Journal of Forensic and Legal Medicine 20 (2013) 471–479

Contents lists available at SciVerse ScienceDirect

Journal of Forensic and Legal Medicine

journal homepage: www.elsevier.com/locate/jflm

Original communication

Estimation of sex from index and ring finger in a North Indian population

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ARTICLE INFO

Article history:
Received 4 April 2012
Received in revised form
18 December 2012
Accepted 2 March 2013
Available online 26 March 2013

Keywords:
Forensic science
Forensic anthropology
Identification
Estimation of sex
Index finger length
Ring finger length
Index and ring finger ratio

ABSTRACT

Estimation of sex is an important parameter in the examination of unknown dismembered and commingled remains. The present study explores the possibility of estimation of sex from length of index and ring finger and the index and ring finger ratio in 140 individuals (70 boys and 70 girls) from North India. Index finger length (IFL) and ring finger length (RFL) of the participants were measured following standard procedures and landmarks. Sex differentiation in the present study was based on sectioning point analysis. The 'sectioning point' for the IFL, RFL and the index and the ring finger ratio was estimated from the average of the mean of male and female values. Binary logistic regression (BLR) analysis was employed to derive a predicting equation for estimation of sex. The results of the present study indicate that significant sex differences exist in the IFL and RFL and index and ring finger ratio. Among finger lengths, RFL is a better predictor of sex than IFL. It is further concluded that the index and ring finger length is of limited utility in estimation of sex in forensic casework and should be employed only in cases when no other means of sexing are available. The study suggests that the index and ring finger ratio should not be employed in estimation of sex in forensic casework due to considerable overlap in male and female values.

1. Introduction

Forensic anthropology involves the identification of unknown skeletal and commingled remains in a legal context. The process of identification focuses mainly on establishing the biological profile by estimating the sex, age, stature, and ancestry.[1] Identification of commingled and dismembered remains has always been a challenge for forensic anthropologists.[2] The need of identification of commingled and dismembered remains arises in cases of mass disasters and in certain cases of homicide where dead bodies are dismembered into parts to conceal the identity of the victim. Establishing the identity of the deceased is of utmost importance for the investigators to establish a crime in cases where the bodies are severely mutilated.

Estimation of sex along with other parameters of identification like stature, age and ancestry[3] is one of the foremost criteria in establishing the biological profile of an individual. Various researchers have conducted studies on estimation of sex from anthropometric measurements of the upper and lower limbs,[4–10] long bones of the extremities,[11–22] small bones of hands and feet[23–25] and from other bones of the body.[26–32] Significance of hand in identification based on its morphometric and skeletal analysis has been reported in the recent past.[33–40] Systematic studies on estimation of sex from different dimensions of the hand have been reported in different populations.[2,10,41–43] Recent studies carried out on the estimation of sex from index and ring finger ratio in adult and sub-adult populations from South India[44–46] observed that statistically significant sex differences exist in the ratio. Similar studies are not reported in any North Indian population groups. Moreover, the sexual dimorphism of the length of index and ring finger has not been explored earlier. In the case of still growing individuals, age is a critical identifying variable. Age of epiphyseal

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1752-928X/$ – see front matter
http://dx.doi.org/10.1016/j.jflm.2013.03.004

Table 1
Age and sex distribution of the study sample.

Age (years)	14	15	16	17	18	Mean (S.D.)
Male ($n = 70$)	09	18	14	19	10	16.04 (1.28)
Female ($n = 70$)	13	24	19	14	00	15.49 (1.02)
Total ($n = 140$)	22	42	33	33	10	15.81 (1.33)

S.D. – standard deviation.

fusion varies in males and females; the epiphyseal union occurring earlier in females than males. Correct prediction of sex in sub-adult populations can narrow down the pool of possible victim matches directly as well as by providing a distinct advantage in estimation of age more precisely based on the predicted sex. In the present study, an attempt is made to establish standards for estimation of sex from index and ring finger length in a sub-adult North Indian population.

2. Material and methods

The present study was conducted on 140 individuals (70 boys and 70 girls) aged between 14 and 18 years. Age and sex distribution of the study participants is shown in Table 1. The sample was taken from Government Senior Secondary School, Naggar and Government High School, Nathan in District Kullu of Himachal Pradesh State in North India (Fig. 1). Rajputs are one of the major populations of North India. All the study participants included in the study were Rajputs – a major endogamous group in North India. Only right handed individuals were included in the study so that the handedness may not affect the standards of the data. It is a well-known fact that the handedness (whether left or right) can significantly affect the dimensions of the dominant side of the body. Previous studies have reported measurable differences in the different measurements of the left and right hands.[33,40] Individuals with any disease or deformity of fingers and hand were not included in the study.

2.1. Finger length measurements and techniques

Two anthropometric measurements, Index finger length (IFL) and ring finger length (RFL) were measured on the study participants using standard procedures and landmarks following Manning et al.[47] The IFL was measured from the mid point of the proximal crease at the base of the index finger to the tip of the index finger while the RFL was measured from the mid point of the proximal crease at the base of the ring finger to the tip of the ring finger. The finger measurements were taken independently on left and right sides of the participants using standard sliding calipers in centimeters to the nearest millimeter. The landmarks for taking measurements on fingers are shown in Fig. 2. Index and ring finger ratio was derived by dividing IFL by RFL in each individual. While collecting the data, the instruments were regularly checked for their accuracy. The finger length measurements were taken by a trained physical anthropologist (NA). Before taking up the present research, finger lengths (IFL, RFL) were measured in 15 participants

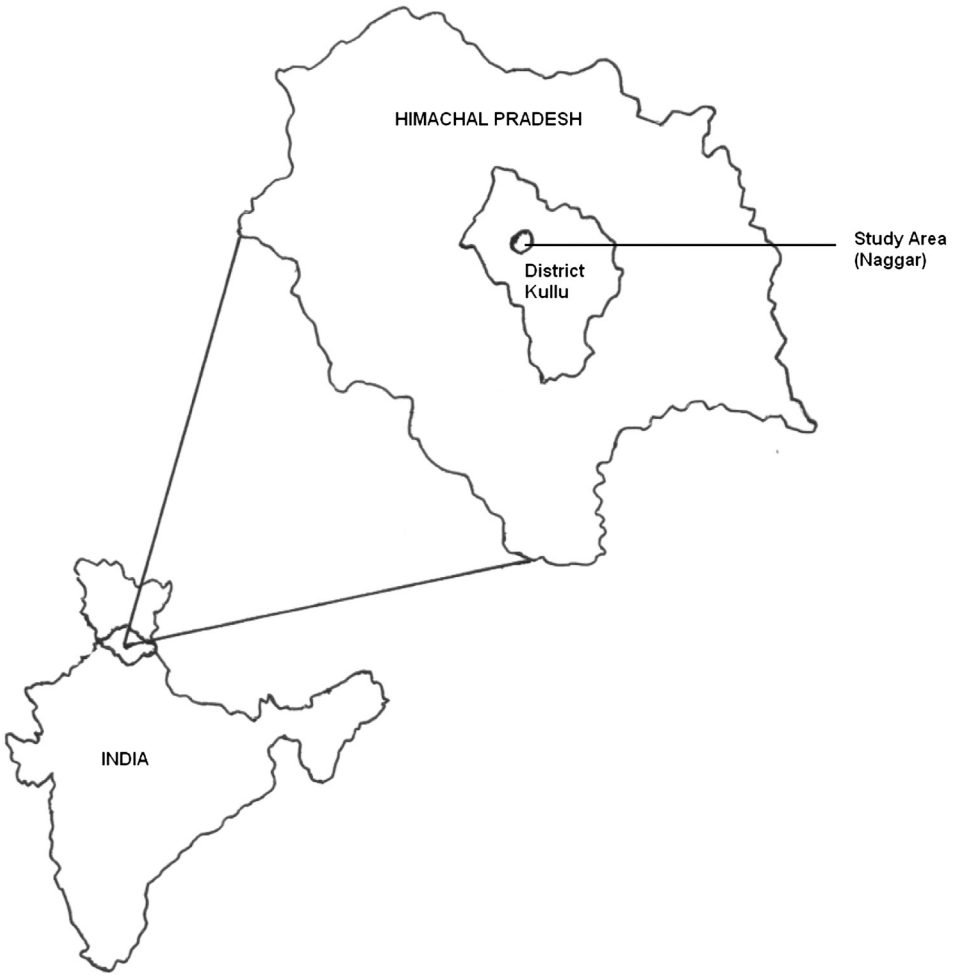

Fig. 1. Map of the study area in India (Not to scale).