

Relationship between Stature and Length of Tendo Achilles in Adult Male and Female of Bangladesh

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Abstract

Background: Tendo Achilles injuries are usually related to poor ankle flexibility and strength and to overuse. Morphology of tendo Achilles is an important tool for its assessment which can be done by measuring tendon thickness, cross-sectional area and length of tendon. **Objective:** The aim of the study was to correlate length of tendo Achilles with stature in several age groups of sedentary people as measured by ultrasonography. **Materials and method:** This cross sectional analytical type of study was conducted in the department of Anatomy, Dhaka Medical College Hospital, Dhaka, Bangladesh from July 2013 to June 2014. The present study was performed on 200 tendo Achilles of 100 people (50 male and 50 female) randomly selected from the patients who came to the Radiology department of Dhaka Medical College Hospital for ultrasonography of any region of their body other than leg. **Results:** In this study length of tendo Achilles was measured in both legs of adult people and was correlated with stature. Highly significant correlation was found between length of tendo Achilles with stature ($p < 0.001$). **Conclusion:** The data of length of tendo Achilles obtained from the present study may provide valuable information in different aspects of medical science as a guide line for physiotherapists, radiologists, sports professionals and ortho-surgeons in early detection and monitoring of rehabilitation especially of professional athletes.

Key words: Length of tendo Achilles; stature; ultrasonography.

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Introduction

The tendo Achilles is the largest, thickest and strongest tendon of the human body that transmits the force of powerful calf muscle to foot facilitating walking and running.^{1,2} The tendon

can receive a load stress of 3.9 times body weight during walking and 7.7 times body weight when running.³ It provides elastic energy storage in hopping, walking and running.⁴ However it is also

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the most common site of injuries. 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 the tendon structure. In addition chronic renal failure, rheumatoid arthritis and thyroid disorders may also be correlated with tendon degeneration and rupture.⁵ It has been reported that the length of tendo Achilles would be changed in patient with long term diabetes mellitus or other diseases.⁶ In sports professionals stature of participant is very important as we know longer tendon makes faster runner. Longer tendo Achilles appears to generate more power because they stretch more.⁶ So it is necessary to understand the normal length of tendo Achilles and its correlation with stature.

High-resolution sonography is a useful imaging tool with high reliability for the assessment of Achilles tendon because of its high image quality for accurate assessment and measurement of the tendons.^{1,5} Ultrasound also has the advantage of allowing the study of tendons in a real-time dynamic mode. Other ultrasound advantages are low cost, easy availability and the fact that, usually, during the examination, the comparison with the opposite side will be available.²

Materials and method

In vivo length of tendo Achilles was measured among adult Bangladeshi people. In the present study, measurement of 200 tendo Achilles of 100 people, aged between 20 to 65 years were taken from Radiology & Imaging department of Dhaka Medical College Hospital, Dhaka, Bangladesh from July 2013 to June 2014. Study subjects were students of different colleges or universities, sedentary workers, small entrepreneurs or third or fourth class employees 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.

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 i.e. 7.5 MHz's. It 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 transverse plane the transducer is turned 90°.

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 taut.⁷ A small layer of ultrasound gel was used as a medium for propagation of sound.⁸ 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° 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 plane.⁹

The length of the tendo Achilles was measured with extended field of view sonography in longitudinal planes from the calcaneal tendon

insertion to the calf tendon muscle interface. Tendo Achilles resting length was measured as the distance between these two points. Distal end of tendo Achilles was measured in transverse plane over the heel at the level of superior calcaneal surface. Then the transducer was positioned in the longitudinal plane and the proximal end of tendo Achilles was recorded with it over the gastrocnemius muscle - tendon junction (MTJ), which was two centimeters medial from the border between medial head and lateral head of gastrocnemius. Autonomic tracing software was used to measure the displacement of these two ends in ultrasound image. Length was measured in millimeters (mm).⁵

This Thesis work was carried out after the Ethical Committee of Dhaka Medical College, Dhaka, had approved the protocol for the research work.

Results

In this study length of tendo Achilles was measured in both legs of adult people and was correlated with stature. Table I shows the distribution of the male and female subjects in different age groups. In this study participants of 30-39 years age group, both male and female, were relatively more than other age groups. The table shows almost even distribution of sex in relation to different age groups.

Table I: Distribution of sex in different age groups (N=100)

Age group	Sex (Frequency, %)	
	Male (n=50)	Female (n=50)
20-29	10 (20%)	11(22%)
30-39	18(36%)	16(32%)
40-49	10(20%)	09(18%)
50-65	12(24%)	14(28%)

In table II, Pearson's correlation was done between stature with length of tendo Achilles of both right and left leg. A highly significant correlation between the length of tendo Achilles with stature was observed (Fig. 1) ($p < 0.001$),

($r = +0.946$ and $+0.942$ for both right and left leg respectively).

Table II: Correlation of stature with length of tendo Achilles of right and left leg in male and female (N=100)

Variables	Right leg		Left leg	
	r	p	r	p
Stature vs. length of tendo Achilles	0.946	0.0001	0.942	0.0001

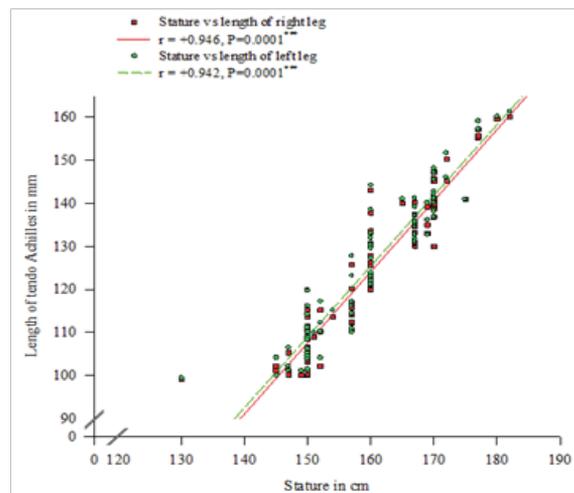


Fig. 1: Correlation of stature with length of tendo Achilles

Discussion

A comparative discussion of the results of different variables of the present study with that of different authors and researchers of other countries are mentioned in this discussion. It is observed by reviewing the available literatures that few works have been conducted on the measurements of tendo Achilles in children, adult and sportsmen in other countries. But so far as 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. Observed results of

different variables showed some similarities as well as dissimilarities with the data available in different articles. The findings of the present study were statistically analyzed and revealed important information about the variations of different measurements of tendo Achilles with stature of the study population. In the present study there was highly significant correlation of length of tendo Achilles with stature ($p < 0.001$). Yinget al.¹ conducted a study on 40 subjects of different age groups in Hong Kong. They showed that there was no significant difference in the length of tendo Achilles between subjects of different age groups ($p > 0.05$). They correlated body height with tendon length and found that there was a low positive correlation between stature and tendon length ($p < 0.05$). The measurements of the tendo Achilles also change with increasing stature. Most of the finding of the present study showed dissimilarities with the findings of afore mentioned study 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 one of the reasons of such dissimilarities. Another cause of differences might be due to racial variation between Hong Kong and Bangladeshi people.

The study has established a normographic data for the length of tendo Achilles of adult Bangladeshi people 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 may be useful in the objective evaluation of pathological condition of tendo Achilles. By correlating different measurements of tendo Achilles with stature can aid in early detection of players at risk of Achilles tendon disorders, thereby preventing the risk of potential injury.¹⁰ Researchers indicate that it can be used as an outcome measure in continually monitoring an athlete's progress to ensure the effectiveness of treatment.¹¹ It can assist efficiently in prevention, assessment and monitoring of rehabilitation of professional sportsmen.

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