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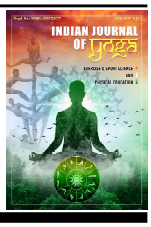

Discussion

AGE AT MAXIMUM GROWTH SQURT IN BODY HEIGHT AND WEIGHT FOR WEST BENGAL SCHOOL CHILDREN AGED 6-17 YEARS

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ABSTRACT

The present study was conducted among the boys and girls of Birbhum District, West Bengal, India in order to evaluate the pattern of growth in height and weight of these middle-class Bengali children. The data comprises 600 children (300 boys and 300 girls) ranging in age from 6-17 years, measured cross-sectionally. The present study reveals that the girls attain peak Height and weight Velocity earlier than boys. The results revealed that the age at Peak Height Velocity (PHV) and Peak Weight Velocity (PWV) for Bengali boys 13-14 years and for Bengali girls for 11-12 years.

Introduction

The chronological age only provides a rough estimate of children's developmental age and often they do not coincide due to the great individual variations in growth. Thus, it is more suitable to use the developmental age to monitor a child growth. Growth reference values appear essential in orthodontic, pediatric dentistry and general dentistry clinics. These values are also useful information in research and in delivering quality healthcare. It has been reported previously that the growth of various facial dimension correlate well with the growth in body height. According to Bjork and Helm, a child's growth in body height was divided into 4 different stages namely the infantile, the juvenile, the puberty (early adolescence) and the late adolescence growth stages with the last stage getting completed at the age of 18-20 years. The adolescent growth spurt is one of the dramatic physical changes that accompany pubertal development. The rate of growth during the adolescent growth spurt is greater than at any other time of life after infancy. The rate of growth varies throughout childhood and adolescence. It is highest immediately after birth, thereafter, falling rapidly until about 5-6 years of age then leveling out until there is a further increase between the ages of 10 and 16 years associated with puberty. It has been reported that the orthodontic treatment including growth modification therapy is more effective during the period of increased growth and the orthognathic jaw corrective surgery treatment is best performed when most of the facial growth is completed. The orthodontists, therefore, are aware of the impact of maximum growth spurt on treatment outcome and the importance of monitoring patient growth during evaluation of the treatment progress. Differences in growth rates of children have been reported among various populations. Moreover, populations of developing societies might show changes in body size over generations due to significant improvement in the nutritional health system in the 20th century. It becomes essential therefore to establish growth standard values for every population, and to update these

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standard values at regular intervals in order to reflect the changes in children's growth and development. The cross-sectional studies have been used to provide growth standards for different populations (Emran 2022).

Growth velocity is independent of the height and weight achieved by a child so it is a sensitive indicator of good or bad health regardless of previous growth delay. The height is relatively a stable measurement of growth as opposed to body weight which reflects only the present health status of the child. On the other hand, the height and weight indicate the events in the past also. The use of growth (height and weight) chart is particularly valuable in studying the trend of height and weight curve (Mansur et al.2015).

Thus, knowledge about the present average height and weight for particular age group helps for regular monitoring of a child's growth and development. The perfect time for monitoring the proper growth and development is the growing period. So, this study was done in school going children of West Bengal in order to evaluate the pattern of growth in height and weight among them.

Material and Methods

The material for the present study was based on a cross-sectional data collected on 600 healthy children (300 Boys and 300 Girls) class (I to XII) aged 6-17 years, from Srinanda High School in Bolpur Municipality, Birbhum, West Bengal, India. Disabled children were excluded from the study. Age, height and weight of each child was recorded in year, kilogram and in centimetre respectively. From each class (l to XII) twenty-five boys and twenty five girls data were randomly collected. Body weight and height were measured three times by standard instruments and average were taken. Then separately average was calculated for each class. Peak height velocity (PHV) and peak weight velocity (PWV) were plotted through the excel software programme.

Results

The result of the anthropometric measurement of peak height and weight velocity in the different age groups of West Bengal School Children depicted in the following Figures and Tables. Peak height and weight velocity for boys was reached in the age of 13-14 years (Figure and Table No.-1 & I, 2 & II). Whereas Peak height and weight velocity in girls was reached in 11-12 years in West Bengal School Children (Figure and Table No.- 3 & III and 4 & IV).

Figure-1: Peak Height Velocity (PHV) for Boys

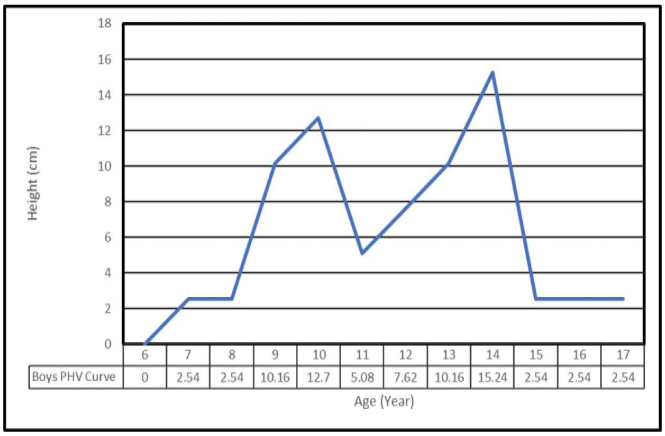

Table-I: Peak Height Velocity (PHV) for Boys

Age (Year)	Boys Height (cm)	Boys PHV Curve
6	104.14	0
7	106.68	2.54
8	109.22	2.54
9	119.38	10.16
10	132.08	12.70
11	137.16	5.08
12	144.78	7.62
13	154.94	10.16
14	170.18	**15.24**
15	172.72	2.54
16	175.26	2.54
17	177.80	2.54

Figure-2: Peak Weight Velocity (PWV) for Boys

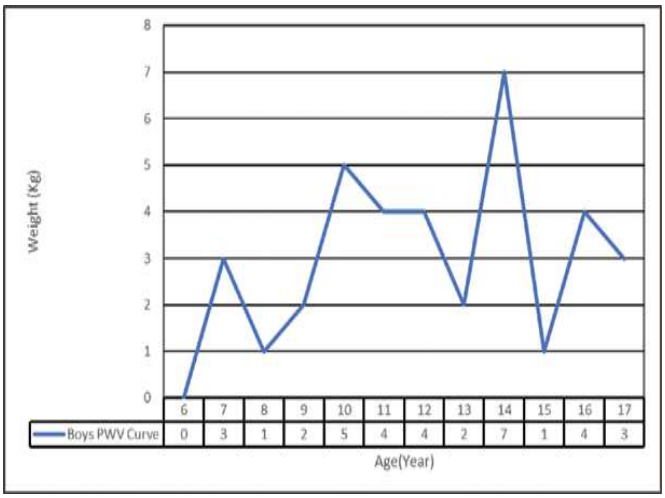

Table-II: Peak Weight Velocity (PWV) for Boys

Age (Year)	Boys Weight (kg)	Boys PWV Curve
6	16	0
7	19	3
8	20	1
9	22	2
10	27	5
11	31	4
12	35	4
13	37	2
14	44	7
15	45	1
16	49	4
17	52	3

Figure-3: Peak Height Velocity (PHV) for Girls

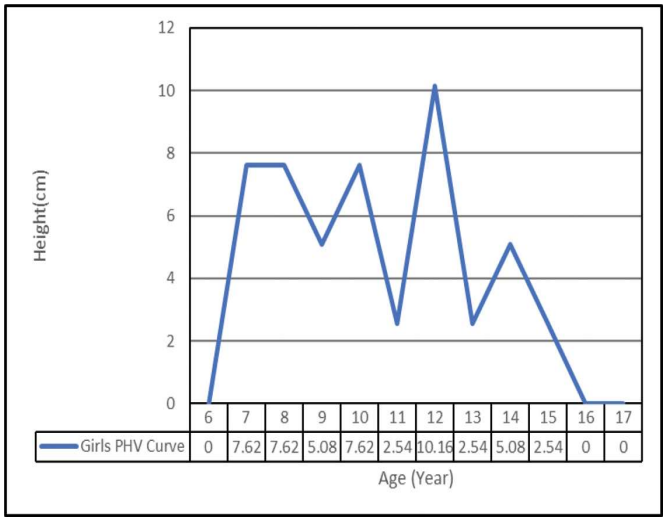

Table-III: Peak Height Velocity (PHV) for Girls

Age (Year)	Girls Height (cm)	Girls PHV Curve
6	104.14	0
7	111.76	7.62
8	119.38	7.62
9	124.46	5.08
10	132.08	7.62
11	134.62	2.54
12	144.78	**10.16**
13	147.32	2.54
14	152.40	5.08
15	154.94	2.54
16	154.94	00
17	154.94	00

Figure-4: Peak Weight Velocity (PWV) for Girls

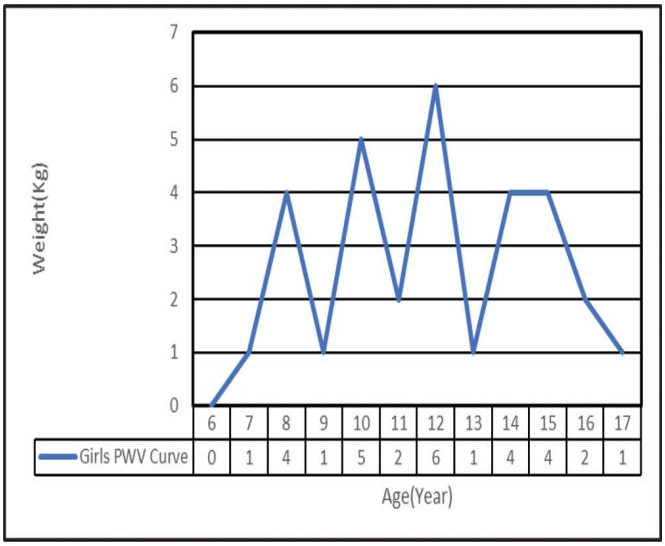

Table-IV: Peak Weight Velocity (PWV) for Girls

Age (Year)	Girls Weight (kg)	Girls PWV Curve
6	16	0
7	17	1
8	21	4
9	22	1
10	27	5
11	29	2
12	35	**6**
13	36	1
14	40	4
15	44	4
16	46	2
17	47	1

Discussion

Updating growth references and standards is necessary because with changing socioeconomics standards and demographic changes children's growth patterns also change and secular trends can be incorporated in the updated growth chart. This is particularly true in a developing country as nutrition transition influences growth patterns significantly and secular trends can be marked over a short time period (Khadilkar et al. 2015). Growth reference charts are essential to assess an appropriate growth of individual children. Anthropometric measurement of height and weight is the most widely accepted method for the evaluation of growth of children. Although growth velocity measurement (like most methods of growth monitoring) is of limited clinical

value in primary care in developing countries, it has advantages as an epidemiological tool when compared with static anthropometric measurements. Velocity is more time specific than a distance measure like height and weight for age: a normal velocity indicates current good health in children who are stunted from previous causes, and a reduced growth velocity suggests poor health even in children whose growth has not yet faltered appreciably on a distance chart (Mansur et al.2015).

In the present study, it was concluded that the age at peak height and weight velocity was 13-14 years in boys and 11-12 years in girls respectively. The results of present study were also supported by various National and International studies. Such as a study was done by Prabhjot et al. (2005) reported that Peak Height Velocity (PHV) among girls between 11-12 years and boys 12-13 years in Indian Children. Prabhjot et al. (2005) also reported that Peak Height Velocity (PHV) for American boys was 12-13 years and girls it was 11-12 years. Tanaka et al. (1988) reported that a mean age of Peak Height Velocity (PHV) to be 11.2 years in girls and 13 years in boys for Japan Children. Lee et al. (2004) reported that the mean age at Peak Height Velocity (PHV) was 12.5 years for boys and 10.5 years for girls in Taiwan School Children. Chae et al. (2013) reported that age at Peak Height Velocity (PHV) was 12 years in boys and 10 years in girls for Korea School Children. Largo et al. (1978) reported an average Peak Height Velocity (PHV) of 12 years in girls and 14 years in boys. Mansur et al. (2005) observed that Peak Height Velocity (PHV) of girls 11-12 years and of boys 12-13 years for Nepalese School Children. Emran et al. (2022) reported that the age at peak height velocity for Saudi boys is 13- 14 years and Saudi girls is 10 -11 years. Hauspie et al. (1980) observed that the adolescent growth spurt in the Indian similar to that seen in the British children, as is the age at which it occur (peak height at 14.0 years in boys, 12.5 years in girls). Satake et al. (1993) reported that ages at which peak height & weight velocity occurred, on average, earlier in Japanese (boys 12.6 — 13.4 years and girls 10.8 — 11.5 years) than in European and North American children. Chavalittamrong et al. (2007) reported that the age of peak height velocity was earlier than the peak weight velocity in both boys and girls in Bangkok school children.

Sharma (1970) reported that peak height velocity in Maharashtrians (India) Children, 14.0 years in boys and about 11.0 years in girls. Seth et al. (1972) reported that peak height velocity is around 12.5 years of age in girls in the State of New Delhi. Kaul et al. (1976) observed that peak height velocity in Madhya Pradesh (India) children 14.0 years in boys and 11.5 years in girls. Dabas et al. (2018) reported that Peak Height Velocity (PHV) at 12-12.9 years for boys and 10-10.9 years for girls in North Indian School Children.

It is only after puberty that children from US and Europe go on to become taller as adults. This reflects accurately the observation made by Gopalan (1989) between American subjects and two Asian groups (Japanese and affluent Indian). Having observed that pre-adolescent children in India have similar growth and stature as those from America and Europe, Gopalan then goes on to ask whether the difference in height gains during adolescence between US subjects and Indians reflected a true genetic difference, or whether it *was* explanable on the basis that the secular trend in the growth of children in developing countries, even among the affluent sections, has not yet reached the plateau stage of completion (Virani 2005).

Genetic factors set a ceiling on growth but become effective only when nutritional and other factors have reached an optimal level (Dugdale et al. 1970). Children with backgrounds of under nutrition start by being shorter during their pre-pubertal phase, but then haveohe normal growth intensities during puberty and a longer growth period resulting in a greater increment in height during puberty (Satyanarayana et al. 1989). Eveleth and Tanner (1990) observed that in India, as far as child growth is concerned, dissimilarities are brought about mainly by socio-economic differences rather than ethnic variation. Other scientist concluded that children from different regions of India have similar growth characteristics when brought up within the same environment (Chatterjee and Mandal, 1994).

Conclusions

Growth hormone, while being essentially unimportant for fetal development, is the most important hormone for postnatal growth. However, growth overall is a complex phenomenon that is affected not only by growth hormone and somatomedins, but also, thyroid hormones, androgens, estrogens, glucocorticoids and insulin. It is also affected of course by genetic factors, and it depends on adequate nutrition. It is normally accompanied by an orderly sequence of maturational changes, and it involves secretion on of protein and increase in length and size, not just an increase in weight.

However, all studies including the present study have shown almost similar growth patterns during childhood. The data of the present study developed the mean height and weight reference charts for children aged between 6-17 years old residing in Bolpur Municipality, Birbhum, West Bengal, India. The trend of physical growth as

observed in height and weight may be expected to serve as the growth standards of West Bengal children. The mean values of height and weight of children indicate positive correlation with age among both the sexes. The age of Peak Height Velocity (PHV) and Peak Weight Velocity (PWV) is an important indicator of tempo growth of a population and the girls in the present study attain peak height velocity and peak weight velocity one year earlier than of boys.

This is one of the basic studies which provide the basic data on child growth which could be utilized by anatomists, forensic experts, anthropologists, and nutritionists. It may also help pediatricians in their clinical practices.

However, the growth charts of West Bengal children presented could serve as a better reference for future comparisons. It is recommended to have a large number of such studies involving large group of children, both boys and girls from various parts of the country to deduce a West Bengal standard.

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