ORIGINAL ARTICLE

# Testicular Normogram of North India

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**Abstract:**

**Aims and Objective:**
To chart a normal testicular volume with standard deviation of north Indian male children for reference value. This study was done to prepare a tabulated data of testicular volume range. This will help in comparing the testicular volume of patients with undescended testes, ectopic testes, and other pathology of testes to rule out small or large testes.

**Materials and Methods:**
This was a hospital based cross-sectional prospective study conducted on 205 male child from 2016-2020 at our institution. Testicular volume was measured by ultrasonography by a single sonologist.

**Results:**
Average right and left testicular volume with standard deviation was 0.6161 ± 0.36159 ml and 0.6178 ± 0.35836 ml respectively. In this study mean testicular volume of both testes was found to be 0.4901 ml, 0.5648 ml, 0.6073 ml, 0.7946 ml, 0.8959 ml, 0.6900 ml, 0.9044 ml, 0.8055 ml, 0.5975 ml, 0.8511 ml for 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 years respectively.

**Conclusion:**
We prepared a testicular normogram of north Indian paediatric population in relation with their age and weight. We found that there is no significant difference between right and left testicular volume.

**Keywords:**
North India, Normogram, Orchidometer, Testes, Testicular volume.

**Introduction:**
Testes are oval shaped paired gonadal organs in males situated in the scrotum. Any abnormality of testes will lead to decrease in fertility potential. Testes performs endocrine as well as reproductive functions. Sperm production is done by germ cells in testes. Seminiferous tubules constitute 80% of the testicular volume and the remaining 20% consist of leydig cells. Anterior pituitary gland produces gonadotropic hormones such as Luteinizing hormone (LH) and follicle-stimulating hormone (FSH). Anterior pituitary gland produced luteinizing hormone work on leydigs cells of the testes. This will leads to production testosterone hormone. Follicle stimulating hormone helps in spermatogenesis.[1,2] Testicular function can be assessed by testicular volume. Size of the testes directly related to testicular function.[3] Normal Testicular volume varies with racial ethnicity. Undescended testes and ectopic testes are the most common abnormalities of testes faced by paediatric surgeons. Testicular volume should be examined in suspected patients of smaller testes. It helps to make differential diagnosis. Following are the common causes of smaller testes: cryptorchidism, torsion testes, atrophic testes after mumps orchitis, prader-willi syndrome (hypogonadotropic hypogonadism),klinefelter syndrome, McCune Albright syndrome, fragile X syndrome .[4,5,6,7,8,9,10] To define the micro orchidism a reference value is required. We give a reference chart of paediatric testicular volume with statistical analysis in our study. Purpose of this study was to prepare a testicular normogram of north Indian pediatric population.

**Materials and Methods:**

This was a hospital based cross-sectional prospective study conducted on 205 healthy male children in J. K. Lon Hospital Sir Padampat Mother and Child Health Institute, Jaipur from 2016 to 2020. We included all healthy male children having no scrotal, testicular and abdominal abnormalities. Cases with undescended testes, ectopic testes, abdominal lump, hepatic mass and brain tumor were excluded from the study. Ultra sonography was done by single sonologist at our institute to avoid the observer's bias. The aim of this study was to prepare a chart of testicular volume with relation to the age of the children. Ultra sonography was done by measuring three dimensions of both testes after holding the testes to avoid the objective bias. Sonologist measured testicular length, width, and height with electronic calipers. Measures of epididymis were excluded. Sonography was performed after taking informed consent. Sonography was performed after explaining nature of the study to the participants and their parents and obtaining their informed consent. Testicular volume was measured by W x H x L x 0.52 equation in our study. Informed consent was taken from Parents of the child and from a child accent is taken.

**Data analysis:**

The Statistical Package for Social Sciences (SPSS) version 17.0 used for statistical analysis. Simple frequencies were used for measurement of testicular volume. Chi square test used to know the significance of testicular volume. Pearson correlation coefficient was used for correlation between testicular volume and age of children. We also did a comparative study of our data with other published paediatric testicular normogram.

**Table No.1: Statistical relation of testicular volume of both testes with variables age and weight**

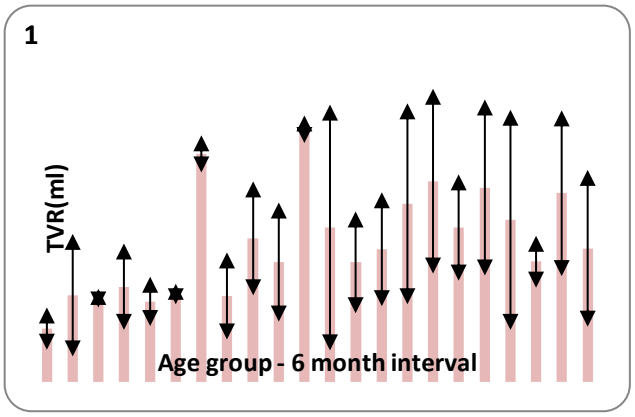
| Sr. no. | Age in Years | Weight in kg. | | | Right testicular volume (ml) | | | Left testicular volume (ml) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | N | Mean | SD | N | Mean | SD | N | Mean | SD |
| 1 | < 1 | 74 | 5.749 | 3.6404 | 82 | 0.4887 | 0.32728 | 82 | 0.4916 | 0.31906 |
| 2 | ≥1 to <2 | 28 | 9.539 | 3.4784 | 38 | 0.5518 | 0.23523 | 38 | 0.5779 | 0.26180 |
| 3 | ≥2 to <3 | 13 | 11.131 | 2.6905 | 23 | 0.6117 | 0.26260 | 23 | 0.6030 | 0.20932 |
| 4 | ≥3 to <4 | 11 | 13.555 | 2.1125 | 15 | 0.8200 | 0.46342 | 15 | 0.7693 | 0.41656 |
| 5 | ≥4 to <5 | 06 | 16.100 | 1.8407 | 11 | 0.9255 | 0.42648 | 11 | 0.8664 | 0.37471 |
| 6 | ≥5 to <6 | 04 | 14.900 | 3.2104 | 07 | 0.7114 | 0.24525 | 07 | 0.6686 | 0.20161 |
| 7 | ≥6 to <7 | 07 | 19.514 | 1.8032 | 09 | 0.8967 | 0.40494 | 09 | 0.9122 | 0.42334 |
| 8 | ≥7 to <8 | 06 | 18.483 | 10.047 | 09 | 0.7467 | 0.50799 | 09 | 0.8644 | 0.64209 |
| 9 | ≥8 to <9 | 01 | 21.000 | - | 02 | 0.5550 | 0.12021 | 02 | 0.6400 | 0.09899 |
| 10 | ≥9 to <10 | 09 | 28.544 | 6.3697 | 09 | 0.8711 | 0.38264 | 09 | 0.8311 | 0.43030 |
| 11 | Total | 159 | 10.490 | 7.2843 | 205 | 0.6161 | 0.36159 | 205 | 0.6178 | 0.35836 |

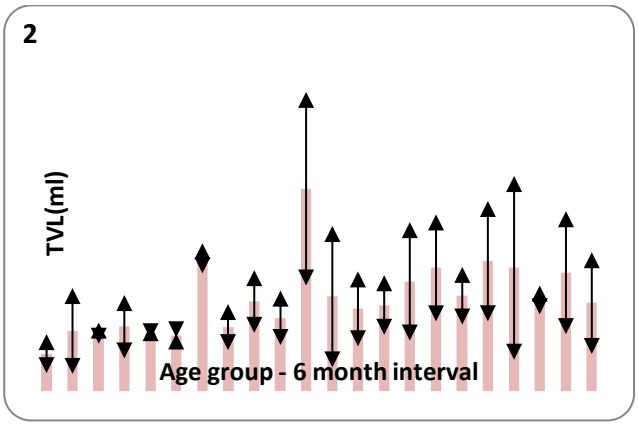
**Table No.2: Comparison of our study data with other studies**

| Sr. No. | Age in Years | Average volume (ml) of both testes (our study) | | Osemlak [11] Mean ± SD | |
|---|---|---|---|---|---|
| | | N | Mean ± SD | N | Mean ± |
| 1 | 1 | 74 | 0.4901 ± 0.3231 | | |
| 2 | 2 | 38 | 0.5648 ± 0.2485 | 17 | 0.55 ± 0.22 |
| 3 | 3 | 23 | 0.6073 ± 0.2359 | 17 | 0.64 ± 0.19 |
| 4 | 4 | 15 | 0.7946 ± 0.4399 | 17 | 0.78 ± 0.21 |
| 5 | 5 | 11 | 0.8959 ± 0.4005 | 17 | 0.67 ± 0.19 |
| 6 | 6 | 07 | 0.6900 ± 0.2234 | 17 | 0.78 ± 0.24 |
| 7 | 7 | 09 | 0.9044 ± 0.4141 | 17 | 0.68 ± 0.21 |
| 8 | 8 | 09 | 0.8055 ± 0.5750 | 17 | 0.81 ± 0.23 |
| 9 | 9 | 02 | 0.5975 ± 0.1096 | 17 | 0.85 ± 0.31 |
| 10 | 10 | 09 | 0.8511 ± 0.4064 | 18 | 1.36 ± 0.61 |
| | Total | 205 | 0.6169 ± 0.3599 | | |

**Table No.3: Comparison of our study data with other studies**

| Sr. no. | Age in Years | Average volume (ml) of both testes (our study) | | Goede et al. [12] | |
|---|---|---|---|---|---|
| | | N | Mean ± SD | N | Mean ± SD |
| 1 | 1 | 74 | 0.4901 ± 0.3231 | | |
| 2 | 2 | 38 | 0.5648 ± 0.2485 | 38 | 0.46 ± 0.09 |
| 3 | 3 | 23 | 0.6073 ± 0.2359 | 36 | 0.51 ± 0.15 |
| 4 | 4 | 15 | 0.7946 ± 0.4399 | 38 | 0.51 ± 0.16 |
| 5 | 5 | 11 | 0.8959 ± 0.4005 | 48 | 0.58 ± 0.15 |
| 6 | 6 | 07 | 0.6900 ± 0.2234 | 42 | 0.63 ± 0.26 |
| 7 | 7 | 09 | 0.9044 ± 0.4141 | 62 | 0.65 ± 0.17 |
| 8 | 8 | 09 | 0.8055 ± 0.5750 | 59 | 0.66 ± 0.22 |
| 9 | 9 | 02 | 0.5975 ± 0.1096 | 53 | 0.79 ± 0.46 |
| 10 | 10 | 09 | 0.8511 ± 0.4064 | 53 | 0.79 ± 0.46 |
| | Total | 205 | 0.6169 ± 0.3599 | | |


1
TVR(ml)
Age group - 6 month interval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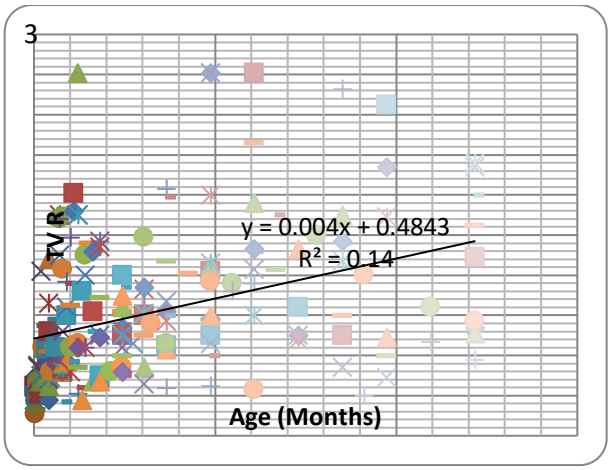
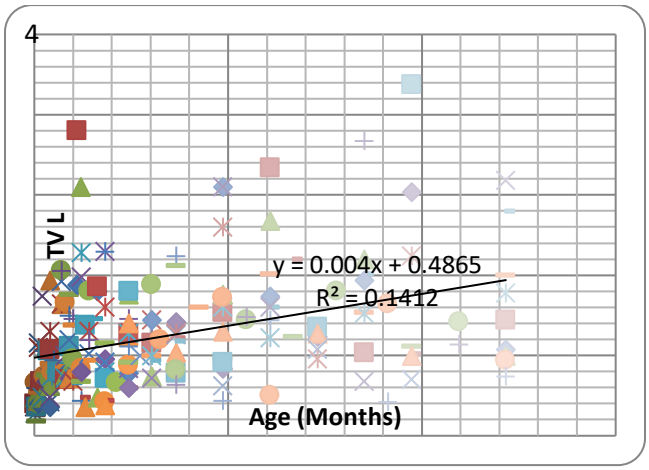
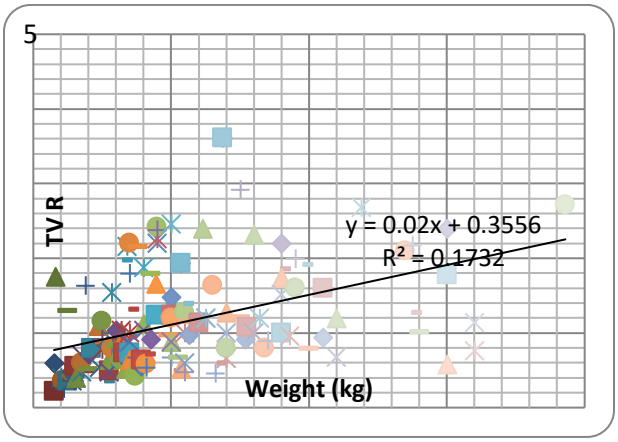
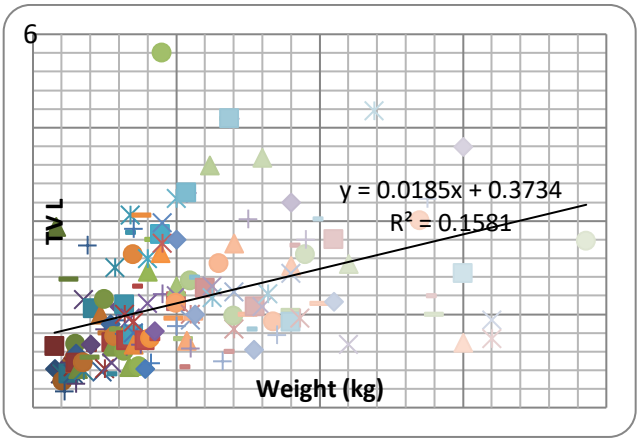
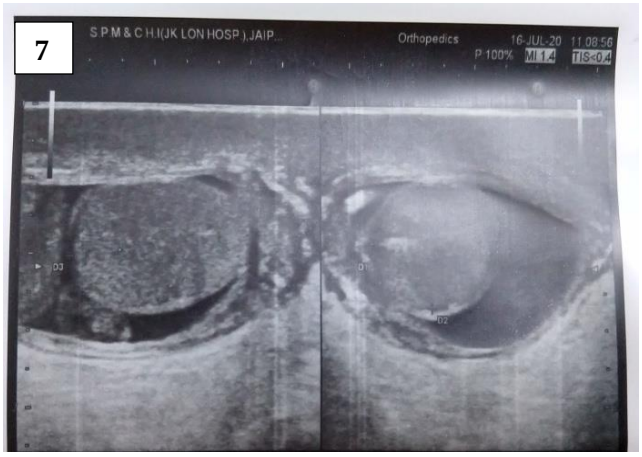
TVL(ml)
Age group - 6 month interval


3
TV R
y = 0.004x + 0.4843
R² = 0.14
Age (Months)


4
TV L
y = 0.004x + 0.4865
R² = 0.1412
Age (Months)


5
TV R
y = 0.02x + 0.3556
R² = 0.1732
Weight (kg)


6
TV L
y = 0.0185x + 0.3734
R² = 0.1581
Weight (kg)



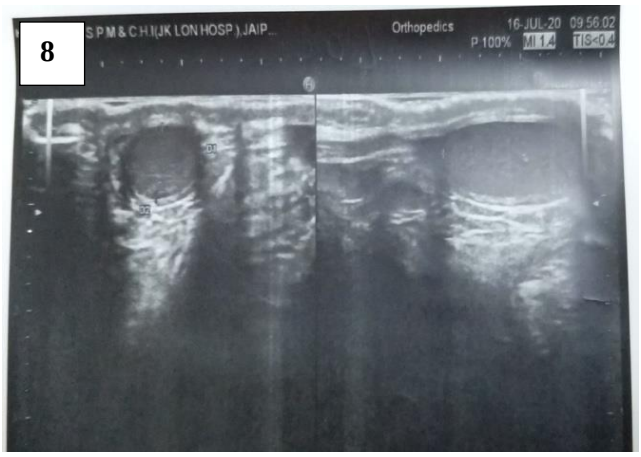




**Figure 1& 2:** Bar chart of right and left testicular volume in ml, relation with age in months (group 1 for 6-month, group 2 for 12-month, group 3 for 18 month etc.).
**Figure 3 & 4:** Scattered square dot graph of right and left testicular volume in ml (vertical axis), relation with age (in months, horizontal axis).
**Figure 5 & 6:** Scattered square dot graph of right and left testicular volume in ml (vertical axis), relation withbody weight (horizontal axis).
**Figure 7 & 8:** Showed USG photograph of testes.

**Results:**

We collected data from 205 male children of different age groups ranging from newborn up to 10 years of age. Average right testicular volume with standard deviation was 0.6161 ±0.36159 ml and 0.6178 ± 0.35836 ml for right and left testis respectively. Reference chart for testicular volume of both testes with relation with age and body weight is mentioned in table 1. Mean testicular volume of right testes ranges between0.2463 ml to 1.1650 ml and left testicular volume ranges between 0.2626 ml to 1.4200 ml. Table 1 shows testicular volume of right and left testis with respect to the age group. There is no statistical correlation between body weight and testicular volume. There were no significant differences between the right and left testis for the age group 1 year to 10 years.

In this study mean testicular volume of both testes are 0.4901 ml, 0.5648 ml, 0.6073 ml, 0.7946 ml, 0.8959 ml, 0.6900 ml, 0.9044 ml, 0.8055 ml, 0.5975 ml, 0.8511 ml for 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 years respectively (Table 2 and3).

**Discussion:**

There are various methods to measures thetesticular volume. Testicular volume can be calculated by rulers, vernier calipers, graphic models, Prader's orchidometer, punched-out orchidometer, water displacement method, ultrasonographic measures etc.[13,14,15,16,17,18,19]. Punched out orchidometer is made up of sixteen punched out ellipses of different size. Testicular volume measured by fitting testis in compatible ellipse. It was introduced in 1983. It is also known as Yamaguchi University or Rochester University or Takihara orchidometer[14].

Prader's orchidometer is a clinical instrument to measure testicular volume. It consists of twelve ellipsoid wooden or plastic balls. These ellipsoid balls are held by string with increasing order from

1 milliliter to 25 milliliter. This orchidometer was invented in 1966 by Swiss pediatric endocrinologist Andrea Prader of the University of Zurich. Testicular volume is measured clinically by comparing the testes with the balls of praders orchidometer[13]. By ultrasonography, we can calculate the testicular volume by three ellipsoid equations. These equations are W2 x L x 0.52 (equation 1); to the equation W x H x L x 0.52 (equation 2); and to the equation W x H x L x 0.71 (equation 3) (W = width, H = height, L = length)[20].

P O Semlak et al reported the mean testicular volume of both testes 0.55 ± 0.22, 0.64 ± 0.19, 0.78 ± 0.21, 0.67 ± 0.19, 0.78 ± 0.24, 0.68 ± 0.21, 0.81 ± 0.23, 0.85 ± 0.31, 1.36 ± 0.61 for 2,3,4,5,6,7,8,9,10 years respectively [11].For same age group, J. Goede et al. also reported the mean testicular volume of both testes 0.46 ± 0.09, 0.51 ± 0.15, 0.51 ± 0.16, 0.58 ± 0.15, 0.63 ± 0.26, 0.65 ± 0.17, 0.66 ± 0.22, 0.79 ± 0.46, 0.79 ± 0.46 ml[12]. Testicular volume in our study was comparable to these study data (Table no. 2 and 3).

**Conclusion:**

This study provides an ultrasound measured testicular normogram of north Indian paediatric population from day one to ten years of age. Here, we charted an ultrasound measured testicular normogram. We observed that there were no significant difference between right and left testicular volume. The testicular volume increases with age. Same age group children have different but normal testicular volume is explained by their volume of testes at birth. About the knowledge of normal range of testicular volume with relation to age of children will help in early diagnosis of testicular pathology. Early diagnosis automatically helps in early institutional intervention.

**Conflict of Interest** - Nil

**Sources of Support** - Nil

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