

## Normal Values of Stretched Penile Length According to Gestational Age in Neonates

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### ABSTRACT

**Objective:** To assess the mean stretched values of penile length and penile circumference according to gestational age in term neonates attending Combined Military Hospital, Rawalpindi, Pakistan.

**Study Design:** Cross-sectional study.

**Place and Duration of Study:** Combined Military Hospital, Rawalpindi Pakistan, from Jan 2022 to Jul 2022.

**Methodology:** Male newborns born apparently healthy with in between 37 to 42 gestational weeks were enrolled within 3 days of birth. Measurements of stretched penile length and penile circumference were performed twice, and the average value of the two measurements was recorded.

**Results:** Among 69 neonates, the average gestational age was  $39.92 \pm 1.44$  weeks. The mean stretched penile length was  $3.15 \pm 0.47$  cm, while the mean penile circumference was  $1.01 \pm 1.30$  cm. Significant differences were observed in birth length ( $p < 0.001$ ), head circumference ( $p < 0.001$ ), stretched penile length ( $p = 0.006$ ), and penile circumference ( $p = 0.002$ ) in relation to gestational age. A significant correlation was observed between stretched penile length and various factors, including gestational age ( $r = 0.414$ ,  $p < 0.001$ ), postnatal age ( $r = 0.429$ ,  $p < 0.001$ ), birth weight ( $r = 0.582$ ,  $p < 0.001$ ), birth length ( $r = 0.398$ ,  $p = 0.001$ ), and total serum testosterone ( $r = 0.475$ ,  $p < 0.001$ ). Similarly, penile circumference exhibited significant correlations with gestational age ( $r = 0.470$ ,  $p < 0.001$ ), birth weight ( $r = 0.419$ ,  $p < 0.001$ ), and birth length ( $r = 0.563$ ,  $p < 0.001$ ).

**Conclusion:** In this study, a moderate positive significant relationship of gestational age was observed with both stretched penile length and penile circumference.

**Keywords:** Gestational age, Penile circumference, Stretched penile length.

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### INTRODUCTION

The genital examination of newborns, particularly the penile size, which is thought to be a significant indicator of hypothalamus or pituitary dysfunction, is one of the key areas of focus for pediatricians.<sup>1-3</sup> The activity of testosterone and the testosterone receptor are necessary for appropriate penile growth.<sup>4</sup> Male foetal undervirilization at birth and sexual differentiation issues like hypospadias and a tiny penis are caused by insufficient testosterone activity throughout the second and third trimesters.<sup>5,6</sup> Disorders of the genital system can often serve as indicators of disorders of sex development, as androgen exposure during fetal sex development plays a significant role in their functioning.<sup>7</sup> Consequently, penile measuring aids in the identification of underlying genetic or endocrine abnormalities.<sup>1</sup> Moreover, penile length assessment is crucial in operations like circumcision in addition to the detection of hypothalamic and pituitary

abnormalities.<sup>8</sup> It should be noted that normal penile length varies between groups and races.<sup>9-11</sup>

As far as Pakistan is concerned, a thorough literature search has revealed scarcity of studies that have investigated penile length in Pakistani infants. Though a number of studies are available on circumcision in Pakistani infants, however, information related to the normal penile length and its relationship with various predicting parameters are not reported from Pakistani infant population. The establishment of a penile nomogram for Pakistani newborns is of great importance, considering the potential occurrence of undetected penoscrotal anomalies that may only become apparent during school age. With this in mind, the objective of this study was to determine the average values of stretched penile length and penile circumference in term neonates, with a particular focus on the neonates' gestational age.

### METHODOLOGY

The cross-sectional study was conducted at Combined Military Hospital, Rawalpindi Pakistan, from January 2022 to July 2022.

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Online sample size calculator<sup>12</sup> was used for the estimation of sample size came taking confidence 95%, precision of 1, recent standard deviation for maximum penile length in a recent study 4.<sup>12,13</sup> The estimated sample size came out to be 69.

**Inclusion Criteria:** Male newborns born apparently healthy with in between 37 to 42 gestational weeks were enrolled within 3 days of birth.

**Exclusion Criteria:** Newborns born with any anomalies of external genitalia or congenital abnormality were excluded. In addition, newborns with maternal history of androgenic medication during pregnancy were also excluded.

Prior to the enrollment of participants, the study received ethical approval from the institution under reference ERC #329. Furthermore, all guardians/parents of eligible neonates provided signed informed consent for their participation in the study.

A pre-designed proforma was used to collect the demographic characteristics and clinical examination details. All genital and anthropometric measurements were carried out by principal investigator (3<sup>rd</sup> year FCPS) assisted by two trained nurses. During the study, the infants were positioned in a warm environment, lying on their backs (supine position), with the perineum adequately exposed. To measure the stretched penile length, a gentle grip was applied to the glans using the thumb and fingers, while a disposable wooden spatula was employed. The measurement was taken from the pubic ramus along the dorsum (upper side) of the penis to the tip of the glans penis. It's worth noting that the foreskin was not included in this measurement. To mark the glans tip on the spatula, a pencil was used. For measuring penile circumference, the suprapubic fat-pad was pressed firmly while extending the shaft of the penis until resistance was encountered. The widest diameter along the shaft was then measured using a digital Vernier caliper, with the penile width recorded to the nearest 0.01 mm. Both the stretched penile length and penile circumference measurements were repeated twice, and the average values were recorded to enhance accuracy.

This information along with demographic characteristics such as maternal age, gestational age, postnatal age, five minutes APGAR score, birth weight, birth length, and head circumference were noted.

Statistical Package for the social sciences (SPSS) version 23:00 was used for the purpose of statistical analysis. Age, gestational age, postnatal age, five minutes APGAR score, birth weight, birth length, and head circumference were expressed as mean and standard deviation. Frequency and percentages were calculated for quantitative variables. Relationship of stretched penile length and penile circumference with predictor variables were explored using Pearson's correlation test. Moreover, mean difference of outcome variables with respect to gestational ages were explored using One-Way ANOVA test. *p*-value of  $\leq 0.05$  was considered as significant.

### RESULTS

Of 69 study participants, the mean post-natal age was  $13.86 \pm 9.52$  hours. The minimum post-natal age was 3 hours whereas maximum post-natal age of 45 hours was observed. The mean birth weight of the neonate was  $2894.20 \pm 345.08$  gram. The minimum birth weight was 2200 grams whereas maximum birth weight of 3600 grams was observed. The mean birth length and head circumference were found to be  $50.01 \pm 5.16$  cm and  $35.23 \pm 1.44$  cm respectively.

The maternal age of the neonates was  $31.13 \pm 2.24$  years. There were 30(43.5%) mothers with  $\leq 30$  years and 39(56.5%) mothers with  $>30$  years of age. The mean APGAR score at 5 minutes was  $8.30 \pm 1.52$ . While the mean total testosterone level was found to be  $538.9 \pm 341.76$  ng/dL.

The gestational age of the neonates was  $39.92 \pm 1.44$  years. The minimum gestational age was 37 weeks whereas maximum gestational age of 42 weeks was observed. There were 43(62.3%) neonates with  $\leq 40$  weeks and 26(37.7%) neonates with  $>40$  weeks of gestation.

The mean stretched penile length was found to be  $3.15 \pm 0.47$  cm whereas mean penile circumference was found to be  $1.01 \pm 1.30$  cm.

A significant mean difference of birth length ( $p < 0.001$ ), head circumference ( $p < 0.001$ ), stretched penile length ( $p$ -value 0.006), and penile circumference ( $p: 0.002$ ) was observed with respect to gestational age (Table-I).

Stretched penile length was significantly correlated with gestational age ( $r: 0.414$ ,  $p < 0.001$ ), postnatal age ( $r: 0.429$ ,  $p < 0.001$ ), birth weight ( $r: 0.582$ ,  $p < 0.001$ ), birth length ( $r: 0.398$ ,  $p: 0.001$ ), total serum testosterone ( $r: 0.475$ ,  $p < 0.001$ ). Moreover, penile circumference was significantly correlated with

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gestational age ( $r:0.470, p:<0.001$ ), birth weight ( $r:0.419, p:<0.001$ ), and birth length ( $r:0.563, p:<0.001$ ) (Table II). A line graph showing the relationship of gestational age with stretched penile length and penile circumference is shown in figure-1 and 2.

changes, genetic predispositions, and environmental influences during this crucial period may contribute to the observed correlation. This finding is also found similar to previous studies that reported positive correlation of gestational age and stretched penile

**Table-I: Mean Anthropometric Measurements and Penile Measurements as per Various Gestational Age (N=69)**

GA (weeks)	n	BW (grams)	BL (cm)	HC (cm)	SPL (cm)	PC (cm)
37	3	2600.1±200.1	45.67±0.58	32.33±0.58	2.70±0.10	0.90±0.01
38	6	2766.67±287.51	48.00±3.84	34.50±2.07	2.88±0.47	0.93±0.19
39	16	2793.75±360.49	50.25±6.28	36.13±0.72	2.93±0.49	0.95±0.14
40	15	2926.67±357.50	45.93±2.66	35.33±1.34	3.27±0.50	0.96±0.07
41	18	2938.89±350.02	51.17±4.51	34.83±1.38	3.29±0.32	1.06±0.15
42	11	3072.73±293.56	55.54±0.93	35.63±0.81	3.37±0.45	1.11±0.09
p-value		0.169	<0.001	<0.001	0.006	0.002

BW: Birth Weight, BL: Birth Length, GA: Gestational age, HC: Head Circumference, PC: Penile Circumference, SPL: Stretched Penile Length

**Table-II: Relationship of Stretched Penile Length and Penile Circumference with General Characteristics**

Characteristics	SPL	PC
	r (p-value)	r (p-value)
Maternal Age	0.006 (0.964)	-0.004(0.976)
Gestational Age	0.414**(<0.001)	0.470**(<0.001)
Postnatal Age	0.429**(<0.001)	-0.021(0.864)
APGAR score at 5 mins	0.187(0.123)	0.063(0.609)
Birth Weight	0.582**(<0.001)	0.419**(<0.001)
Birth Length	0.398**(<0.001)	0.563**(<0.001)
Head Circumference	0.026(0.829)	-0.035(0.778)
Total Serum Testosterone	0.475** (<0.001)	0.171(0.161)

SPL: Stretched penile length, PC: Penile Circumference

## DISCUSSION

In the current study, the average stretched penile length was determined to be 3.15 cm, indicating the average length of the penis when it is stretched from the base to the tip. On the other hand, the mean penile circumference was found to be 1.01 cm, representing the average measurement around the thickest part of the penis. These findings are consistent with the findings reported by previously published international studies in which the mean penile length was reported to be three and penile circumference as one.<sup>14-16</sup> The similarities in the current study findings with various international studies are indicating that the normal stretched penile length of Pakistani population is somewhat similar to the mean values reported by other areas of the world.

A moderate positive significant relationship of gestational age was observed with penile measurements in this study. The observed relationship between gestational age and penile measurements can have several implications. It suggests that penile development is influenced by the duration of fetal development in the womb. Factors such as hormonal

length.<sup>9,17,18</sup> However, in a study carried out by Kollurage *et al.*, in Sri Lanka has reported no correlation of stretched penile length with gestational age.<sup>16</sup> Even, in their study stretched penile length was also found uncorrelated with birth weight of the neonates. Contrary to this finding, in the current study, a moderate positive significant relationship of birth weight age was also observed with both penile measurements in this study. In previous studies conducted by Akin *et al.*,<sup>11</sup> Chikini *et al.*,<sup>17</sup> Asafo-Agyei *et al.*,<sup>14</sup> and Kareem *et al.*,<sup>15</sup> a weak positive significant relationship between birth weight and stretched penile length was reported. It has been observed that an increase in subcutaneous fat in the pubic region can potentially impact the accurate assessment of penile length.<sup>15</sup>

In this study, a significant moderate positive relationship was observed between total serum testosterone levels and stretched penile length. However, there was no significant correlation found between penile circumference and serum testosterone levels. These findings align with previous studies that have reported a significant correlation between serum testosterone levels and stretched penile length.<sup>15,19</sup> According to reports, the postnatal surge in reproductive hormones is believed to play a crucial role in genital growth.<sup>19</sup>

This study found no significant correlation between stretched penile length, penile circumference, and maternal age. Specifically, stretched penile length exhibited a weak positive relationship, while penile circumference showed a weak negative relationship with maternal age. It is worth noting that a previous study reported an inverse relationship between maternal age and stretched penile length.<sup>14</sup>

Despite being a single-center study, the findings of this research hold significance. It should be noted that this study focused on reporting normal values of penile measurements and their correlation with gestational age and other predictor variables. However, it is crucial to conduct follow-up studies on these participants to examine factors such as circumcision and other potential genital issues. In order to gain a more comprehensive understanding of the topic, it is recommended that future research endeavors focus on investigating these aspects. As no evidence on mean penile length and their significant correlation with various predicting variables particularly gestational age are available from Pakistan therefore comparison with previous national estimates is not possible. More such studies are needed on a larger scale from Pakistan to validate the current study findings using large data. In addition, other important issues like micropenis frequency and related complications should be addressed by primary collected data.

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#### LIMITATIONS OF STUDY

This study did not conducted follow-up of the participants to examine factors such as circumcision and other potential genital issues. In addition, the study was carried out in a single center on a limited number of samples.

#### CONCLUSION

In this study, a moderate positive significant relationship of gestational age was observed with both stretched penile length and penile circumference.

**Conflict of Interest:** None.

**Funding Source:** None.

#### Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

RT & MTN: Data acquisition, data analysis, critical review, approval of the final version to be published.

HJ & MJ: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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