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Songographic Assessment of the Heel Pad Thickness in Normal Nigerians

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Abstract: The study was designed to determine the mean heel pad thickness in apparently normal Nigerians which could serve as a possible reference values for the assessment of the anatomical integrity of the heel pad. 231 volunteers that met the inclusion criteria were recruited far the study. This consisted of 130 males and 101 females. Measurement of the heel pad was made using a high frequency ($10MH_2$) transducer and a high resolution ultrasound machine sonoace 5500. The weight and height of the subject were measurement using an electronic weighing scale and a meter rule. The results were analyzed using SPSS version 14.0. $P<0.05$ was considered statistically significant. Males had thicker HPT than females. There was a strong positive correlation (r=0.851) between HPT and BMI. Age had a week positive correlation (r-0.241) with HPT. A unit rise in BMI resulted to a 0.036±0.023mm rise in HPT. The study has thus establish a nomogram for heel pad thickness among Nigerians which could serve as a possible reference values for the assessment of the anatomical integrity of the heel pad.

Key words:

INTRODUCTION

The heel pad otherwise called corpus adipose is a pad of fat that is located under the heel bone (calcaneus). The heel pad protects the heel bone and the hollow foot tendon (called aponeurosis plantaris) which flattens on the heel bone under the heel. It also function as shock absorber thus providing a cushioning effects during walking running, jumping or landing [1].

The human foot combines mechanical complexity with structural strength to enable it play its roles in dynamic support, balance and mobility and thus functions as a propulsion engine. The heels bone is designed to be the first contact the foot has with the ground and so this part of the foot must be structurally and mechanically stable to provide the necessary support, balance and mobility.

Given the forces of walking, running and jumping that the heel pad is subjected to and the pull from various ligaments and muscles, it is not surprising that heel pain is so common. The size of the heel pad has been fingered as being one of the causes of heel pain [2, 3].

It has been shown that some patients have low shock absorbency of the heel pad and supplement of orthotic therapy [4] and surgical intervention had been advocated as management regiments for the treatment of plantar heels pain [5]. Studies have provided the relationship between the thickness of the heel pad and the unset of heel pains [2, 3, 6]. Other studies have shown that heel pad thickness is significantly greater in diabetics [7] as well as in patients suffering from unilateral displaced intra-articular fractures of the calcaneum at 21-35 months after injury [8, 9]. Again, increased heel pad thickness can be used as a marker of soft tissue enlargement in acromegalic patient [10].

The anatomical integrity of the heel pad should be ascertained especially in athletes because certain conditions, injuries and abnormalities of the heel pad which could affect the use of the foot are common in competitive athletes and gymnasts [11].

Despite the dynamic and the cushioning roles the heel pad provides to the foot, very little attention is paid to this part of the body. The aim of this study was to determine the normal heel pad thickness among Nigerians which could serve as an index of the anatomical integrity of the heel pad.

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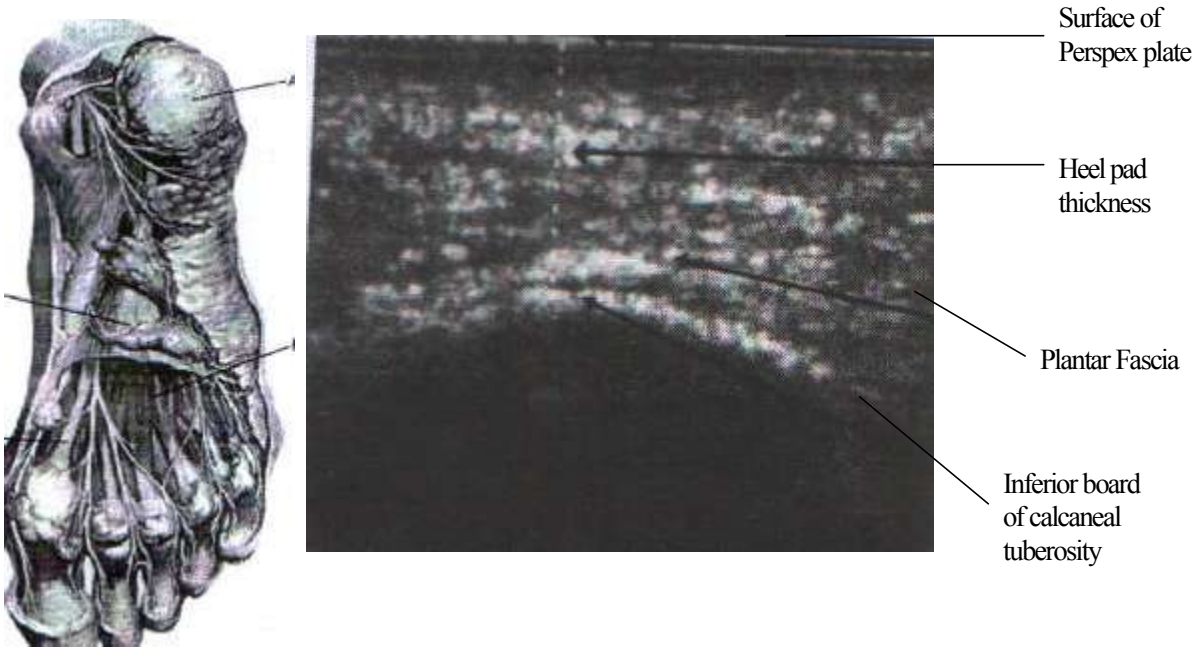

MATERIALS AND METHODS

231 apparently healthy volunteers were recruited for the study. There were all Nigerians in origin, had no foot diseases or acutely painful conditions which could affect gait,were non diabetic and non-agromegalic. There were 130 males and 101 females. The aims and procedures of the study were clearly explained to the patients and they all gave informed consent. The ethics committee of Ebonyi State University Teaching Hospital approved the study. A digital ultrasound machine sonoace 5500 (medicol, Korea) with a 10MHz transducer was used for the measurement of the heel pad. The subjects lay in a prone position on the couch with legs extended. The ultrasound gel was applied on the surface of the heel and the heel pad was scanned. Measurement of the pad was made from its calcaneal border to the end of the pad using the machine calliper.

The weight and height of the subject were determined using an electronic weighing scale and a meter rule. The subjects gender and age were analyzed using SPSS version 14.0

RESULTS

A total of 231 subject were selected for the study. There were 130 males (age range 25-72 years, means age = 38.5±5.5 years and 101 females (age range, 26-67 years, means age =30.3±6.1 years. The means body mass index for the males was 24.2±1.1 while that of females was 20.4± 2.3.

The mean value of HPT in the male subject from the study was 14.3±1.24mm. It ranged from 11.00mm to 16.55mm. In the females, the mean HPT was 12.14±1.26mm. It ranged from 10.30mm to 13.51mm. Analysis of variance shows that there is a significant difference between the value of HPT obtained from the male subjects and those obtained from the females. Body mass index (BMI) had a strong positive correction with HPT (r=.851) while age had a weak correlation (r=.241). Regression analysis shows that a unit rise in BMI result in 0.036±0.023mm rise in HPT.

DISCUSSION

The foot sustains enormous pressure from various physical activities, therefore feasibility, resilience and shock absorption must be maintained. The principal shock absorber in the foot is the heel pad. The means HPT in the present study was 14.33±0.24 (range= 1100 to 16.55mm) in the male subject and 12.14±0.26mm (range=10.30 to 13.51mm) in the females. These values agree with the findings of Morage *et al*. [12] and Erdemir *et al*. [13]. Both studies reported the heel pad thickness of normal adult to be 14.33mm. Nass *et al*. [14], in their own study identified the mean heel pad thickness of males to be 14.6mm and that of females was 12.2mm. A review of the literature reports a wide diversity of normal values of the heal pad [3, 7, 15, 16]. This may be due to racial differences or associated differences in the imaging modalities used.

Males, in the present study, had a significantly thicker PAT than females ($P<0.05$). The anatomical and hormonal differences between males and females is

the most probable reason for the difference noticed. Body mass index had a strong positive correlation with HPT (r=.761, P<0.05). A unit rise in BMI results in 0.036± 0.023mm rise in HPT.

Studies have observed a direct link between inadequate heel pad shock absorbency and many shock-induced over use syndromes [17]. Result from previous studies, Levy *et al*. [18] and Rom [17] suggested that middle aged women with a sedentary lifestyle are at risk of developing heel pain. This finding suggested that isolated risk factors, such as lifestyle, age and body weight affect the property of the heel pad [17]. Despite the foregoing, other mechanical factors such as footwear and the shock absorbency of the pad should also be put into consideration [19]. Again, inflammation of the heel pad occurs often after repeated vigorous overload, e.g. landing after jumping. This condition is often seen in gymnasts [11] and present with pains when walking as well as when applying pressure on the edges of the heel pad. In some cases, it is possible to see haemorrhage in the heel pad. Furthermore, numerous pull and forces exerted on the heel bone and pad should also be considered in heel pain. The Achilles tendon inserts into the back of the heel bone (calcaneus) and a very strong ligament (planter fascia) is attached to the bottom of the heel bone. Several small muscles also attach to the heel bone above the insertion of the plantar fascia. As a result of walking running and jumping that the heel bone is subjected to and the pull of all these ligaments and muscles, it is not surprising that heel pain could still occur even when the heel pad is structurally stable.

Inadequate heel pad had been directly linked with heel pain and low shock absorbency [17]. Quantifying heel pad thickness by clinical observation is difficult [3]. Radiographs requires ionizing radiation and poor Reliability of radiographs in foot measurement has been reported by Gibbon *et al*. [20]. Ultrasound is a quick,non-invasive and reliable technique for musculoskeletal measurements (23) making it the preferred modality for the assessment of the heel pad in this locality.

Our study has thus established a nomogramm for heel pad thickness among Nigerians which could serve as a possible reference values for the assessment of the anatomical integrity of the heel pad.

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