H28   Tarsal Measurements to Estimate Sex for Use in a Forensic Setting

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After attending this presentation, attendees will learn that osteometric analysis of the tarsals can produce accurate determination of the sex of the decedent in forensic cases. While previous studies in the past have utilized the calcaneus and talus for osteometric analysis to determine sex in both modern and prehistoric populations, this study has utilized all seven and found that higher levels of accuracy are achievable using all seven tarsals in the sample population studied. Attendees will also learn how to accurately measure all seven tarsals to reproduce the results of this study.

This presentation will impact the forensic community by providing new ways of determining the sex of the decedent. This study contributes to the forensic community, and specifically the forensic anthropology community, as the identification of an individual based upon skeletal traits is of primary concern. This study does just that by helping to predict with a certain amount of accuracy the sex of an individual based upon the tarsals alone.

Identification of an individual based on skeletal traits is of primary concern in forensic anthropology. A basic antemortem profile should include age, ancestry, and sex; factors that can help law enforcement identify the decedent (Bass 2005). Although there has been extensive research and testing of many bones as indicators of age and sex, often these bones are not available in a forensic setting. More research is needed on those bones which can withstand greater extremes such as weathering and fire, since these elements are often those encountered in forensic settings. The irregular bones of the ankle fit such criteria, as they are relatively dense in some areas (White 2000). While several studies have been done using the calcaneus and talus, (Gualdi-Russo 2007, Steele 1976, Murphy 2002, 2005) no significant contribution to the study of modern populations have been published concerning all seven tarsals (Bass 2005; Bidmos and Asala 2003, 2004; Gualdi-Russo 2007; Murphy 2002a, 2002b; 2005; Steele 1976; Wilbur 1998). This current project advances these previous studies by publishing data and analysis of tarsal dimension patterns for a museum population of individuals who died within the last 25 years and are curated at the University of New Mexico.

Several sources have studied the measurements of the calcaneus and talus in relation to sex on prehistoric populations. Murphy (2002a, 2002b, 2005) studied the talus and calcaneus of prehistoric New Zealand Polynesians. Wilbur (1998) published on the subject of hand and food bones for the determination of sex in a prehistoric population from West- Central Illinois.

Modern population specific research has been done on the calcaneus and talus as well. Using five measurements each from the talus and the calcaneus on a modern American ancestral white and black population, Steele (1976) accurately predicted sex 79% to 89% using a discriminant function analysis. Gualdi-Russo (2007) has produced a high percentage of correct classification of sex (87.9-95.7%) within a modern northern Italian population. The tali and calcanei from the Raymond A. Dart Collection of Human Skeletons were utilized in two studies by Bidmos and Asala (2003, 2004) to determine sex in South African black and whites and Bidmos and Dayal (2004) applied a discriminant function analysis to the tali of a South African white population, yielding 80% to 82% accuracy for the univariate method, 85%-88% for the stepwise method, and 81% to 86% for the direct method.

The purpose of this study was to see if sexual dimorphism in all seven tarsals among a modern North American documented skeletal collection was statistically viable, and if so, how this might aid the forensic community. In this current study, all seven tarsals from a modern North American population were measured – the calcaneus, talus, navicular, 1st - 3rd cuneiforms, and the cuboid – to determine if there is a clear discrimination between the sexes. These measurements were subjected to univariate and stepwise discriminant function analysis to determine the percentage of accuracy achievable.

Utilizing a selection of 69 adult male and female individuals ranging in age from 18 to 101 from the modern documented skeletal collection housed within the Maxwell Museum at the University of New

Mexico in Albuquerque, NM, this study has found that an accurate sex assessment of 94.24% can be achieved utilizing measurements from all seven tarsals, and that single measurements can predict sex up to 88.41% accurately.

Tarsals, Sex Determination, Osteometric Analysis