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Research Article

**DETERMINATION OF SUBPUBIC ANGLE IN SAUDI
POPULATION**Bayan Al-Ghadeer¹, Zahra Alsubaie¹, Shaikha Alsaeed¹, Omya Zedan²¹College of Medicine, King Faisal University, Saudi Arabia, ²Department of anatomy, College of Medicine, King Faisal University, Saudi Arabia**Abstract:**

Background: Sex determination of unknown skeletal material is one of the most vital determinations made by forensic anthropologists. The pelvis is probably the most accurate bone from which sex is determined. In that context, the subpubic angle showed correct gender identification in over 98% of cases. The subpubic angle was wider in females than in males. Moreover, it has been ascertained that significant differences exist between populations in subpubic angle measurements. Also, it was found that the subpubic angle is affected by ethnicity. So, the aim of this work was to quantify the subpubic angle in Saudi males and females to establish national parameters and also to determine whether any statistically significant differences exist between males and females and other population groups.

Material and method: The subpubic angle was measured in the antero-posterior radiographs of 33 adult Saudis male and female. The data was analyzed using SPSS version 16 for statistical analysis.

Result: The subpubic angle for males ranged from 69° to 117° with a mean \pm SD [91.10 \pm 13.88] and for females from 114° to 155° with a mean \pm SD [132.29 \pm 13.44]. The angles were significantly wider in female than males [P<0.05]. Furthermore, the results for both sexes were statistically significant in comparison to previous established results for other population groups.

Conclusion: The subpubic angle of Saudi population can be considered as an obtuse angle in females but overlaps between acute and obtuse in males. It also shows regional variations and hence, reinforces the need for population specific parameters which are useful to obstetricians, anthropologists and forensic specialties.

Keywords: Subpubic angle, Saudi population, sex-determination, radiology, forensic medicine.

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INTRODUCTION:

The subpubic angle is the angle that exists between the inferior rami and below the pubic symphysis in an articulated bony pelvis. It is also referred to as pubic arch [Moore and Dalley, 1999]. It has been observed that the size of the subpubic angles determines the size of birth canal, which is an important criterion in vaginal delivery [1].

Sex determination of unknown skeletal material is one of the most vital determinations. It is widely recognized that skeletal characteristics vary among populations made by forensic anthropologists [2] thus, each population should have specific standards to optimize the accuracy of identification [3]. It was found that the pelvis is one of the most critical structure in term of sex determination [4]. In that context, the subpubic angle, the sciatic notch, the preauricular sulcus, the auricular area and many other pelvic structures were reported to exhibit sex-dependent morphological differences [5-7]. Moreover, the subpubic angle showed correct gender identification in over 98% of cases [4].

Recently, the subpubic angle was quantified in various African populations using radiographs [8-10]. The authors found that the subpubic angle was wider in females than in males, and ascertained that significant differences existed between the population groups. Moreover, Previous report by Oladipo et al. [2009] showed that subpubic angle is affected by ethnicity hence the need for data for each ethnic group [8].

Many reports on subpubic angle were found in relation to different population as in the Egyptian,

[11] Indigenous Malawian population [12] Nigerian [13] and Ugandan [5]. But further research is needed to develop population specific osteological standards for Africa central, south East Asia and Pacific region populations.

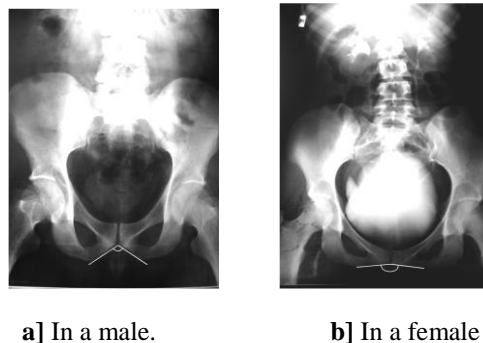
So, the aim of this work was to quantify the subpubic angle of both male and female of Saudi Arabia to establish national parameters and also to determine whether any statistically significant differences exist between males and females, and other population groups.

THE MATERIALS AND METHODS:

The study investigated 33 antero-posterior radiographs of the pelvis comprising 19 males and 14 females aged above 18 from Poly clinic at King Faisal University. The radiographs were chosen showed no underlying bone disease or fracture which may affect the intact pelvic bones. Furthermore, only radiographs with complete alignment at the inferior margins of the pubic bones at the pubic symphysis were measured because determination of misalignment is best made at the inferior margins [Lusted and Keats, 1978].

Each radiograph was placed on x-ray film viewer, and the subpubic angle was that formed by the inferior border of the two pubic bones joining the symphysis pubis. A point was chosen at the inferior midline of the interpubic disc and two tangential lines were drawn at the inferior borders of the pubic rami intersecting at an angle at the chosen point. Protractor was placed over the intersection of these two lines, and the inferior angle was measured [Fig.1].

Fig. [1]: Anteroposterior radiograph of pelvis demonstrates the subpubic angle



STATISTICAL ANALYSIS:

The results were analyzed with SPSS version 16. Independent T-test was used to compare subpubic angle mean among males and females with 95% confidence interval. Also, we compared this research's result with previous studies in different subjects [Ugandans, Malawians, black Americans, white Americans, Amerindians and Egyptians].

RESULT:

Table [1] shows the range, mean and standard deviation of subpubic angle measurements in the studied Saudi sample. The range of subpubic angle measurements in Saudi males was found to be [69° to 117°] and [114° to 155°] regarding Saudi females with mean \pm SD [91.10 \pm 13.88°] and [132.29 \pm 13.44°] respectively. Females have wider angles than males.

Table [1]: The range, mean, standard deviation of subpubic angles in Saudi males and females

Sex	Range	Mean \pm SD	T	df	P
Males n= 19	69° - 117°	91.10 \pm 13.88	-8.536	31	0.0001*
Female n= 14	114° - 155°	132.29 \pm 13.4403			

* Highly Significant P<0.05

The difference in subpubic angle measurement among males and females in Saudi population was statistically significant between both sexes [P <0.05] [Fig.2].

Figure [2]: comparison of means of subpubic angles among Saudi males and females

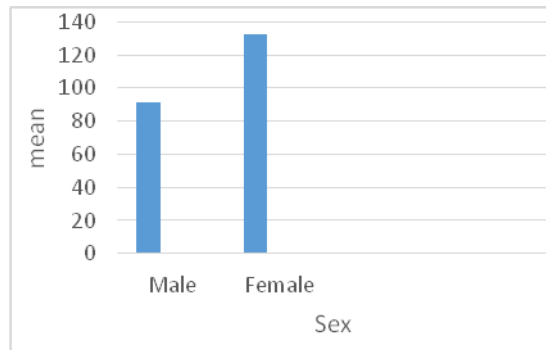


Table [2] shows the mean of subpubic angle in different population groups. The race was assigned from the overall mean for each ethnic group; Amerindians, Black race [Ugandans, Malawians and black Americans] and white Americans.

Table [2]: Mean Subpubic Angles in different population groups.

Population groups	Sex	N	Mean \pm SD	Overall mean Angle
	Males	110	-	50°-140°
	Females	95	-	75°-155°
<u>Malawians</u> [Msamati et al., 2005]	Males	73	99.16 \pm 15.73	50°-140°
	Females	46	129.07 \pm 14.19	75°-155°
<u>Black Americans</u> [Igbigbi and Igbigbi, 2003]	Males	50	65.8 \pm 8.7	-
	Females	49	85.2 \pm 8.5	-
<u>White Americans</u> [Igbigbi and I	Males	50	63.7 \pm 7.8	-
	Females	50	88.4 \pm 8.5	-
<u>Amerindians</u> [Igbigbi and Igbigbi, 2003]	Males	253	67.4 \pm 8.1	-
	Females	212	93.1 \pm 10.4	-
<u>Egyptians</u> 2009	Males	200	102.31 \pm 12.50	50°-140°
	Females	200	143.28 \pm 15.82	75°-155°

Table [3] represents the racial variability in Saudis compared to other races [Ugandans, Malawians, black Americans, white Americans, Amerindians and Egyptians]. Comparing the Saudis, versus [vs.] other populations there were significant differences between the pairs both in males and females. However, Malawians and Saudi females showed no significant differences in subpubic angles [$P > 0.05$].

Table [3]: The racial variability in Saudis compared to other races.

Pair of studies	Difference in mean	T value	DF	P
Males				
Saudi Arabia vs. Ugandans	- 2.76	2.18984	90	0.02*
Saudi Arabia vs. Malawians	- 8.06	-10.39907	270	0.001*
Saudi Arabia vs. black Americans	25.3	-7.41280	67	0.001*
Saudi Arabia vs. white Americans	27.4	-8.13226	67	0.001*
Saudi Arabia vs. Amerindians	23.7	-7.35103	270	0.001*
Saudi Arabia vs. Egyptians	-11.21	3.39054	217	0.001*
Females				
Saudi Arabia vs. Ugandans	16.18	-4.016	58	0.001*
Saudi Arabia vs. Malawians	3.22	-0.77462	58	0.40
Saudi Arabia vs. black Americans	47.09	-12.41926	61	0.001*
Saudi Arabia vs. white Americans	43.89	-11.58720	62	0.001*
Saudi Arabia vs. Amerindians	39.19	-10.70087	224	0.001*
Saudi Arabia vs. Egyptians	-10.99	2.92120	217	0.002*

vs.: versus

* Highly Significant $P < 0.05$

DISCUSSION:

In the present study, it was found that a significant difference in the mean \pm SD of subpubic angles in both Saudi males and females [$P < 0.05$]. Similar results had been observed in previous studies on Ugandans, Amerindians, white and black Americans [10], Malawians [14], and Egyptian [11].

Our study revealed that significant differences in the subpubic angles were also found to exist between Saudi and some other races [Ugandans, Malawians, black Americans, white Americans, Amerindians, Egyptians] in both sexes, except for female Ugandans. This coincides with previous researches as Egyptian stated that racial variations were apparent between subpubic angles of male [Amerindians and White Americans, Amerindians and Black Malawians, White Americans and Black Malawians, Black Americans and Black Malawians]and females

also compared to same races but there were no significant differences in subpubic angles of men between Amerindians and black Americans and between White Americans and African Americans as these groups live in the same environment – climate and diet although social amenities could vary[11], [14]. The presence of sexual, regional, and racial variability of the subpubic angles could possibly be explained on genetic, dietary, body use and environmental factors [15].

Our study revealed that no significant differences in subpubic angles between women of Saudi and Ugandans. This could be explained by genetic, age, nutritional, social, body usage and parity which might account for the differences.

Moreover, previous report showed that the subpubic angle was significantly greater in older age group

[46-70 years] [16] than in younger age group [21-45 years] of Nigerians [17].

In conclusion, the sub-pubic angle of Saudi population can be considered as an obtuse angle in females but overlaps between acute and obtuse in males. The sub-pubic angle does not only determine the sex but also shows regional variations and hence, reinforces the need for population specific parameters. Moreover, our present study provides reference values for adult Saudi people. So, it is recommended that other countries should establish their own standard references which are useful to obstetricians, anthropologists and forensic specialties.

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