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## Testicular volume in Japanese boys up to the age of 15 years

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**Abstract** Previous studies have indicated that Japanese children grow and mature significantly faster than Caucasian children, thus calling for a separate reference standard for each skeletal and sexual maturity index. To establish normal reference values for testicular volume in Japanese boys, we studied from 1985 to 1995, 900 healthy male children of 0 to 15 years of age for medical history, physical examination, height, weight, sitting height, and head circumference measurements, Tanner sex maturity stage, and testicular size. The testicular volume was determined using a Prader orchidometer by the same observer (N.M.). Based on these data, we established the cross-sectional percentile growth curves (90th, 50th, 10th percentiles) for testicular volume of Japanese boys. The testicular volume of 3 ml was attained at 9.3 years of age (90th percentile), 11.0 years of age (50th percentile), and 12.1 years of age (10th percentile), respectively.

**Conclusion** Swelling of the testis in Japanese children begins approximately 1 year earlier than in Swiss children in accordance with the earlier skeletal maturation in Japanese children.

**Key words** Prader orchidometer · Testicular size · Cross-sectional data · Puberty

### Introduction

Assessment of the testicular volume provides useful on-site information on the spermatogenesis of an individual. Although the accuracy of the measurements has been challenged by several investigators [1, 7], the Prader orchidometer remains clinically the most useful tool and is widely used in practice [3, 4, 6, 8, 9]. There have been at least three investigations on the testicular volume in Swiss [9], Israeli [10], and Italian [2] children determined with the Prader orchidometer, showing apparent ethnic differences. However, there is no reference standard available for Japanese children, similarly assessed with the Prader orchidometer, who tend to mature faster than their Caucasian counterparts. In this study, we have attempted to establish norms for testicular volume of Japanese children.

### Subjects and methods

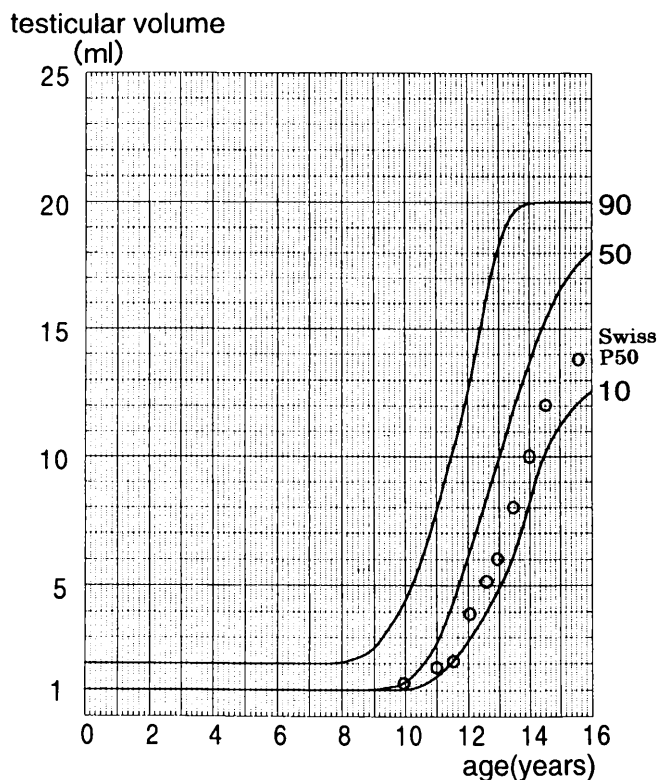
This study was conducted at the Out-Patient Clinic, Keio University Hospital from 1985 until 1995. The subjects were derived from male Japanese children in the Tokyo metropolitan area seen in our clinic for minor illnesses or at the time of well child check-up during the above-mentioned period. All were from well-to-do families and did not have a past history of major illnesses or chronic diseases and underwent the routine physical examination to confirm that each subject did not have dysmorphic features or a detectable abnormality. All were weighed and measured for height (> 2 years) or length (2 years of age), sitting height (> 5 years of age), and head circumference. Those who were below -2 SD or above +2 SD for each measurement were excluded. The Tanner secondary sexual stage was assessed in all by one of the co-authors and the testicular volume was determined with the Prader orchidometer by one investigator (N.M.).

## Results

The results are given in Table 1 and Fig. 1. The mean values and the 50th percentile values are given in Table 1. The 50th percentile values were lower than the mean values, indicating a skewed distribution. Thus, the percentile growth curves of the testis were drawn for clinical use (Fig. 1). The 3rd percentile and 97th percentile curves were not included, since the number of children in each age range was less than 100. For comparison, the Swiss 50th percentile value was plotted in our reference curves, indicating earlier maturation of Japanese children. A testicular volume of 3 ml, the earliest pubertal sign in males, was reached at 9.3 years of age for the 90th percentile value, at 11.0 years of age for the 50th percentile value, and at 12.1 years of age for the 10th percentile value, respectively.

**Table 1** Skewed distribution of testicular volume

| Age group (years)      | 9.5 | 10.5 | 11.5 | 12.5 | 13.5 | 14.5 |
|------------------------|-----|------|------|------|------|------|
| <i>N</i>               | 43  | 54   | 62   | 97   | 93   | 74   |
| Testicular volume (ml) |     |      |      |      |      |      |
| P50                    | 1   | 2    | 4    | 8    | 12   | 15   |
| Mean                   | 2   | 2.8  | 4.6  | 8.6  | 12.4 | 15.9 |



**Fig. 1** Japanese cross-sectional standard testicular percentile growth curve and comparison with the Swiss 50th percentile (open circles) for testicular volume

## Discussion

The findings of this study further confirm and extend the fact that Japanese children mature significantly faster than Caucasian children. In short, the enlargement of the testis starts and proceeds 1 year earlier in Japanese children than in Swiss children. It is in accordance with our previous study on bone age of both sexes, showing approximately 1 year earlier skeletal maturation in Japanese adolescent children compared to their Swiss counterparts [5]. Our unpublished data show earlier ossification of the sesamoid bone of the thumb in Japanese children than in Swiss children (Anzo M, Matsuo N, unpublished data). Our previous data also showed that the mean menarchial age was approximately 1 year younger in Japanese girls than in Swiss girls [5]. Thus, we suspect that the difference between Japanese and Swiss children is due to the true ethnic difference. However, the observed difference could be in part due to the secular trend and/or measurement bias; (1) there are about 20 years time difference at the time of the study between the Swiss data [9] and the present Japanese data and (2) interobserver coefficient of variation is known to be relatively large for the orchidometer estimates of the testis. For the secular trend, the accelerated tempo of growth and maturation has persisted during the past century in both countries. Thus, the reliable inference could be drawn regarding the effects of the secular trend on the observed difference, if the more recent Swiss data are available. Unfortunately, there have been no such data published since then and the magnitude of such effects remains to be determined. For the measurement bias, the possibility that the observer (N.M.) tended to give larger readings cannot be excluded [1]. However, the testicular sizes, 2 ml and 3–4 ml, are unequivocally distinguishable by an observer experienced in the use of the Prader orchidometer, supporting the primary finding of the present study that swelling of the testis begins earlier in Japanese children than in Swiss children. Our experience with the Prader orchidometer apparently differs from that of Rivkees et al. [7].

In conclusion, Japanese children grow and mature 1 year faster than Swiss children, although the precise degree of difference needs to be determined.

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