40. Small sample size could be the reason of dissimilarities. Another cause of differences might be due to racial variation between Hong Kong and Bangladeshi people. Hong Kong is the first special administrative region of the People's Republic of China, The people of Hong Kong are a racial admixture of Han, Qin, Nanyue, Kowloon, Manchu, Mongol, Turkish, and Tibetan ethnic group (Wikipedia, 2013). Bangladeshi population is a mixed race of Negroid, Caucasoid and Mongoloid (Wikipedia, 2010). Egwu¹⁴ assessed the thickness of tendo achilles in an apparently 120 healthy young adult population of Southeast Nigeria with age ranging from 19 to 30 years. Egwu showed that thickness of tendo achilles correlated highly with stature in 19-30 years age group people. This study showed highly significant difference in the measurement of thickness of both tendon and its correlation with the present study (p<0.001). The dissimilarities of the finding of their study with the

finding of the present study might be due to the selection of different age groups and also due to racial variation between Nigerian (Negroid) and Bangladeshi people. Nigerian population is racial admixture of Chadi, Fulani, Zarma, Songhai, Kanuri and Shuwa (Wikipedia 2013).

Conclusion:

The study has established a normographic data for the thickness, of tendo achilles of adult Bangladeshi with a highly positive relationship with stature. The use of ultrasound can give reliable information regarding the morphological state of tendo achilles and these findings might be useful in the objective evaluation of pathological condition of tendo achilles. Correlating thickness of tendo achilles with stature can aid in early detection of players at risk of achilles tendon disorders, thereby preventing the risk of potential injury¹⁵. Researchers indicate that it can be used as outcome measure in continually monitoring an athlete's progress to ensure the effectiveness of treatment¹⁶. It can assist efficiently prevention, assessment and monitoring the rehabilitation of professional sportsman.

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