ANDROLOGY/SEXUAL MEDICINE
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# Reference range of flaccid and stretched penile lengths of adult males in Baghdad: A cross-sectional study

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**Abstract** **Objectives:** To establish a baseline reference range for flaccid (FPL) and stretched penile lengths (SPL) in adult males and to compare with reports from different nationalities, as concerns over penile size are common among men and currently the number of men seeking help for the perceived problem of a 'short' penis is increasing.

**Subjects and methods:** Over a 1-year period, FPL and SPL measurements were taken from males undergoing medical examination in the outpatient clinic of the Al-Karama Teaching Hospital, using a rigid centimetre ruler. The correlation between penile length and age was investigated.

**Results:** In all, 223 apparently healthy males were included in this study with a mean (SD; range) age of 41.3 (15.0; 20–77) years. The mean (SD; range) FPL was 9.8 (2.0; 5–17) cm and the SPL was 12.6 (1.9; 7.5–19.5) cm. Statistical analysis showed that penile length is increased in older age ($> 55$ years). A penile length nomogram was constructed, showing that the 50th percentiles of FPL and SPL were 9.0 and 12.5 cm, respectively.

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**Conclusion:** Our data establish a baseline reference range for adult male penile lengths in the Capital of Iraq (Baghdad), which should be useful for urologists when counselling patients.

## Introduction

Penile size has been a concern throughout history and in many cultures, including the Arab culture. Larger penile sizes have been perceived as evidence of sexual prowess and fertility potential, with some reports of women attaching considerable importance to the size of the penis [1,2].

Today, increasing numbers of men are dissatisfied with their penile size and seek urologist and andrologist consultations. These men are otherwise physically normal males, but it appears that they glean their idea of 'normal' from images of penises seen in pornography [3,4]. Measurement of penile length and knowledge about normal penile length have become increasingly important in clinical and academic situations. For example, these reference size measurements are useful in diagnosing micropenis and malformed genitalia. In addition, they can be referred to when considering penile lengthening procedures and also are useful for condom manufacturers [5,6].

Several studies have previously been conducted to measure penile length and have found variations in size in different populations. After a careful search of English Medical databases no published articles about standardised measurement of penile length was found in Iraq. Therefore, the present exploratory study was designed to provide reference data for penile length in apparently healthy males aged 20–79 years in Baghdad.

## Subjects and methods

The present cross-sectional study was conducted in the Alkarama Teaching Hospital General Urology Outpatient Clinic between January 2014 and January 2015. Apparently healthy males aged 20–79 years with no obvious organic disease, attending the clinic and consenting to participate in the study, were included. The exclusion criteria included: penile abnormalities, epispadias, hypospadias, penile curvature, Peyronie's disease, buried penis, history of delayed puberty, infertility, and erectile dysfunction.

A minimum sample size of 200 was considered sufficient for the estimation of a nonparametric reference range; in that such a sample size should provide a stable reference range between the 2.5 and 97.5 percentiles with a 99% confidence level [7]. Other researchers have shown that samples as small as 120 can estimate a reference range with a 90% confidence level [8]. The data collection continued throughout the year, which allowed for a final sample size of 223.

After obtaining verbal consent the measurements were performed. The flaccid (FPL) and fully stretched penile lengths (SPL) were measured in a standing position at room temperature. A single observer did all the measurements using a rigid centimetre ruler, which was placed along the dorsal side of the penis, extending from the pubo-penile skin junction to the tip of the glans where the pre-pubic fat pad was pushed to the bone. For the stretched penile length, the penis was held parallel to the floor and stretched as comfortably as possible but still in a flaccid state [3].

A nomogram is a graphical presentation of the 5th and 95th percentiles of a quantitative measurement and in our study is used to show the reference range of normal values of FPL and SPL. Thus values < 5th percentile and > 95th percentile may be considered as abnormally small and large penile lengths, respectively.

### Statistical analysis

The dependent quantitative variables (penile length, both FPL and SPL) did not show a significant departure from a normal distribution when tested with the Kolmogorov–Smirnov test. The difference in the mean between more than two groups with an ordinal level (age group) was tested with an ANOVA model (polynomial trend). Further exploration for the statistical significance of differences in means between all paired combinations of groups was tested with Bonferroni $t$-test. The quintile method (percentile) was used to set the upper and lower margin for acceptable measurements, because of small sample sizes when stratified by age group. Pearson's linear correlation coefficient was used to assess the strength and direction of linear correlation between two normally distributed quantities. The fitness of tested regression models was assessed by determination coefficient. The non-parametric method for defining the 90% CI of the reference range of values for measured penile length was used.

## Results

In all, 223 physically normal males were included in this study with a mean (SD; range) age of 41.3 (15; 20–77) years. The mean (range) FPL was 9.8 (5–17) cm and

the SPL was 12.6 (7.5–19.5) cm. Fig. 1 shows a strong and statistically significant positive linear correlation ($r = 0.93$, $P < 0.001$) between FPL and SPL, which indicates a high quality of measurement.

The age of the subjects was categorised into 10-year intervals as shown in Table 1, where the mean FPL and SPL ranged between as small as 9 and 11.8 cm in the age group 30–39 years to as high as 11.4 and 14.1 cm for those aged 60–77 years. In addition, there were no statistically significant differences in the mean FPL and SPL in the 20–59 years age groups (FPL and SPL mean ranging between 9 and 10 cm; and between 11.8 and 12.9 cm, respectively, for these age groups). However, the oldest age group (60–77 years) was associated with highest mean FPL and SPL (11.4 and 14.1 cm, respectively), which was significantly higher than that of the other age groups.

Table 2, shows a cubic regression model (curve estimation model) was the best regression model to predict FPL based on age, as the determination coefficient ($R^2$) was higher than that of the quadratic and linear regression models. The cubic model was statistically significant and able to explain 18.6% of variation in FPL, moreover the model indicates that penile length shows an increase in older age ($> 55$ years).

As the sample size of the present study is an average one, the median is a more stable measure of the average than the mean. As shown in Figs. 2 and 3, the median lengths for FPL and SPL were constant at 9 and 12 cm for the age groups 20–59 years (the range of normal values of FPL was 7–12 cm and for SPL was 10–15 cm) (Table 3). However, the median lengths of FPL and SPL for oldest age group (60–77 years) were obviously higher (11 cm and 14 cm, respectively) with a
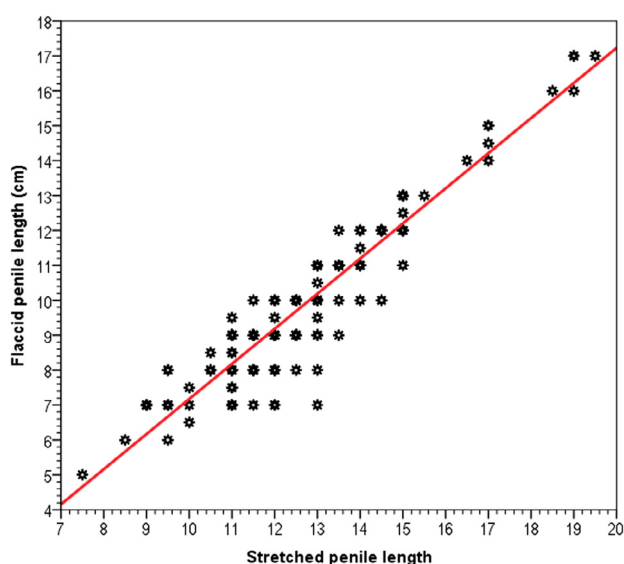
wider range of normal values between 9 and 17 cm for FPL and 12 and 19 cm for SPL.

## Discussion

In the present climate of globalisation, the definition of 'normal' penile size has become a common inquiry among both genders. If a man is preoccupied about his penis being inadequate, whether real or imagined, then this can impact on his interaction with a sexual partner. Additionally, a lack of self-esteem may even interfere with his interaction with professional associates [9]. Moreover, published articles have shown racial penile length differences [10], which need to be considered.

Measurement of penile length can be made during flaccid, stretched and erect states. The present study measured penile length in the flaccid and stretch states only. The erect penile length was not measured because of ethical and religious belief barriers. This limitation is not expected to infringe the benefits of the present study measurements. Other studies have suggested that measurements of FPL and SPL provided a reliable indicator of erect size. The regression equation in the Wessells et al. [11] study showed that SPL is a good predictor for erect penile length ($R^2 = 0.793$). In the present study, the mean (SD; range) FPL and SPL was 9.8 (2.0; 5–17) cm and 12.6 (1.9; 7.5–19.5) cm, respectively, for males aged 20–77 years. In addition, the measurements followed a positive curvilinear trend with age, which indicates that penile length increases in older age ($> 55$ years). This finding agrees with an earlier study by Khan et al. [12] from the UK, which concluded that the average penile length does not generally decrease with age. Table 4 [1,5,12–18] shows the results of several published studies from different ethnicities, including the data presented in the present study. Moreover differences in measurement technique, age, and health status of the study sample might contribute to differences in the measurements [12]. In addition, comparing the results of our present study with other surveys showed that the FPL and SPL in Iraqi men (9.8 and 12.6 cm) are between recorded sizes for men in Jordan (9.3 and 13.5 cm), Scotland, UK (10.2 and 14.3 cm), and the USA (8.85 and 12.45 cm). Our present results for FPL (9.8 cm) and SPL (12.6) are close to those cited in the Veale et al. [18] study (2015), which was a systemic review of up to 15 521 men and compared the results of 20 studies from several countries on different populations. They concluded that the mean FPL and SPL for men aged between 17 and 91 years were 9.16 and 13.24 cm, respectively [1,5,12–18]. In the present study, a penile length nomogram (sample comprised of Iraqi adult males living in Baghdad) used the non-parametric method for defining the 90% confidence level for the reference value of penile length (5th and 95th



**Figure 1** Scatter diagram with fitted regression line showing the linear correlation between FPL and SPL measurements ($r = 0.93$, $P < 0.001$).

**Table 1** The mean FPL and SPL by age group.

| | Age group, years | | | | |
| --- | --- | --- | --- | --- | --- |
| | 20–29 | 30–39 | 40–49 | 50–59 | 60–77 |
| Number of subjects | 63 | 50 | 41 | 33 | 36 |
| FPL, cm | | | | | |
| Minimum | 6 | 5 | 6 | 7 | 9 |
| Maximum | 14.5 | 12 | 16 | 17 | 17 |
| Mean | 9.3 | 9 | 9.6 | 10 | 11.4[*] |
| SD | 1.7 | 1.5 | 2 | 2 | 2.3 |
| SE | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 |
| P (ANOVA) <0.001 | | | | | |
| SPL, cm | | | | | |
| Minimum | 9 | 7.5 | 8.5 | 11 | 11.5 |
| Maximum | 17 | 14.5 | 18.5 | 19 | 19.5 |
| Mean | 12.1 | 11.8 | 12.5 | 12.9 | 14.1[*] |
| SD | 1.7 | 1.5 | 1.8 | 1.7 | 2.1 |
| SE | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 |
| P (ANOVA) <0.001 | | | | | |

[*] The oldest age group (60–77 years) was the only age group to show a statistically significant difference ($P < 0.001$) in mean value vs the other age groups.

**Table 2** Modelling FPL as the dependent variable and age as the predictor variable with three selected regression equations.

| | $R^2$ | $P$ |
| --- | --- | --- |
| Linear | 0.131 | <0.001 |
| Quadratic | 0.184 | <0.001 |
| Cubic | 0.186 | <0.001 |

Cubic regression model: Predicted FPL = $(-0.00965 \times Age)$ + $(0.00097 \times Age2)$ + $(0.00002 \times Age3)$.

percentile). Most sexual literature available to doctors and men come from the Western world and thus may raise incorrect expectations and perceptions of normal sexual performance and genital size. The results presented here provide a useful baseline to help clinicians counselling men who desire to know where they stand among their fellows, to investigate the relationship between condom failure and penile dimensions, and or establish the change in size percentile following penile augmentation procedure, which is becoming a growing request in different populations with unclear indications and many complications [18–20]. The 50th percentile (median) FPL of the age groups 20–59 years was constant at 9 cm, with a reference range of normal values of 7–12 cm. However, this median was obviously higher (11 cm) with a wider range of reference values (9–17 cm) for the oldest age group (60–77 years). The 50th percentile SPL of the age groups 20–59 years was 12 cm (with a reference range of normal values between 10 and 15 cm). The oldest age group (60–77 years) had an obviously higher median SPL (14 cm) with a wider range of reference normal values of between 12 and 19 cm.
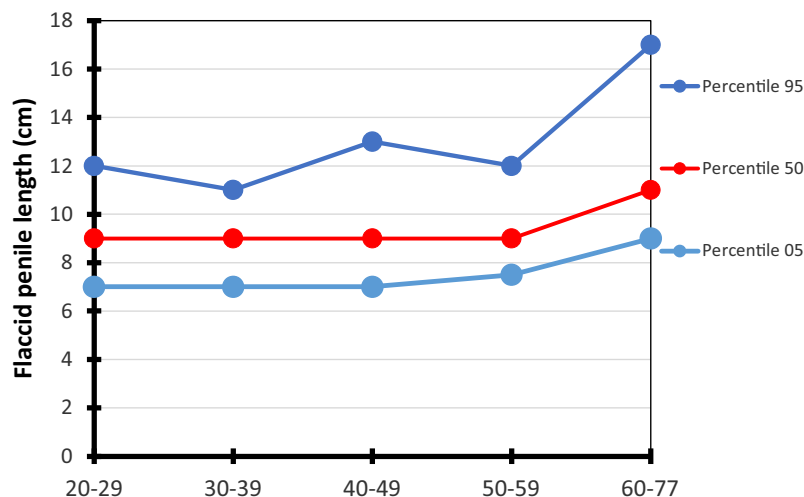


**Figure 2** Line graph showing the median together with the lowest (5th percentile) and highest (95th percentile) normal values of FPL.
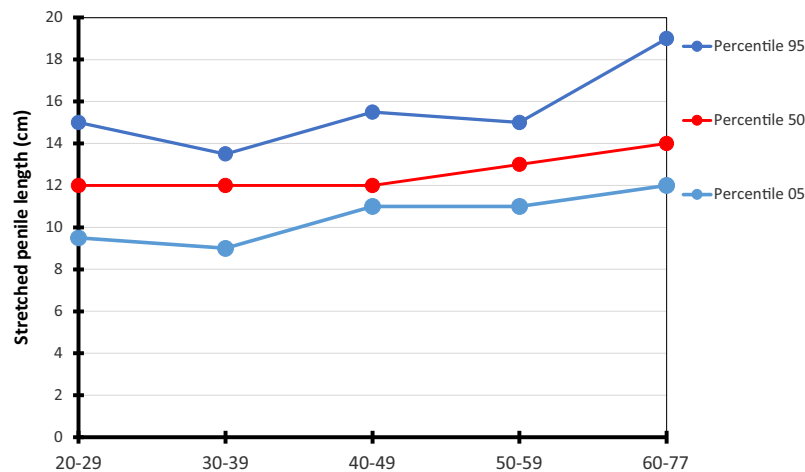
**Figure 3**  Line graph showing the median together with the lowest (5th percentile) and highest (95th percentile) normal values of SPL.

**Table 3**  Percentile cut-off values for FPL and SPL by age group.

| | Age group, years | | | | | |
|---|---|---|---|---|---|---|
| | 20–59 | 20–29 | 30–39 | 40–49 | 50–59 | 60–77 |
| Number of subjects | 187 | 63 | 50 | 41 | 33 | 36 |
| **FPL, cm** | | | | | | |
| Percentile 05 | 7 | 7.0 | 7.0 | 7.0 | 7.5 | 9.0 |
| Percentile 25 | 8 | 8.0 | 8.0 | 9.0 | 9.0 | 9.5 |
| Percentile 50 | 9 | 9.0 | 9.0 | 9.0 | 9.0 | 11.0 |
| Percentile 75 | 10 | 10.0 | 10.0 | 10.0 | 11.0 | 12.8 |
| Percentile 95 | 12 | 12.0 | 11.0 | 13.0 | 12.0 | 17.0 |
| **SPL, cm** | | | | | | |
| Percentile 05 | 10 | 9.5 | 9.0 | 11.0 | 11.0 | 12.0 |
| Percentile 25 | 11 | 11.0 | 11.0 | 11.5 | 11.5 | 12.3 |
| Percentile 50 | 12 | 12.0 | 12.0 | 12.0 | 13.0 | 14.0 |
| Percentile 75 | 13 | 13.0 | 13.0 | 13.0 | 14.0 | 15.0 |
| Percentile 95 | 15 | 15.0 | 13.5 | 15.5 | 15.0 | 19.0 |

**Table 4**  Penile length data from worldwide literature.

| Study | Country | No. of subjects | Age, years, mean (SD; range) | FPL, cm, mean (SD; range) | SPL, cm, mean (SD; range) |
|---|---|---|---|---|---|
| Awwad et al. [1] | Jordan | 271 | 44.6 (16.3; 17–83) | 9.3 (1.9; 4–15) | 13.5 (2.3; 7.5–20) |
| Choi et al. [13] | Korea | 144 | 57.3 (16.5; 21–89) | 7.7 (1.7; 4–12) | 11.7 (1.9; 7.5–17) |
| Khan et al. [12] | Scotland, UK | 610 | 43 (16–90) | 10.2 (1.4) | 14.3 (1.68) |
| Mehraban et al. [14] | Iran | 1500 | 29.61 (5.50; 20–40) | N/A | 11.58 (1.45; 7.5–19) |
| Promodu et al. [15] | India | 301 | 31.58 (6.38; 18–60) | 8.21 (1.44; 4.5–13) | 10.88 (1.42; 6.5–16) |
| Sengezer et al. [5] | Turkey | 200 | 21.2 (20–22) | 6.80 (0.08; 4–9) | 8.98 (0.09; 6.5–12.5) |
| Shalaby et al. [16] | Egypt | 2000 | 31.6 (4.2) | N/A | 13.84 (1.35; 12–19) |
| Spyropoulos et al. [17] | Greece | 52 | 25.9 (4.4; 19–38) | N/A | 12.8 (1.7; 9–17.5) |
| Wessells et al. [11] | USA | 80 | 54 (14.37; 21–82) | 8.85 (2.38; 5–15.5) | 12.45 (2.71; 7.5–19) |
| Veale et al. [18] | – | 15521 | 17–19 | 9.15 (1.57) | 13.24 (1.89) |
| Present study 2016 | Iraq | 223 | 41.3 (15.0; 20–77) | 9.8 (2.0; 5–17) | 12.6 (1.9; 7.5–19.5) |

*Study limitations*

Although the sample size was large enough for accurate estimates, the reference range of normal values for FPL and SPL is not intended to represent the Iraqi adult male population, as it was based on a convenient sample from one centre located in Baghdad. It is nevertheless, useful as baseline data, until a larger random sample is

available. The reference range for age groups is clearly less accurate, as the sample size for each age group was less than the optimum sample size of 200.

## Conclusion

The present study establishes the first reference range for penile size in a convenient sample of adult males in the capital of Iraq (Baghdad). This is expected to be helpful for urologist and andrologist in counselling patients.

## Conflicts of interest

None.

## Financial disclosure

None.

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