

Stature Estimation and Sex Determination : An Evaluation of the Reliability of Phalange : Private Hospital Staff Case, Thailand

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การศึกษาค้นคว้านี้มีวัตถุประสงค์เพื่อระบุเพศและประมาณความสูงของบุคคลจากกระดูกนิ้วมือ ในขั้นตอนการระบุตัวบุคคลจากชิ้นส่วนร่างกายมนุษย์ที่พบบ่อยในกรณีภัยพิบัติและความผิดทางอาชญากรรม เป็นสิ่งสำคัญที่จะต้องระบุการประมาณความสูงและระบุเพศในการศึกษานี้ได้วิจัยกระดูกนิ้วมือ 300 ตัวอย่างจากพนักงานโรงพยาบาลเอกชนแห่งหนึ่งในกรุงเทพมหานคร (ชาย 150 คน และหญิง 150 คน ในช่วงอายุระหว่าง 20-60 ปี) โดยการวัดความยาวของกระดูกนิ้วมือและความกว้างของข้อต่อข้อแรก และนำมาวิเคราะห์ทางสถิติ SPSS ผลการศึกษาแสดงให้เห็นว่ากระดูกนิ้วกลางด้านซ้ายของทั้งเพศหญิงและชาย เป็นนิ้วที่มีความสัมพันธ์กับความสูงของบุคคลมากที่สุด การระบุเพศจากความยาวของกระดูกนิ้วมือมีความแม่นยำมากกว่าจากความกว้างของข้อกระดูกนิ้วมือโดยมีค่าเท่ากับ 75.7% และ 62.3 % ตามลำดับ นิ้วที่ให้ความแม่นยำในการระบุเพศจากความกว้างของข้อกระดูกนิ้วมือคือนิ้วกลางด้านซ้ายในเพศหญิง (58.0 %) และจากความยาวของกระดูกนิ้วมือคือนิ้วหัวแม่มือด้านซ้ายในเพศชาย (79.2%) จากผลการศึกษาแสดงให้เห็นว่ากระดูกนิ้วมือด้านซ้ายมีความแม่นยำมากกว่าด้านขวาเนื่องจากเป็นมือข้างที่ไม่ค่อยถนัดจึงไม่ได้รับผลกระทบจากกิจกรรมการใช้มือในชีวิตประจำวัน ข้อเสนอแนะการศึกษาค้นคว้าต่อไป ให้เก็บตัวอย่างจากกลุ่มตัวอย่างในอาชีพเดียวกันเพื่อเป็นการควบคุมปัจจัยภายนอกมีผลต่อการศึกษ โดยการวิเคราะห์ทางสถิติในการจำแนกนี้อาจช่วยนักนิติมานุษยวิทยาเมื่อกระดูกมนุษย์ส่วนอื่นไม่สามารถนำมาใช้ในการระบุตัวบุคคลได้

คำสำคัญ : กระดูกนิ้วมือ ข้อต่อข้อแรกของกระดูกนิ้วมือ

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Abstract

The objective of this study is to obtain whether forensic identification of the skeletal structure of the hand bone is sufficient in determining the sex of the victim of a mass disaster or criminal case. This study has analyzed the bones of 300 hands (150 males and 150 females, aged between 20-60 years) from the staff of Bumrungrad International Hospital. It shows the middle finger on the right on both sexes is the most useful bone of stature estimation. Sexual determination from phalange's length shows higher prediction accuracy of sex determination than from proximal inter-phalangeal joint width at 75.7% and 62.3% respectively. The most useful of sexual determination from proximal inter-phalangeal joint wide is the middle left in female = 58.0 % and from phalange's length is thumb left in male = 79.2 %. The results show left finger is more useful bone than the right one cause of less impact from regular activity. A suggestion in future study is to collecting the hand bones from people in the same occupation and control the living environment factor, the discriminant functions carried out by statistical analysis may aid the forensic anthropologist when no other human skeletal remains suitable for identification are available.

Keywords : Phalange, Proximal inter-phalangeal joint

Introduction

Many countries throughout the world have recently suffered from disaster and conflagration. Identification of bodies is an important area of forensic science that helps to repatriate victims back to their families. There are many techniques that can be used to identify the body, even though in some cases, only some parts of the body are recovered. (Terrie, 2004) Usually, the material examined consists of largely or completely skeletonized remains, or skeleton evidence that has been removed from fresh remains and bring to the interpretation to assess properly the probabilities involved.

This study aims to determine gender and estimate body structure through the examination of the bones of the hand. Usually these factors are determined from examination of the skull or pelvis; however it is not uncommon for these parts of the skeleton to be missing or broken into fragments. In consideration of this, it will be of great benefit to forensic science if gender can be determined from other parts of remains. In addition, identification by considering bone structure is less time consuming, more financially

economical, less complex and more effective. Although, hand bone gender determination wouldn't conclusively identify the victim it will reduce the number of possible matches by 50% and estimate to nearest stature of victim only but it would be useful in the order to give us a basic information to identify our victim which was found at the crime scene.

Objectives

It's to determine gender from phalanges and find correlation between phalanges's length and structure.

Population and Samples

In this research, the study was directed at samples from staff of Bumrungrad International Hospital because researcher working at this organization which sample group is appreciates to co-operate with this research. Sampling by random from staff who under age between 20-60 years 300 peoples.

Materials

1. Phalanges
2. Vernier Caliper (Absolute Digimatic Caliper Series 500) Made in Japan
3. Gloves
4. Data record instrument

Methods

The object of the research is aim to study about evaluation of the reliability of hand bones. This is a descriptive and inferential statistic in order to determination gender and estimation stature of victims by measure the length of phalange and width of proximal inter-metacarpal phalangeal joint. Since we had reviewed the literature from Mania University as they measured the length of phalange from the top of finger to the third of foldable joint but if we review the anatomy theory carefully the phalange bone will appear all the way through metacarpo-phalangeal joint isn't the third of foldable joint instead. So this experiment we had measured from the top of finger to metacarpo-phalangeal joint from alive people in the order to record length of phalanges and for sexual determination, we

had measured the proximal inter-phalangeal joint's width by using vernier caliper (Absolute Digimatic Caliper Series 500) Made in Japan from 300 staffs of Private Hospital on August 2012 on both issue.

Methodology

A. Estimation bodies' structure

Independent Variable : Each sample's length.

Dependent variable : Each phalange's stature.

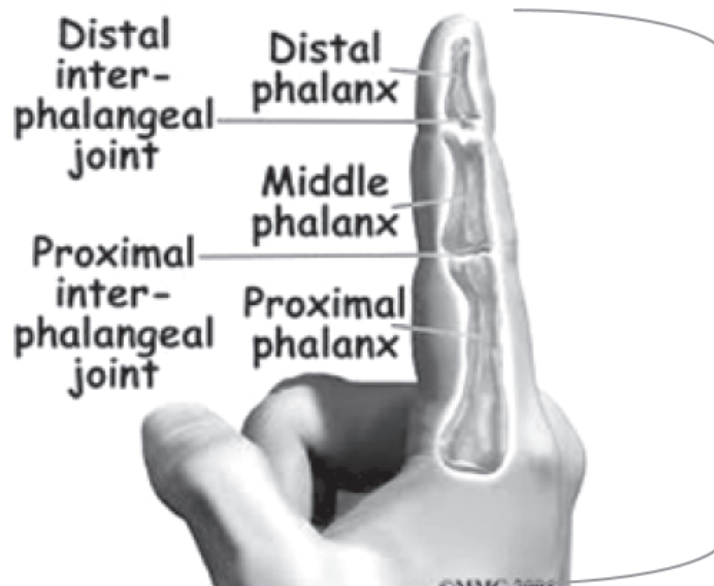


Figure 1. Measurement of each phalange's length

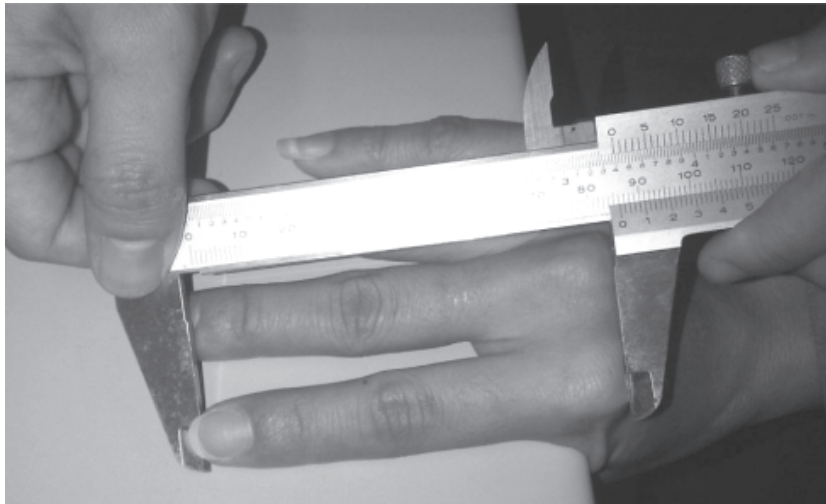


Figure 2. Measurement of phalanges' length.

B. Determination gender from hand bond (proximal inter-phalangeal joint)

Independent Variable : Each 1st metacarpal phalangeal joint wide.

Dependent variable : Sex.



Figure 3. Measurement of each 1st metacarpal phalangeal joint's width

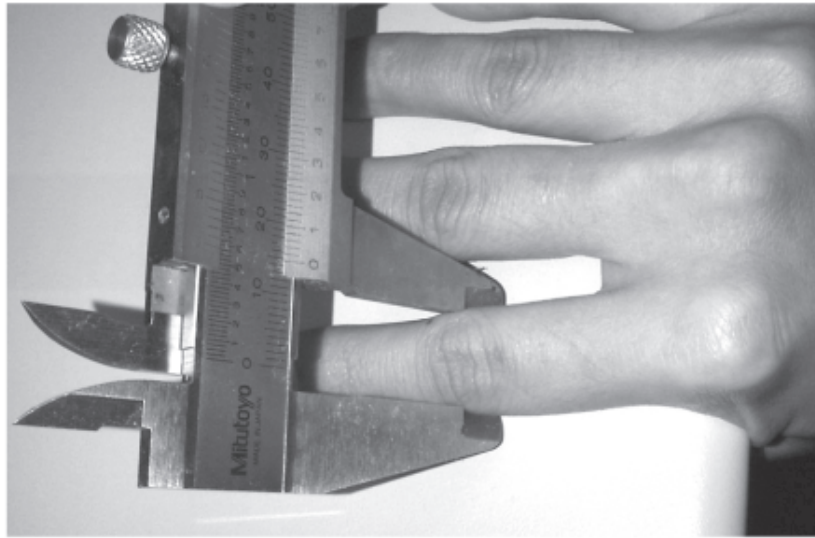


Figure 4. Measurement of 1st metacarpal phalangeal joint's width.

Collecting data

1. Record the gender and stature of each sample's owner
2. Measure wide from proximal inter-phalangeal joint and phalanges's length in millimeter unit following :
3. Statistical analysis : One sample test, Paired t-test, Independent Samples t-test and Discriminant.
4. Connectionism process by using spss
5. Blind test

Statistical analysis

Using Statistical package for the social science following : The descriptive statistics such as Percentage, Minimum, Maximum, Mean, Standard deviation, correlation and inferential statistics such as linear regression analysis and case wise.

Results

The result of stature estimation shows the length of middle left finger is the most useful bone in the order to estimate stature which the mean on male show longer length than female. The measurement in female show the middle, ring and little are statistically significant bilateral difference and all male's phalanges's length and thumb, index in female aren't statistically significant bilateral difference. The correction of this study shows 80% by blind test. In the meantime sexual determination indicated that phalange's length is more useful bone than proximal inter-phalangeal joint's width in the order of sexual determination with classification accuracy = 52.0%-79.2% and 50.7%-58.7%, respectively.

Determine sex from proximal inter-phalangeal joint width is 62.3% and the most useful bone is thumb left in female and little left in male with 45% correction by blind test and from phalange's length is thumb left on both sexes with 60% correction by blind test.

Discussion

From the result above, the most useful bone for this study is mostly from left side because the general people using the right hand for activity. So the left hand bone is less impact than right hand. Moreover sexual determination from proximal inter-phalangeal joint width is only 45% correction reason of our female sample is a nurse but male sample is back officer service which they have a different activity. Nurse(s) who always doing more tough activity than back office staff.

We also found the proximal inter-phalangeal joint's widths on both sexes almost are statistically significant bilateral difference except in thumb of male only. On the other hand, phalange's length show the statistically significant bilateral difference in middle and little (female) and middle, ring and little (male) and the rest of phalanges aren't statistically significant bilateral difference.

Sexual dimorphisms from each phalange's length are statistically significant and from proximal inter-phalangeal joint's width, there are only 4 phalanges are statistically significant following : middle left, ring left, little left and little right. Sexual prediction is more reliable in case of Thai males than in females.

As per blind test of 10 samples above, the stature of victim could be estimate from phalanges length of 8 samples and the most useful bone is L2, L3, L4, L5, R2 and R3 = 80%, 70% = R4 and 60% = L1, R5 respectively.

The result of sexual determination from blind test is also support to the result above which the phalange's length is more accuracy than proximal inter-phalangeal joint's width.

Our finding are consists to Sotiris et al. (2013) who found that metacarpals are useful bone for sexing skeleton in Greek population with high classification accuracy at 83-89% and also recommended that generally, on comparing can be drawn that asymmetry in the lower limbs would be less pronounced than in limbs because legs are used for locomotion but arms, especially hands, may be used for variety of activity.

The published Stature estimation from hand and phalanges length of Egyptians of Sahar and N.N. Nashwa (2010) shows that hand and phalange length are highly reliable for the estimation of stature in forensic examination. The regression equations can be derived from hand and phalange length and indicated that the stature can be estimated from them with SEE ranging from +4.54 to +7.27 cm for both sexes.

Recommendation

The aim of this study was to present phalange length and proximal inter-phalangeal joint's width produce acceptable result for stature estimation and sexual determination. The results may be used for the identification from forensic context.

Future study should be collecting the hand bones information from people in the same occupation and control the living environment factor and may try to determine gender from another joint of phalange, the discriminant functions carried out by statistical analysis may aid the forensic anthropologist when no other human skeletal remains suitable for identification are available.

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