

Determination of Sex on the Basis of Skeletal Evidence

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Abstract:

This paper discusses the importance of forensic anthropology, which is used as an important tool for the purpose of identification. The significance of present criminological anthropological studies cannot be overemphasized. In criminal cases, mass disaster cases, fire accidents, plane crash accidents, exhumation, bomb blast, and explosion cases the skeletal remains collected by anthropologists are highly deteriorated and fragmented, requiring various methods and techniques to interpret the evidence. Teeth and bones discovered from these events are resistant to degradation processes which act as crucial evidence and serve as a significant tool used for forensic identification hence, forensic anthropology applied for the purpose of identification of skeleton and distinguish other skeletal evidence. Whenever the skeletal evidence is found initially anthropologists determine whether the obtained material is bone or not as the piece of a bone is covered with dust or mixed with alike substances, after assuring that the evidence discovered is bone next they determine that it from human origin or not. Anthropologists generally arranged the pieces of bones in "Anatomical position". It gives visual information by which the experts can differentiate that the skeletal remains belong to the human origin or animal origin, in addition to that investigators also face some serious issue when several individuals are present at such incidents like mass disaster investigators examines the skeletons separately. After this next step is to determine the age of bones, anthropologists elaborate on the difference between ancient and modern skeleton by examining the extra deposited layer. Biological profiles: age, sex, stature, and ancestry. Skeletal sex should be determined by two methods of forensic anthropology: morphological method or metric method. Morphological methods are based on the concept of sexual dimorphism.

Key Words: Sexual Dimorphism, Anatomical Position, Stature, Forensic Anthropology, Skeletal Remains.

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Introduction

Identification can be defined as to determine the individuality of a person on the basis of physical or biological traits e.g., sex, age, stature, tattoos, scars, dental estimation, and DNA typing. Identification can be categorized as complete and partial identity (Bardale, 47). Sasouni in 1963 proposed the following techniques for human identification which falls into two groups: Reconstructive group- These systems, utilized on bodies where there is nothing to propose the individual identity, are not concerned with extracted height, race, age, sex, occupation, etc., used for identification. Comparative Group- This method comprises of strategies under which antemortem records and post-mortem records are compared to make proper identification, and it also incorporates radiology (Srivastava et al., 153). Forensic anthropology is a new scientific area that comes under practice is a blended mixture of forensic medicine and physical anthropology. In general terms, this discipline is defined as the utilization of physical human anthropology strategy and systems under the medico-legal system. Even though significant advances have been made in past years in the field of forensic anthropology, various difficulties are still faced by the professionals (Bidmos, Gibbon, Strkalj, 1). Forensic anthropology comes in practice from the late nineteenth century, and known as Alphonse Bertillon’s anthropometric system which is based on principles- After 21years of age the size of the body parts remains the same and the ratio in size among individuals is unique. From a forensic perspective, it is critical to decide the sex of the skeleton stays as right on time as soon as possible under the circumstances (Bardale, 75-76). According to the Krogman, estimation of sex on the basis of skeletal remains is as follows-

- Whole Skeleton – 100%
- Pelvis – 95%
- Skull – 90%
- Pelvis along with the skull – 98%
- Long Bones – 80%

At the point when skeletal remains are discovered, it is important to recreate a natural profile to comprehend the demographics of the population and the individuals this incorporates evaluating age, sex, parentage, and stature and the anthropologists face various challenges at this point. Methods used for skeletal sex diagnosis, forensic anthropologists should have their focus on the accuracy and reliability of the method used for the determination of skeletal sex. Rate of high accuracy may have low reliability. Pelvic bone of the skeleton

is only considered portion which has stable sexual dimorphism so that, results of sex determination have positive results with low possible errors. Every single morphological technique utilized for sex determination depends on the presence of sexual dimorphism in the skeleton. Sexual dimorphism is brought about by the presence of various sex chromosomes and with the growth of males and females. Consequently, it is unimaginable to expect to decide the sex of non-adult people with fundamental accuracy and unwavering quality as during ontogeny the degree of sexual dimorphism in the skeleton is low. Another factor is the constant inconstancy in the improvement of sex characteristics that appear differently in relation to the elective nature of the two sex classifications (Bruzek and Veleminsky, 46).

Table No. 1: Diagnostic Difference between Male and Female Skeleton

S. No.	Traits	Male	Female
1.	General Size	Massive and larger	Slender and shorter
2.	Weight	4.5 kg	2.7 kg
3.	Longer Bones	Longer up to 8%	Less prominent
4.	Shorter Bones	Broad	Narrow
5.	Intramuscular Surface	Larger	Smaller
6.	Shafts	Rough	Smooth

The sex determined by the skull is based on the following traits like the appearance of the male skull is larger with a capacity of 1500 to 1550 ml, the forehead is less rounded, glabella is rough and more prominent, orbits are square in shape with rounded margins and the area present above orbits is more prominent, cheekbones are heavier, a nasal aperture is high with sharp margins, the palate is larger with deep grooves and large teeth. On the other hand, females have a smaller and lighter skull with a capacity of 1350 to 1400 ml, the forehead is vertical and round, glabella is absent and if present then it is smooth, orbits are round in shape with sharp margins and the area present above is less prominent or absent, cheekbones are compressed and lighter, a nasal aperture is lower with broad margins, the palate of a female is smaller or parabolic with not so deep grooves and small teeth.

Pelvis plays an important role to differentiate male and female skeleton having various characters that were useful for the purpose of sex determination. Male pelvis is massive and rough with a deep funnel shape, ilium is more prominent and less vertical, diameter of acetabulum is 52mm. and it directs laterally, obturator foramen is large with oval base, greater sciatic notch is narrow and deep, body of pubis is thick with a triangular shape, subpubic angle is V-shaped, pelvic inlet is heart shaped, pelvic cavity is conical and funnel shaped, pelvic outlet is small, sacrum is more prominent and well-marked, coccyx is less movable, Ischiopubic index- 73 to 94, Sciatic notch- 4 to 5, pubic ramus ratio- 1:1 and sacral index-112. In contrast to this female pelvis less massive with flat bowl shape, ilium is more vertical and curves of crest are well marked, acetabulum is narrow with 46mm., obturator foramen is small with triangular apex, greater sciatic notch is larger and shallow, body of pubis is thick with triangular shape, sub pubic angle is U-shaped, pelvic inlet is elliptical, pelvic cavity is broad and round shaped, pelvic outlet is large, sacrum is less prominent and less marked, coccyx is highly movable, Ischiopubic index- 91 to 115, Sciatic notch- 5 to 6, pubic ramus ratio- 2:1 or greater and sacral index-116.

Long bones also have some marked characters which were utilized to determine sex from the skeletal remains as follows:

- **Femur** – Male femur has a larger head with 47 mm. diameter, neck forms an obtuse angle, bicondylar width is 74-89 mm. Female femur has a smaller head with 45 mm. diameter, neck forms less obtuse angle with the shaft, bicondylar width is 67-76mm.
- **Humerus** – Diameter of a head of the male humerus is 47 mm. and the diameter of a head of female is 43mm.
- **Radius** – Diameter of a head of male radius bone is 24 mm. and diameter of a head of female radius bone is 21 mm (**Reddy and Murty, 59-62**).

Review of Literature

Bruzek and Veleminsky (2008) studied discriminated capacities are appropriate for deciding the sex of early medieval skeletons from the Great Moravian locale just (without the impacts of roaming Asian people groups). They are intended for a speedy, starter assurance of sex of skull in the fieldwork and are an accessible strategy without the pelvic bone. The precision of sex assurance is around 80%.

Bidmos, Gibbon, and Strkalj (2010) reviewed those strategies for sex estimation from human skeletal stays in South Africa inside the criminological setting. Sex is one of the key factors in getting a biological profile of the individual or population whose remaining parts are examined. Sex estimation dependent on the morphological attributes of skeletal components is population explicit and along these lines, the foundation of territorial criteria is one of the objectives for current forensic anthropology. A writing survey was done wherein the accessible techniques for sex distinguishing proof (morphological, metrical, geometric morphometrics, and molecular) from South African skeletal material were basically inspected. The ways to deal with sex estimation dependent on bone morphology have a long and gainful history in South Africa. Various methodologies giving precise outcomes on the nearby population have been created. Research in molecular determination strategies is still in its earliest stages in South Africa and the first inventive investigations showed up just in quite a while. While every one of the four techniques dissected is limited by various imperatives, they appear to supplement one another and give the best outcomes when applied related to one another.

Kumar, Ali, and Wadhvani (2014) conducted a study to determine various methods to determine age, sex, and identification of a perished individual by skeletal bones and by teeth were examined. Stature in throughout everyday life, reason for death, and Individual Skeletal Characteristics were likewise dissected by different methods for scientific methodology. Sex determination by utilizing bone as ahead of schedule as conceivable is significant from the legal perspective. The determination of sex by utilizing the skull relies on attributes and estimations. The appraisal of sex by long bones is simpler on the grounds that the male long bones will, in general, be longer and huger than those of the female, with progressively checked muscle connections. Teeth are especially helpful in deciding sexual orientation by utilizing distinctive odontometric techniques. In life, the reason for death and Individual Skeletal Characteristics was additionally examined by different methods for legal methodology. Sex determination by utilizing bone as right on time as conceivable is significant from the measurable perspective. The assurance of sex by utilizing the skull relies on characteristics and estimations. The appraisal of sex by long bones is simpler on the grounds that the male long bones will, in general, be longer and more enormous than those of the female, with increasingly stamped

muscle connections. Teeth are especially valuable in deciding sexual orientation by utilizing diverse odontometric methods.

Sierp and Henneberg (2015) studied the determination of sex from skeletal remains is performed utilizing various techniques created by biological anthropology humans. They should be assessed for consistency and their presentation in a legal setting. Twenty skeletons of fluctuated provenance had their sex controlled by 15 existing strategies for criminological human sciences (7 measurements and 8 morphological). The techniques were assessed for their consistency in the assurance of sex. No single individual was recognized as having a place with one sex solely. Equivocal outcomes were gotten by metric techniques for fourteen people (70%) and by morphological strategies for just five people). Techniques which utilize the size of bones as a pointer of sex perform ineffectively on skeletal survive from people of obscure provenance. Strategies which consolidate morphologic and metric methods, that is, geometric morphometric examination, may bring about more prominent degrees of consistency.

Discussion

In this study, I have discussed that the determination of skeletal sex can be established by examining the morphological features of the skeleton, morphological method depends on the features developed by convergence between genetically driven sex-associated pattern of development and growth. According to **Bruzuk and Veleminsky** Discriminant

Function Analysis (DFA) is a technique that is highly reliable and accurate tool used for sex determination. This method consists of primary and secondary sex determination method performed in three stages and was successfully tested on the population, skeletal sexual dimorphism is highly influenced by body mass, body size, large joints and muscular structure of male compared with female.

Conclusion

Forensic anthropology is a powerful tool for the purpose of identification, morphological, and metric methods are generally used to determine the skeletal sex. For philanthropic reasons and criminal examination, the identification of obscure expired people is significant. At the point when an assortment of bones is found, the principal thing to find out is whether any of the bones are human or of lower creatures. This isn't simple for a lay-person to recognize. The assessment of human sex from skeletal remains has specific Importance in Forensic Osteology and it depends intensely on the forward-thinking procedures so as to give precise data to medico-legal framework. Sex estimation from skeletal remains is vital in the recognition of human remains, as it parts the quantity of potential matches. Distinguishing obscure people is a key piece of forensic anthropology. Anthropologists aid distinguishing pieces of proof basically by building a biological profile. This incorporates evaluating age, sex, stature, and ancestry, just as distinguishing specific attributes, similar to diseases or wounds.

 References:

- Bardale, Rajesh. *Principles of Forensic Medicine and Toxicology*. Jaypee Brothers Medical Pub., 2016.
- Bhosale, Rajeshwari S. "Sex Determination from Femur Using Length of Femur in Maharashtra." *IOSR Journal of Dental and Medical Sciences*, vol. 3, no. 4, 2013, pp. 1–3., doi:10.9790/0853-0340103.
- Bidmos, Mubarak A., et al. "Recent Advances in Sex Identification of Human Skeletal Remains in South Africa." *South African Journal of Science*, vol. 106, no. 11/12, 2010, doi:10.4102/sajs.v106i11/12.238.
- Kumar, Anand, et al. "Determination of Age and Sex and Identification of Deceased Person by Forensic Procedures." *Universal Research Journal of Dentistry*, vol. 4, no. 3, 2014, p. 153. doi:10.4103/2249-9725.140674.
- Reddy, K.S Narayan. Murty O. P. "*Essentials of Forensic Medicine and Toxicology*". Jaypee Brothers Medical Publication, 2017.Print.
- Sierp, Ingrid, and Maciej Henneberg. "The Difficulty of Sexing Skeletons from Unknown Populations." *Journal of Anthropology*, vol. 2015, 2015, pp. 1–13., doi:10.1155/2015/908535.
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