

Original Article

CURRENT PRACTICE OF STATURE ESTIMATION IN MALAYSIA

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ABSTRACT

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Stature estimation studies from bones have been well established in the past in countries such as the US and UK, but it is slowly progressing in Malaysia. This study was conducted to assess the current practice of the forensic pathologists in Malaysia with regards to stature estimation. A set of questionnaire comprised five objective questions and three survey rating scales were distributed to forensic anthropologists and forensic pathologists whom handling skeletonised cases in Malaysia. The majority of respondents had applied formula from Trotter and Gleser (1958), and Mahakkanukrauh (2011). Majority of respondents agreed that these formulae were only slightly accurate when applied to the Malaysians. In terms of bone utilised for stature estimation, all respondents concurred that long bones exhibited the best estimate and the best measurement was the maximum length of long bone. The respondents also accorded that, formulae for the Malaysian population should be generated, which will add to the accuracy of stature estimates for the Malaysians. The current practice had seen the utilisation of formulae from other populations, which may lead to vast error. Forensic anthropologists in Malaysia are fully aware of this problem, and suggestions to undertake researches were forthcoming to accommodate population-specific formulae for Malaysia.

INTRODUCTION

Forensic anthropology is the application of anatomical science of anthropology to study human skeletal remains for medico-legal purposes. The discipline has interaction with anatomy, physical anthropology and forensic medicine [1]. In cases, where physical identification of an individual is impossible due to adverse condition of the remains, forensic anthropologist would identify the remains based on sex, ancestry, age and stature. In mass disaster such as open fire or major flooding, the bodies were often found dismembered, burnt and/ or even skeletonised. When a large number of victims was involved, possible victims were identified by narrowing down the unknown into sex, ancestry, age and stature for identification purposes.

Forensic anthropology was established since early 1940s, when physical anthropologists were recruited by the American military to identify American soldiers during World War II and Korean War at the United States (US). Currently, forensic anthropologists were given tasks to deal with identification of human remains in mass disasters of war and bombing, and mass graves for instance, Tsunami (December 26, 2004) in Thailand, Indonesia, Sri Lanka and Malaysia involving 226,408 victims [2], the bushfires disaster in Victoria

state of Australia with 173 deaths [3], World Trade Center bombing in the US (September 11, 2001) [4] and national or civil wars (e.g. Argentina, Venezuela, Bosnia, Kosovo, Cyprus) [1].

The development of forensic anthropology discipline has grown rapidly in the US, South America, Europe, Africa and Asia in the past [5, 6]. Standard guidelines were prepared for handling skeletonised remains and monitored by the forensic anthropologists through several associations around the world. For instance, the Scientific Working Group for Forensic Anthropology (SWGANTH), which was founded in 2008 by the Federal Bureau of Investigation (FBI) and the Department of Defence Central Identification Laboratory (CIL) in the US were established as the platform for the forensic anthropologists to disseminate the consensus guideline for the current practice [7]. The British Association for Forensic Anthropology (BAFA) and Forensic Anthropology Society of Europe (FASE) [8] were involved in monitoring the current practice of forensic anthropology in the UK and Europe.

However, the development of the discipline differed in each country, depending on history, status of education, legislation and forensic practice. In the

US, a PhD in anthropology is normally required to practice forensic anthropology [9]. In Europe and other developing countries, the examination of unidentified human remains is mandatorily a task for forensic anthropologist [10, 11]. Nevertheless, in most countries, the number of available forensic anthropologists is limited, hence most of the task were undertaken by the forensic pathologists. In brief, a concerted multidisciplinary effort is required from both forensic anthropologist and pathologist when dealing with human body, particularly in complicated cases. When there is more soft tissue present on the body, it naturally becomes the domain of the pathologist to work on the case. Likewise, in skeletonized, decomposed or burnt remains, it becomes the domain of the anthropologist to work on the case [6]. It is, thus essential to acquire thorough knowledge of the current practice of autopsy in each country to become familiar with practices within the area.

In Malaysia, there are 34 forensic pathologists in over 14 states and federal territories of Malaysia. In the state hospitals, there are only one or two forensic pathologists working, and none in the district hospitals. The ratio and distribution of forensic pathologist is higher in the town centre (Kuala Lumpur and Selangor), especially at the Hospital Kuala Lumpur, which housed six forensic pathologists from different sub-specialties. The clinical forensic settings are based on on-call system, but the duration of the call system differs between hospitals depending on the availability of the working staff.

Additionally, it is noteworthy to mention that not all forensic pathologists will involve in examining anthropological cases. When a case is received, the case is referred to the forensic anthropologist upon availability. Nevertheless, there are only three forensic anthropologists in the service under the Ministry of Health of Malaysia. If the case is received in district hospitals in the absence of forensic pathologist, the standard procedure as the above will be followed. However, if the case is received in the state hospital with one or two forensic pathologists available, they will have options whether to conduct the anthropological examination or to refer to the forensic anthropologist in the headquarters.

By qualification, forensic pathologists are certified to conduct anthropological examination, but they would prefer to seek consultation from a forensic pathologist with a sub-specialisation in anthropology. The preferred option was created due to the nature of medico-legal issues that will be questioned in court, in which an expert report by a forensic anthropologist will be highly approved. In a different scenario, anthropological cases received in Hospital Kuala Lumpur will be handled by the forensic anthropologist.

In Malaysia, thus far there were no anthropological studies conducted on dry bones for stature estimation. Forensic anthropologists in Malaysia have been using formula developed from other

populations mainly by the Western population to estimate stature. As stature estimation are population-specific [12], the estimates produced were not accurate and reliable, as they were based on different population databases. Hence, it is essential for researchers to derive the Malaysian population-specific equations to obtain accurate stature estimates for the Malaysians in future practice.

MATERIAL & METHOD

Ethical approval was obtained from several institutions such as NMRR, CRC and UKM. The consent forms were signed, and relevant information of the study was described briefly to the respondents beforehand. Questionnaires were distributed to all the forensic pathologists in Malaysia, who are involved in the anthropological examination. Thirteen of them were identified, but only ten pathologists had responded. The questionnaire comprised five objective questions, three survey-rating scales and general comments. In the objective section, each question had five options, while in survey-rating scales, the respondents were requested to choose from scale 1 to 5, that represented either strongly agree, disagree, neutral, agree and/ or strongly agree, accordingly.

RESULTS

Questionnaires were answered by ten forensic pathologists, out of whom three were forensic anthropologists. Results revealed that the majority of the forensic pathologists in Malaysia utilised the formulae by Trotter and Gleser [13] in the current anthropological practice, while others preferred to use more than one equations, from both the Trotter and Gleser [13] and Mahakkanukrauh, Khanpetch [14] depending on relevancy of cases. One forensic pathologist had adopted the formulae by Pearson [15], while another forensic pathologist employed the formulae by Dupertuis and Hadden [16]. Figure 1 exhibited the number of respondents using the aforementioned formulae routinely. In the assessment of accuracy of the regression equations (Question number 2), all the regression equations were found to be slightly accurate. Nevertheless, three respondents had refused to offer comments as there were no data available to validate the accuracy of the estimated statures.

Based on Figure 2 and Figure 3, all respondents concurred that long bones were the best bones to be utilised for stature estimation. The best parameter used was the maximum length of long bones rather than the width of bone, midshaft diameter of bone or circumference of the bone. The best method for bone measurement was the conventional method, i.e. the bone measurement directly on dry bones (Figure 4). Only one respondent (forensic anthropologist) contemplated that CT scan is the most effective method of bone measurement for stature estimation.

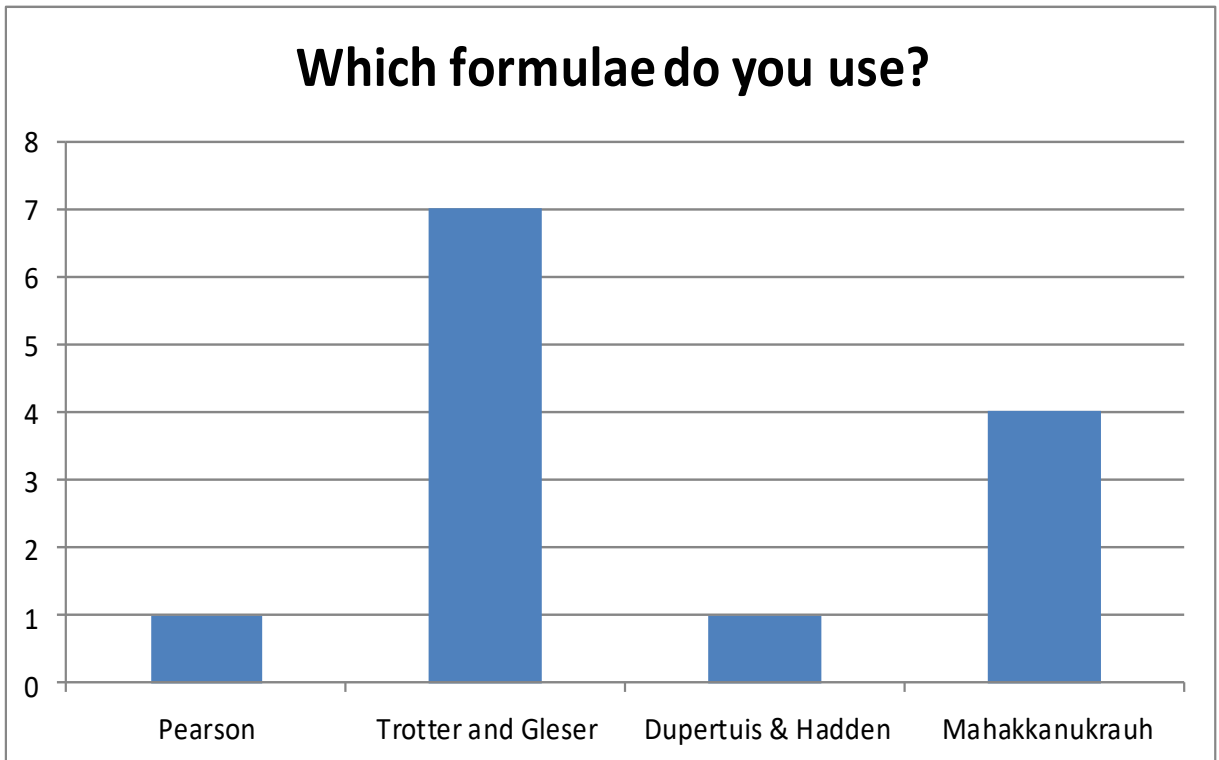


Figure 1: Stature estimation formulae in the current forensic anthropology practice

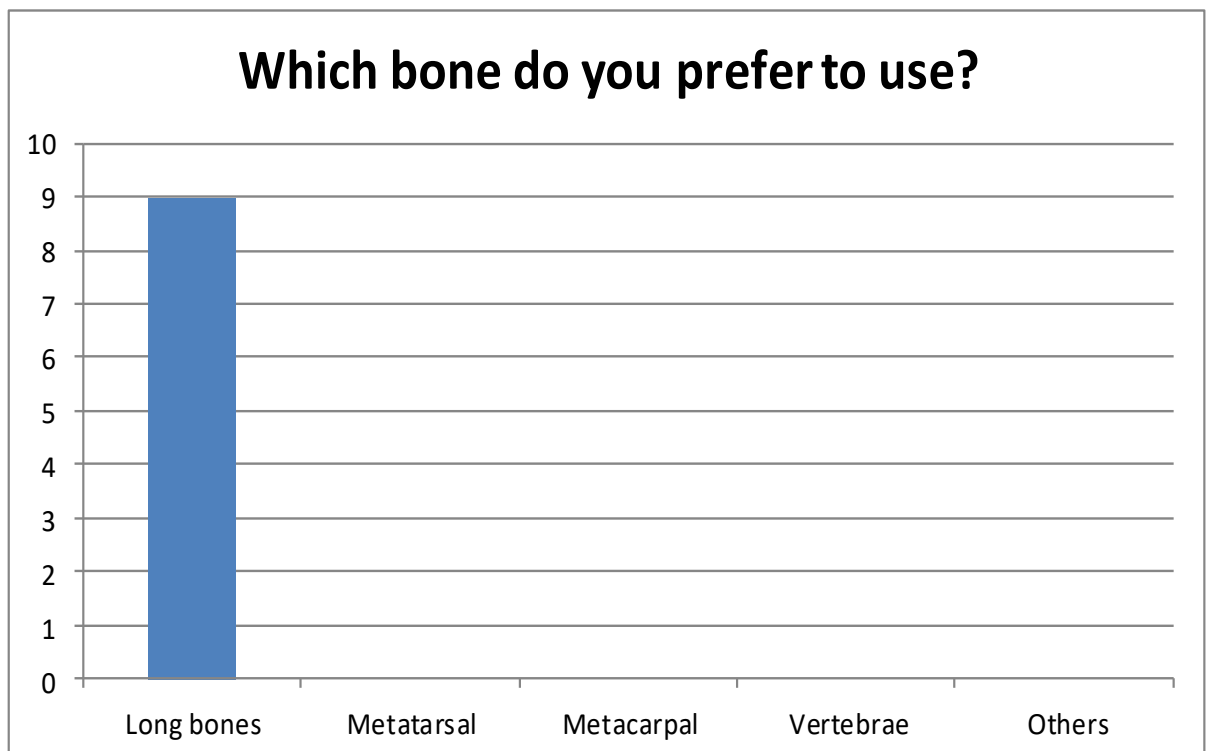


Figure 2: Preferred skeletal elements for stature estimation

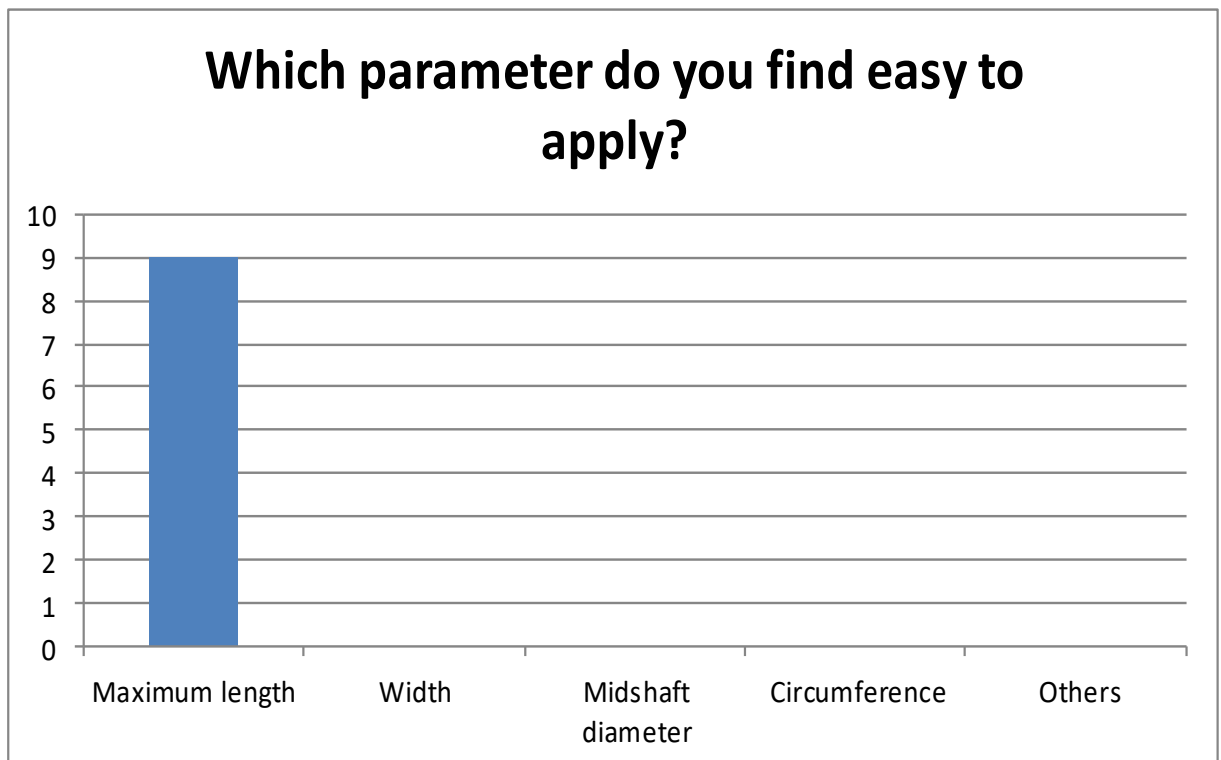


Figure 3: Preferred parameters for computation of stature.

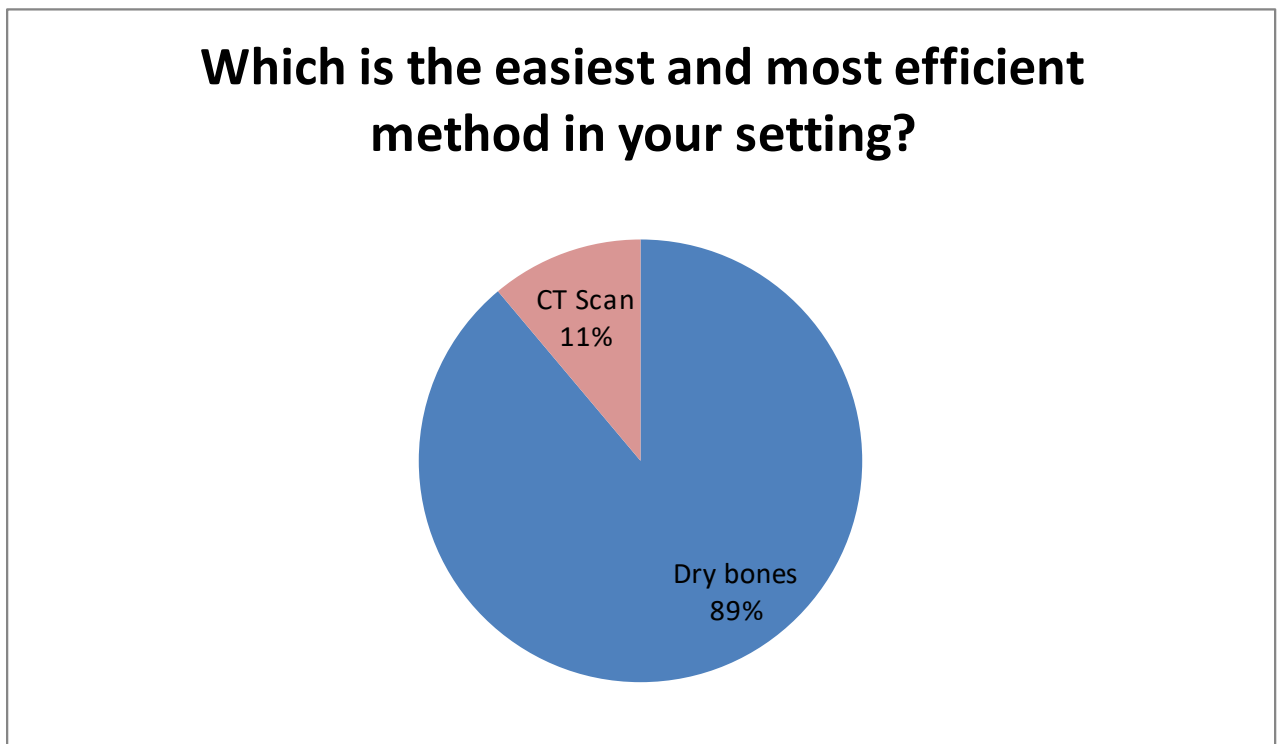


Figure 4: Method of bone measurement for computation of stature.

In survey-rating scale section (scale 1 to 5), three questions were implored regarding developing formulae for stature estimation based on the Malaysian population. The majority of the forensic pathologist had strongly accorded (scale 5) that the formulae for stature estimation should be specifically developed for the Malaysians. Nevertheless, a few forensic pathologists preferred one general formula, which would be applicable and practical compared to having a specific formula for each ethnic groups in Malaysia. As expected, the majority of forensic pathologists decided that having specific ethnic formulae, will not only help to increase the accuracy of stature, but will conform to specific individual characteristics to represent the multi-cultural practice across ethnic in the population.

DISCUSSIONS

Results clearly portrayed that Malaysians do not have an anthropological standard for stature estimation. The decision to employ which formulae to be used depends entirely on the expert, and the two most employed formulae were by Trotter and Gleser [13] and Mahakkanukrauh, Khanpetch [14]. The formulae by Trotter and Gleser [13] were generated from the Mongoloid origins, while the equations by Mahakkanukrauh, Khanpetch [14], were developed from the Thais, thus these equations were believed to be close to the Asians in origin.

The formulae by Pearson [15] and Dupertuis and Hadden [16] were still utilised by few of forensic pathologists, even though they were developed from the Western population. The formulae by Pearson [15] was derived from the prehistoric people, while the formulae by Dupertuis and Hadden [16] was developed from the Whites and Negroes. Hence, both equations could not be applied to the Malaysians. Further, the equations were derived from studies conducted nearly a century ago, which clearly did not take into account the secular changes that have occurred [14, 17-21]. Secular change can be defined as non-genetic factors that contribute to stature development in the average modern generation, in which they are generally taller than the older generation. The increase in stature was evidently analogous to the length of their bones anthropometrically [22].

In the assessment of questionnaire, 100% of the respondents concurred that the regression equations were only slightly accurate for reasons that the regression equations were developed from an unrelated population [23-26]. Thus, this indicated that population-specific equations are necessary for the Malaysians to account for the inherent population variation due to genetic differences and environmental factors such as nutrition, physical activity and climate.

Also, the results of the questionnaire also implied that the predictor to develop regression equations were the long bones, and the best parameter to be applied is the maximum lengths of long bones. Previous studies have proven that long bones exhibited the highest correlation

with stature [14, 27-30] compared to other bones, where correlations were much lower [31-38].

The final question (Question 5) showed that majority of forensic pathologists was in the opinion that dry bones was the best method for measurement of bones. In recent years, CT scan was introduced to measure bones with high accuracy and reliability, but the unavailability of the scan is a hindrance to its application for daily practice. The only CT scan available for use in forensic department is located in the Hospital Kuala Lumpur. Despite the availability of the virtual autopsy service in the Hospital Kuala Lumpur, the dry bone method was still employed. Additionally, CT scan would provide an important source of bone samples for research purposes. In the general comments, the intra-observer and inter-observer reliability were the biggest challenge in developing the equations from CT scan. Thus, stature estimation will be deemed accurate and reliable with negligible error in the intra-observer and inter-observer error analyses.

CONCLUSION

In conclusion, a majority of forensic pathologists/ anthropologists indicated that specific population regression equations should be developed for the Malaysian population. The existing equations by the western researchers are no longer applicable in the current Malaysian population. It was also exhibited that the long bones and their maximum lengths are the best predictors of stature. Also, specific regression equations should be developed for specific ethnic groups in Malaysia. This will greatly enhance the accuracy and reliability of the regression equations.

CONFLICT OF INTEREST

All authors declared no conflict of interest in the production of the manuscript.

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