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The Study of Sexual Dimoprphism of Human Hip Bone by Using Washburn Ischiopubic Index in Gujarat State

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ABSTRACT

Determination of identity of an individual from skeletal remains may assume great importance in some cases in the field of forensic medicine. The aim of the present study is to find out importance and accuracy of Washburn ischiopubic index as a sex indicator. Material for the study consists of 98 hip bones from individuals of known sex and length of ischium and length of pubis were measured with the help of vernier caliper and applied for Washburn Ischio pubic index (=length of pubis×100/length of ischium). Following parameters were calculated: Range, mean, S.D., Mean ±3 S.D., Demarking point and Percentage beyond demarking point The method used by present study was demarking point method. The student "t" test was applied to the parameters and 'p' value was calculated and findings were compared with the study of 1,2 and 3.

KEYWORDS : Ischio-pubic index, Sex determination of hip bone

INTRODUCTION: The nature and degree of sexual differentiation in the pelvis has long been of interest to anatomists and anthropologists and forensic medicine. It is of practical importance to obstetricians also.

REVIEW OF LITERATURE: Sexual differentiations from bones have drawn the attention of many research workers & results are highly encouraging specially when the whole skeleton is available 2.The sexual differences of the ischiopubic proportion reflect the adaptation of the female pelvis to parturition, and result in the remodeling of the female bone pelvis during puberty6.

Here an attempt has been made to measure the Washburn ischiopubic index of hip bones in anatomy department as the present institute has huge collection of hip bones. The present study was undertaken to determine the reliability as an indicator.

Washburn ischiopubic index and sexual dimorphism of hip bone:Washburn has devised an ischio-pubis index which will accurately sex, according to him, over 90% of skeletons. 3.The medico legal expert also uses the ischium-pubis index, which reveals the sex of an adult pelvis in more than 90% of instances; that is because the pubic bone is relatively and absolutely longer in the female and the ischium relatively and absolutely longer in the male. The index is less than 90 in adult males and more than 90 in adult females 4.

D.P. of ischiopubic index is the best criteria for discriminating sexual dimorphism in hip bones:(83%-90% in females and 15%-35% in males) 5. With the application of Washburn ischiopubic index sexual identity with an accuracy of 99.75% was achieved utilizing 'demarking point' method 2. Washburn found that using both the index and the notch, "the sex of over 98 percent of the skeleton could be determined" from the width of the sciatic notch in Bantu and Bushman 7.

MATERIAL AND METHODS:
Material for the study consisted of 98 hip bones (82 male hip bones and 16 female hip bones, 48 of right side and 50 of left side) from individuals of known sex. The bones studied were free of any congenital or pathological anomaly. Following materials were included in the present study 1. Vernier caliper 2. Computer and statistical aids

Following two parameters were used for measurement and data were entered into proforma and statistical analysis was carried out.1.Length of pubis: it measures the straight distance between the midpoint of acetabulum and upper margin of symphysis.2.Length of ischium: it measures the straight distance from the mid point of acetabulum to the deepest point of the ischial tuberosity.

Then these measurements were applied for Washburn ischiopubic index:

Washburn Ischio pubic index =length of pubis×100/ length of ischium.
The data obtained for all these parameters were analyzed statistically to find range, mean and standard deviation (S.D.) in both the sexes. The student't' test was applied to know whether these differences of means between two sexes were statistically significant or not. These parameters were then subjected to "demarking points" (DPs) analysis. The observations of either side of bones were tabulated and interpreted for discussion in details.

OBSERVATIONS: Washburn ischiopubic index of each index of each individual bone has been calculated and included in the data.By statistical formula mean of pubic and ischial length has been calculated.

Mean of the male pubic length is 73.90 mm in right side and 75 mm in left side.Mean of the male ischial length is 77.07 mm in right side and 75.22 mm in left side.The mean ischiopubic index of male is 96.04 in right side and 99.99 in left side. Mean of the female pubic length is 76.71 mm in right side and 78 mm in left side.Mean of the female ischial length is 72.86 mm in right side and 71.67 mm in left side.The mean ischiopubic index of female is 104.28 in right side and 110.44 in left side.

Mean pubic length is slightly larger in female as compared to male. Mean ischial length is slightly lesser in females as compared to male. Mean ischiopubic index is larger in female as compared to male.

DISCUSSION:For statistical study and comparison, male and female Washburn ischiopubic index has been tabulated in Table 3(data of right side hip bones) and Table 4(data of left side hip bones) has been processed statistically in which range, mean, standard deviation, demarking point and percentage beyond demarking point have been studied.

OVERLAPPING RANGE:In tables and graphs of present study, there is not an exact demarking point, by which we can say either it is male or

female hip bone. So there is a one range in which we find both male and female hip bones.

In present study Table V shows 92.11-110.70 is common range for both male and female. This range covers (35/48) 72.92% observations on right side. Table VI shows 100-119.40 is common range for both male and female. This range covers (32/50) 64% observations on left side. Therefore it is possible to differentiate sex of hip bones in 27.08% on right side and 36% on left side.

DEMARKING POINT METHOD: The present study for this method included a calculated range by statistically using mean±3SD 8. Because this range covers maximum sample size (99.75%) and give more accuracy to the result. Such limiting points were called "Demarking points" (D.P.s) by 9.

The D.P.s of various parameters if crossed by any hip bone will identify the sex with certainty, which is of paramount importance in medico legal cases. However, it is not necessary that all the parameters of a bone should cross the D.P.s before sex can be assigned. Even if a single parameter crosses the D.P. it would identify the sex of unknown bone with 100% accuracy.

Table 1 shows two ranges 72.37-110.70 and 92.11-119.10 for male and female respectively on right side. Table 2 shows two ranges 77.91-119.40 and 100-130.77 for male and female respectively. In table 1 maximum value of male index is 122.47 and minimum value of female index is 77.67 after mean± 3 S.D. . These two points are accepted as demarking points.

TABLE-1 BISEXUAL DIMORPHISM OF WASHBURN ISCHIOPUBIC INDEX OF RIGHT HIP BONES

	Male (n=41)	Female (n=7)
Range	72.37-110.70	92.11-119.10
Mean	96.04	104.28
S.D.	8.81	8.87
Mean ±3 S.D.	69.61-122.47	77.67-130.89
Demarking point	<77.67	>122.47
Percentage beyond demarking point	16.4%(4)	-
't' value: M=69.82 F=31.12 'p' value<0.001(male VS female)		

So, there is not a single observation, which is <77.67in female range. That means all observations <77.67 are definitely male on right side hip bones. Same way there is not a single observation which is >122.47 in male that means all observation >122.47 are definitely female on right side hip bones. In present study percentage beyond demarking point methods are 16.4%and 0% in male and female respectively on right side hip bones.

In table 2 maximum value of male index is 128.85 and minimum value of female index is 78.73 after mean± 3 S.D.. These two points are accepted as demarking points. So, there is not a single observation, which is <78.73 in female range. That means all observations <78.73 are definitely male on left side hip bones. Same way there is not a single observation which is >128.85 in male that means all observation >128.85 are definitely female on left side hip bones.

TABLE-2 BISEXUAL DIMORPHISM OF WASHBURN ISCHIOPUBIC INDEX OF LEFT HIP BONES

	Male (n=41)	Female (n=9)
Range	77.91-119.40	100-130.77
Mean	99.99	110.44
S.D.	9.62	10.57
Mean ±3 S.D.	71.13-128.85	78.73-142.15
Demarking point	<78.73	>128.85
Percentage beyond demarking point	4.88%(2)	11.11%(1)
't' value: M= 66.57 F= 31.34 'p' value <0.001(male VS female)		

Table 2 shows percentage beyond demarking point method are 4.88% and 11.11% both in male and female on left side hip bones.

COMPARISON: Observations of present study are compared with observations by Jani et al (2003), Sharma et al (1999), and Singh et al (1977)

TABLE-3 COMPARISION OF ISCHIOPUBIC INDEX OF RIGHT SIDE HIP BONES

	Male				Female			
	Present study (n=41)	Jani et al (n=35)	Sharma et al (n=60)	Singh et al (n=60)	Present study (n=7)	Jani et al (n=18)	Sharma et al (n=40)	Singh et al (n=40)
Range	72.37-110.70	75.64-97.56	60.66-98.71	79.26-91.35	92.11-119.10	89.61-111.66	83.33-111.76	92.75-122.97
Mean	96.04	86.70	78.58	87.31	104.28	96.68	96.60	105.68
S.D.	8.81	4.51	5.84	3.17	8.87	5.23	6.56	6.12
Mean±3S.D.	69.61-122.47	73.17-100.23	61.06-96.10	77.8-96.82	77.67-130.89	80.99-112.37	77.02-116.18	87.32-124.04
Demarking point	<77.67	<80.99	<77.02	<96.32	>122.47	>100.23	>96.10	>86.82
Percentage beyond demarking point	16.4%(4)	8.57% (3)	53.33% (32)	35.00%	-	16.66% (3)	57.50 (23)	90.00%

TABLE-4 COMPARISION OF ISCHIOPUBIC INDEX OF LEFT SIDE HIP BONES

	Male				Female			
	Present study (n=41)	Jani et al (n=35)	Sharma et al (n=60)	Singh et al (n=60)	Present study (n=9)	Jani et al (n=18)	Sharma et al (n=40)	Singh et al (n=40)
Range	77.91-119.40	78.37-97.50	67.44-96.20	81.48-91.66	100- 130.77	87.17-106.25	85.52-111.76	92.00-118.66
Mean	99.99	87.37	78.99	87.07	110.44	97.05	96.92	104.58
S.D.	9.62	5.29	6.34	3.7	10.57	4.79	6.48	7.27
Mean±3S.D.	71.13-128.85	71.50-103.24	59.97-98.01	75.97-98.17	78.73-142.15	82.68-111.42	77.48-116.76	82.86-125.81
Demarking point	<78.73	<82.68	<77.48	<82.86	>128.85	>103.24	>98.01	>98.17
Percentage beyond demarking point	4.88% (2)	22.85% (8)	53.33% (32)	15.00%	11.11% (1)	5.55% (1)	40% (16)	82.50%

In present study, ischiopubic index of right side hip bones of male shows the 16.4 % beyond demarking point which is higher as compared to study of Jani et al and lower as compared to studies of Sharma et al and Singh et al . Right side hip bones of female does not show any value beyond demarking point.

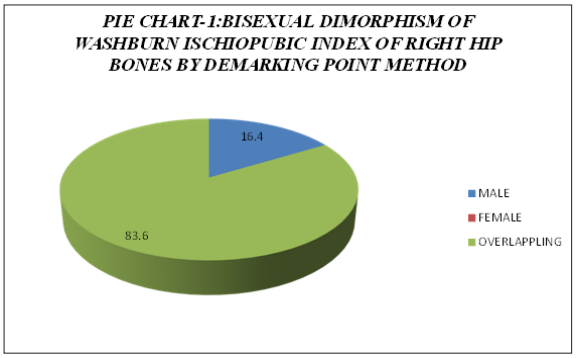
In present study, ischiopubic index of left side hip bones of male shows 4.88 %(2) beyond demarking point which is lower as compared to other studies.Left side hip bones of female shows the 11.11%(1)beyond demarking point which is higher as compared to study of jani et al and lower as compared to studies of Sharma et al and Singh et al.

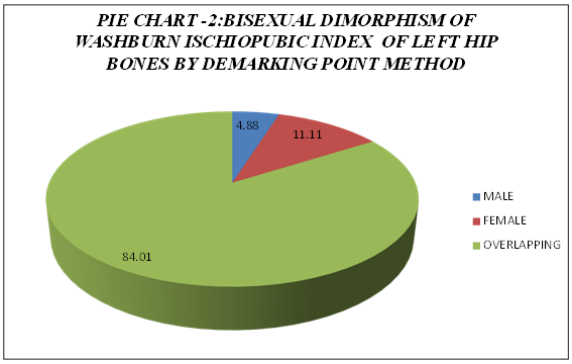
Right side of hip bones shows the t' value: M= 69.82 , F=31.12 and 'p' value<0.001(male VS female).Left side of the hip bones shows the 't' value: M=66.57, F=31.34 and 'p' value <0.001(male VS female). 't' and 'p' value also show it very significant, indicating high reliability of this technique.

The present study for sexing hip bones has revealed that D.P. of ischio-

pubic index is the best criteria for discriminating sexual dimorphism in hip bones. Though the D.Ps. evolved by Jit and Singh (1966) do not provide a miracle of identification of sex in 100% of cases but do so with 100% accuracy in whatever number it is identified. These D.Ps. are much more simpler to apply than the more recent multivariate discriminant functional techniques and identify sex with equal certainty 5.

CONCLUSION: Based on the findings of present study we can conclude following points about the efficacy of parameters. it can be concluded that in the Gujarat population, 1. Ischiopubic index <77.67 are clear cut male whereas index >122.47 are clear cut female in right side hip bones. 2. Ischiopubic index <78.73 are clear cut male whereas index >128.85 are clear cut female in left side hip bones. 3. Thus Washburn ischiopubic index identified 7.32% of male hip bones and 6.25% of female hip bones.





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