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Commentary

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Truncated Foot Length: A Potentially More Reliable Foot Dimension for Stature Estimation

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Stature estimation is a vital tool in forensic investigation. It answers the pertinent question of how tall an individual is in an attempt to establish the biological profile of unknown deceased or suspect. The widely used methods of stature estimation in forensic science are the anatomical and the mathematical methods [1]. While the anatomical method is largely abandoned in the light of the obvious difficulty in recovering the complete skeleton in its intact form from a crime or disaster scene, as well as the tedious and time consuming nature of the technique [2], the mathematical method has undergone several refinements and modifications since its inception in order to provide easy-to-use, reliable and consistent regression equations for the estimation of stature. Initially, the mathematical method for stature estimation is mostly achieved using regression equations particularly derived from measurements of long bones of the upper and lower limbs [3,4]. These equations have a reasonable degree of accuracy, although the lower limb bones are more reliable than the bones of the upper limb [5,6]. Nevertheless, such bones are not usually recovered in intact form due to their fragility [6]. Consequently, alternative approaches have been made to derive regression equations from fragmented skeletal materials [7,8]. However, despite such attempts, the fragmented skeletal materials have been found to be less reliable compared to the long bones [9]. The fragmentary materials are also less reliable than the small bones of the body particularly those of the foot [10-12]. Moreover, due to the protection offered by footwear and the particular feature of their own tissue, the integrity of the pedal elements is more likely to be recovered undamaged in mass disasters [6]. Thus, the foot constitutes a reliable body part up for grabs in forensic investigations for stature estimation.

A number of regression equations, both population-specific and sex-specific, have been derived for stature estimation from foot dimensions in various studies [13-16]. Among the various foot dimensions, foot length was found to be the best parameter for estimation of stature [13,16]. However, a recent study by AlQahtani has shown that the length of proximal phalanx of the second toe does not show significant correlation with the stature despite the development of predictive regression equation [17]. Accordingly, it is plausible to assume that due to the short nature of the phalanges of the foot, their length may not be accurately proportional to person's stature. Thus, the truncated foot length (foot length without the phalanges) may be more reliable in stature estimation than the total foot length. Furthermore, in a situation where a recovered foot with toes deformities (e.g. claw or hammer toes) is brought for forensic examination to establish the identity of the diseased, truncated foot may offer a more reliable alternative for estimation of stature as the measurement of total foot length may be affected by the deformities.

As a follow-up to these observations, Gwani et al., [18] recently published study on a sample of 32 young adults comparing the reliability of regression equations derived from full foot length and truncated foot length (measured from lateral radiographs of the foot) in stature estimation. At the end of the study, it was found that truncated foot length has a higher correlation with stature than total foot length. This is evident by the larger R, R2, and adjusted R2 as well as the smaller SEE in regression equations derived from truncated foot length compared to those derived from the total foot length in the sex-specific equations as well as the overall sample. This strengthens the idea that truncated foot length presents a more reliable foot dimension for stature estimation. However, further studies in larger samples of different populations are needed to substantiate this claim.

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