

Stretched Penile Length in Boys - A Cross-sectional Single Centre Study

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Abstract

Introduction: Stretched penile length is the most relevant measurement to define the size of the penis, which varies in various ages, geographical regions and ethnicities. Thus, a population specific normative data on stretched penile length helps in early diagnosis of penile abnormalities and endocrine disorders in children.

Methods: A cross sectional study was done in 501 healthy boys from neonatal period till 12 years of age. Boys with abnormalities of external genitalia, suspected endocrine disorders, suspected syndromes, chronic diseases were excluded from the study. Stretched penile length was measured with a transparent ruler from the pubic ramus till the tip of the glans penis excluding the foreskin. Height and weight of the boys were also recorded. Spearman's rank correlation coefficient test was used to find the correlation of stretched penile length vs height and weight of the boys. $P < 0.05$ was considered significant.

Results: The median, 5th, 95th percentiles of stretched penile length were calculated. The median stretched penile length of the boys ranged from 3.01 (2.32, 3.06) cm in infancy to 6.33 (6.04, 6.62) cm by 12 years. The correlation of stretched penile length vs height and weight showed a statistically significant positive correlation. ($r_s = 0.979$, $p < 0.001$; $r_s = 0.971$, $P < 0.001$ respectively).

Conclusions: Our study provides normative data on stretched penile length from neonatal period till 12 years of age. There was a significant positive correlation between stretched penile length and height and weight of the boys.

Introduction

Children with abnormalities of the penis are commonly encountered in an outpatient clinic of a paediatrician, paediatric urologist, endocrinologist or a geneticist.¹ Many parents are anxious about the size of the penis of their children.² Size of the penis differs in various ages, geographical regions and ethnicities.³

Stretched penile length is the most important parameter to define the size of the penis. Studies on stretched penile length have been done in various countries.⁴⁻⁶ Few studies have been done on penile anthropometry from Northern India and Western India.^{2,7}

There is a lack of such data in the South Indian population. Hence population specific normative data for stretched penile length will serve as a useful reference in the early diagnosis of penile abnormalities like micropenis, concealed penis and endocrine disorders in our population. The objective of our study was to provide a normative data of stretched penile length in boys from neonatal period to 12 years of age and to find a

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correlation between stretched penile length and height and weight of the boys.

Methods

This cross-sectional study was started after obtaining approval from our Institutional Ethics Committee. Written informed consent was obtained from the parents and informed assent was obtained from boys aged more than seven years of age before commencing the study. The study was done in our tertiary care hospital for a period of one year from October 2019 to October 2020. 501 boys of age ranging from neonatal period till 12 years of age were enrolled in the study. The study sample was taken from apparently healthy boys who attended our regular outpatient clinic, immunization clinic and siblings of children who were admitted in our ward. Term healthy neonates delivered in our hospital were included in the study. Boys with abnormalities of the penis / external genitalia, suspected endocrine disorders, chronic diseases, suspected genetic syndromes were excluded from the study. Weight of the child was measured by a digital weighing scale with an accuracy of 10 grams. Length of the child was measured up to two years of age with an infantometer with an accuracy of 0.1 cm. Height of the child was measured in children aged more than two years in a stadiometer with an accuracy of 0.1 cm. After explaining the procedure to the parents and the child, the child was taken to a private warm room. Child was made to lie in the supine position. Stretched penile length was measured with a transparent ruler after stretching the penis and pressing the suprapubic pad of fat with one end of the ruler. Length was measured from the base of the penis (pubic ramus) till the tip of the glans penis, excluding the foreskin on the dorsal side of the penis. All the measurements were taken twice by two trained observers and the average of the two measurements was taken as the final measurement. The data were filled in a structured proforma and were analysed with SPSS version 29.0. Continuous data were represented as median (IQR) and correlation was calculated by Spearman's rank correlation coefficient test.

Results

The mean and median values of stretched penile length in various age groups are depicted in Table 1. The median stretched penile length ranged from 3.01 cm (2.32, 3.06) in less than one year old to 6.33 cm (6.04, 6.62) in 12 years to 12 years 11 months boys.

Table 1: Stretched penile length (SPL) in various age groups (centimetre)

Age (n)	Mean \pm SD	Median (IQR)
0 to 11 M (37)	2.83 \pm 0.33	3.01 (2.32,3.06)
1 Y to 1 Y 11 M (49)	3.99 \pm 0.06	3.98 (3.95,4.01)
2 Y to 2 Y 11 M (37)	4.16 \pm 0.08	4.16 (4.09,4.22)
3 Y to 3 Y 11 M (38)	4.31 \pm 0.11	4.32 (4.22,4.39)
4 Y to 4 Y 11 M (40)	4.35 \pm 0.12	4.35 (4.25,4.46)
5 Y to 5 Y 11 M (39)	4.48 \pm 0.12	4.51 (4.39,4.58)
6 Y to 6 Y 11 M (38)	4.55 \pm 0.19	4.56 (4.41,4.70)
7 Y to 7 Y 11 M (39)	4.71 \pm 0.15	4.73 (4.58,4.85)
8 Y to 8 Y 11 M (39)	4.89 \pm 0.15	4.92 (4.79,5.03)
9 Y to 9 Y 11 M (39)	4.88 \pm 0.16	4.86 (4.76,4.96)
10 Y to 10 Y 11 M (39)	5.12 \pm 0.19	5.16 (4.98,5.28)
11 Y to 11 Y 11 M (39)	5.49 \pm 0.24	5.52 (5.31,5.70)
12 Y to 12 Y 11 M (28)	6.32 \pm 0.32	6.33 (6.04, 6.62)

Y - years, M - months, IQR - Interquartile range

As our data were not normally distributed, percentiles were calculated. The 5th, 50th and 95th percentiles of stretched penile length in various age groups are shown in Table 2.

Table 2: Percentiles of stretched penile length (centimetre)

Age (n)	5 th percentile	50 th percentile	95 th percentile
0 to 11 M (37)	2.29	3.01	3.09
1 Y to 1 Y 11 M (49)	3.89	3.98	4.11
2 Y to 2 Y 11 M (37)	4.02	4.16	4.30
3 Y to 3 Y 11 M (38)	4.10	4.32	4.47
4 Y to 4 Y 11 M (40)	4.16	4.35	4.54
5 Y to 5 Y 11 M (39)	4.27	4.51	4.65
6 Y to 6 Y 11 M (38)	4.27	4.56	4.82
7 Y to 7 Y 11 M (39)	4.46	4.73	4.90
8 Y to 8 Y 11 M (39)	4.61	4.92	5.09
9 Y to 9 Y 11 M (39)	4.68	4.86	5.20
10 Y to 10 Y 11 M (39)	4.80	5.16	5.37
11 Y to 11 Y 11 M (39)	5.04	5.52	5.83
12 Y to 12 Y 11 M (28)	5.80	6.33	6.77

Y – years, M - months, IQR - Interquartile range

The mean and median weight of boys in various age groups are shown in Table 3.

Table 3: Weight in various age groups (kilograms)

Age (n)	Mean \pm SD	Median (IQR)
0 to 11 M (37)	6.18 \pm 2.12	6.90 (3.78,7.90)
1 Y to 1 Y 11 M (49)	11.57 \pm 0.95	11.20 (10.80,12.40)
2 Y to 2 Y 11 M (37)	15.25 \pm 1.04	15.40 (14.60,16.10)
3 Y to 3 Y 11 M (38)	16.31 \pm 1.48	16.11 (15.03,17.52)
4 Y to 4 Y 11 M (40)	18.70 \pm 1.80	18.68 (17.14,20.21)
5 Y to 5 Y 11 M (39)	20.41 \pm 1.92	20.70 (18.70,22.10)
6 Y to 6 Y 11 M (38)	22.03 \pm 2.11	21.73 (20.12,23.89)
7 Y to 7 Y 11 M (39)	22.76 \pm 2.69	21.23 (21.13,24.30)
8 Y to 8 Y 11 M (39)	27.88 \pm 3.15	28.07 (25.32,30.82)
9 Y to 9 Y 11 M (39)	27.38 \pm 2.80	26.30 (25.30,29.20)
10 Y to 10 Y 11 M (39)	33.32 \pm 3.87	33.32 (29.92,36.72)
11 Y to 11 Y 11 M (39)	34.31 \pm 5.31	32.20 (30.20,38.40)
12 Y to 12 Y 11 M (28)	38.67 \pm 5.40	37.95 (34.33,41.58)

Y- years, M- months, IQR- Interquartile range

The mean and median height of boys in various age groups are shown in Table 4.

Table 4: Height in various age groups (centimetre)

Age (n)	Mean \pm SD	Median (IQR)
0 to 11 M (37)	63.30 \pm 6.8	64.30 (57.00, 69.40)
1 Y to 1 Y 11 M(49)	78.22 \pm 3.15	79.10 (76.20, 80.35)
2 Y to 2 Y 11 M(37)	93.17 \pm 2.91	92.80 (90.60, 95.35)
3 Y to 3 Y 11 M (38)	102.75 \pm 3.33	102.75 (99.83, 105.68)
4 Y to 4 Y 11 M(40)	108.48 \pm 2.47	108.40 (106.35,110.45)

5 Y to 5 Y 11 M (39)	112.40 \pm 3.80	112.50 (109.50,115.50)
6 Y to 6 Y 11 M (38)	116.93 \pm 3.74	116.68 (113.76,119.61)
7 Y to 7 Y 11 M (39)	122.72 \pm 3.98	122.17 (119.07,126.27)
8 Y to 8 Y 11 M (39)	125.46 \pm 5.19	125.10 (121.10,129.10)
9 Y to 9 Y 11 M (39)	130.42 \pm 3.61	129.70 (127.70, 131.70)
10 Y to 10 Y 11 M (39)	137.51 \pm 4.49	136.70 (133.70,141.60)
11 Y to 11 Y 11 M (39)	141.01 \pm 5.67	141.90 (135.90,145.50)
12 Y to 12 Y 11 M (28)	149.56 \pm 5.78	149.55 (144.48, 154.63)

Y- years , M- months, IQR- Interquartile range.

As our data were not normally distributed, correlation was calculated by Spearman's rank correlation

coefficient test. Further the correlation between stretched penile length and weight and height are shown in Table 5.

Table 5: Correlation of stretched penile length (SPL) with weight and height

Age (n)	SPL vs Weight		SPL vs Height	
	r _s value	p value	r _s value	p value
0 to 11 M (37)	0.686	< 0.001	0.631	< 0.001
1 Y to 1 Y 11 M (49)	0.625	< 0.001	0.218	0.132
2 Y to 2 Y 11 M (37)	0.154	0.363	0.180	0.301
3 Y to 3 Y 11 M (38)	0.468	0.003	0.471	0.003
4 Y to 4 Y 11 M (40)	0.428	0.006	0.428	0.006
5 Y to 5 Y 11 M (39)	0.832	< 0.001	0.705	< 0.001
6 Y to 6 Y 11 M (38)	0.798	< 0.001	0.997	< 0.001
7 Y to 7 Y 11 M (39)	0.307	0.057	0.964	< 0.001
8 Y to 8 Y 11 M (39)	0.287	0.076	0.525	< 0.001

9 Y to 9 Y 11 M (39)	1.000	< 0.001	1.000	< 0.001
10 Y to 10 Y 11 M (39)	0.855	< 0.001	0.855	< 0.001
11 Y to 11 Y 11 M (39)	0.852	< 0.001	0.337	0.036
12 Y to 12 Y 11 M (28)	1.000	< 0.001	1.000	< 0.001

Y - years, M - months

There was a significant strong positive correlation between stretched penile length and weight and height of the boys ($r_s = 0.971$, $p < 0.001$; $r_s = 0.979$, $p < 0.001$) respectively. There was a strong positive correlation between stretched penile length and weight of the children aged five years to six years 11 months and nine years to 12 years 11 months ($p < 0.001$) whereas the correlation was moderate in boys aged 0 to 11 months ($p < 0.001$) and fair in three years to four years 11 months. There was a very strong positive correlation between the stretched penile length and height in boys aged six years to seven years 11 months, nine years to 10 years 11 months and 12 years to 12 years 11 months ($p < 0.001$) whereas the correlation was moderate in boys aged five years to five years 11 months and 0 to 11 months ($p < 0.001$) and fair in boys aged three years to four years 11 months and eight years to eight years 11 months (Table 5).

Discussion

Stretched penile length is the relevant measurement in assessing the size of the penis.^{8,9} This helps in tracking the normal growth of a child's male external genitalia and also in diagnosing various penile abnormalities like micropenis and concealed penis. Thus it helps in the early diagnosis of endocrine disorders like hypogonadotropic hypogonadism or hypergonadotropic hypogonadism.⁹ Size of the penis differs in various ages and ethnicities. Hence normative data of a specific group of population may help in defining normality of the penile size in various age groups in that population. This study provides data for normative values for penile length of boys in South India.

In our study, the median stretched penile lengths were 3.01 cm in infancy, 4.35 cm at four years to four years 11 months and 4.86 cm at nine years to nine years 11 months which were almost similar to the study done by Bhat et al where the mean penile lengths were 3.34 cm in infancy, 4.28 cm at four to five years and 5.25 cm at nine to 10 years.² But

the study done by Teckchandani et al showed higher mean penile lengths of 4.02 cm in infancy, 5.82 cm at four to five years and 6.71 cm at nine to 10 years.¹⁰ The study done by Roy et al showed higher median penile lengths of 5.5 cm at three years to four years 11 months and 6.5 cm at nine years to 10 years 11 months.¹ The variation in penile lengths may be due to the diversity of the Indian population.

We observed that the median stretched penile length in our study matched with the study done by Gul et al from Turkey where the mean penile lengths were 2.76 cm in infancy and 4.63 cm at four to five years.⁴ The study done by Tomova et al from Bulgaria showed mean penile lengths of 4.26 cm at four years and 4.66 cm at nine years which matched with our study.⁶ But, the study done by Camurdan et al from Turkey showed that the mean penile length was 6.02 cm at four to five years which was higher than our study.¹¹ The study done by Park et al from Korea showed that the average stretched penile lengths were 4.1 cm in infancy, 4.9 cm at four to five years and 5.8 cm at nine to 10 years which were higher than the values observed in our study.¹²

Micropenis is defined as a normally formed penis that is at least 2.5 SD below the mean in size.⁹ The 5th percentile of stretched penile length in our study was 4.16 cm at four years to four years 11 months which matched with the study done by Roy et al where the 5th percentile showed 4.0 cm at three years to four years 11 months.¹ A similar cut off of 4.2 cm (-2.5 SD) was observed in four to five years by Teckchandani et al in India.¹⁰ However, study by Bhat et al (-2SD) showed lower cut off values than our study in all the age groups.² The variation in the lower cutoff of the stretched penile length may be due to the multiethnicity of the Indian population and variation in sample size. The studies done by Gul et al and Park et al show lower cut-off values of stretched penile length at four to five years as 3.33 cm (5th percentile), and 3.0 cm (- 2 SD) respectively.^{4,5}

The present study shows that stretched penile length has a highly significant positive correlation with the height ($r_s = 0.979$, $p < 0.001$) and weight ($r_s = 0.971$, $p < 0.001$) of the boys which was similarly observed in the study done by Camurdan et al ($r = 0.881$, $r = 0.864$, $p = 0.001$) respectively.¹¹ But the correlation between stretched penile length and height of the boys was not significant in one year to one year 11 months and two years to two years 11 months age groups (Table 5). The correlation between stretched penile length and the weight of the boys was not

significant in two years to two years 11 months, seven years to seven years 11 months, eight years to eight years 11 months age groups (Table 5). The study done by Roy et al shows a significant positive correlation between penile length and the height of the child ($r = 0.516$, $p < 0.0005$).¹ This implies that the height and weight of the child must be considered while assessing the penile length. Our study has limitations as it was a cross-sectional study from a single centre and the relatively small sample was taken from the hospital setting rather than the community. Hence, the study findings would not be appropriate to generalize to the entire Indian population. The study findings should be corroborated with more larger multi centric studies for further application.

Conclusions

This study provides a normative data for stretched penile length in boys from infancy till 12 years of age. The median stretched penile lengths were 3.01 cm in infancy, 4.35 cm at four years to four years 11 months and 4.86 cm at nine years to nine years 11 months. There was a significant positive correlation between the stretched penile length and the weight and height of the boys.

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