

TIMING OF ADOLESCENT GROWTH SPURT AND PREDICTED ADULT HEIGHT IN BOYS IN RELATION TO BMI IN PREPUBERTAL PERIOD

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Background

Time of 1-2 years before the beginning of puberty can be considered as a critical period conditioning the rate of growth during puberty. In boys, the influence of BMI in the prepubertal period on the time of the growth spurt is unambiguous.

Aim

To investigate whether the BMI at the age of 8 years is associated with early and late markers of adolescent growth spurt such as: age at take-off (ATO), age at peak height velocity (APHV), velocity at take-off (VTO), peak height velocity (PHV), growth spurt duration (Δ APHV-ATO), and predicted adult height (PAH) in boys

Methods

This longitudinal study included 133 boys for whom body mass and body height measurements were obtained in 2, 4, 6, 8, 10 years of age. BMI was calculated on the basis of measurements obtained at 8 years of age, with the use of IOTF criteria. The structural growth model JPA2 available in the AUXAL SSI 3.1 program was used to assess selected markers of growth spurt.

$$y(t) = A \cdot \left[1 - \frac{1}{1 + \left(\frac{t+E}{D_1}\right)^{C_1} + \left(\frac{t+E}{D_2}\right)^{C_2} + \left(\frac{t+E}{D_3}\right)^{C_3}} \right] + \varepsilon$$

where
 t = postnatal age; Y = height reached at age t ; A = adult height; E = estimated prenatal duration of growth; D_1, D_2, D_3 = time-scale factors; C_1, C_2, C_3 = dimensionless exponents

Results

A significant negative correlation has been found between BMI and a) APHV ($r = -0.23$; $p < 0.05$), and b) PHV ($r = -0.22$; $p < 0.05$), positive correlation has been shown between BMI and VTO ($r = 0.24$). There were no relationship between BMI in prepubertal period and ATO, as well as PAH. BMI differed the age at PHV ($H = 22.53$; $p < 0.001$). The APHV was lowest in obese and overweight boys (APHV = 13.54 y). The latest PHV was observed in underweight boys (PHV = 13.92). BMI also affected the VTO ($H = 16.42$, $p < 0.001$) and PHV ($H = 10.6$, $p = 0.034$) (Tab. 1 and Fig. 1).

Table 1. Selected parameters of adolescent growth spurt in underweight, normal and overweight boys

	Underweight (n=14)	Norm (n=92)	Overweight/obese (n=27)	H	p
ATO (years)	10.45 (SD=0.45)	10.19 (SD=0.68)	10.40 (SD=0.48)	8.4	ns
VTO (cm/year)	4.67 (SD=0.75)	4.86 (SD=0.65)	5.36 (SD=0.58)	16.42	<0.001
APHV (years)	13.92 (SD=0.53)	13.62 (SD=0.55)	13.54 (SD=0.67)	22.53	<0.001
PHV (cm/year)	9.53 (SD=1.99)	9.14 (SD=1.12)	8.84 (SD=1.81)	10.6	0.034

ATO – age at take-off, VTO – velocity at take-off, APHV – age at peak height velocity, PHV – peak height velocity

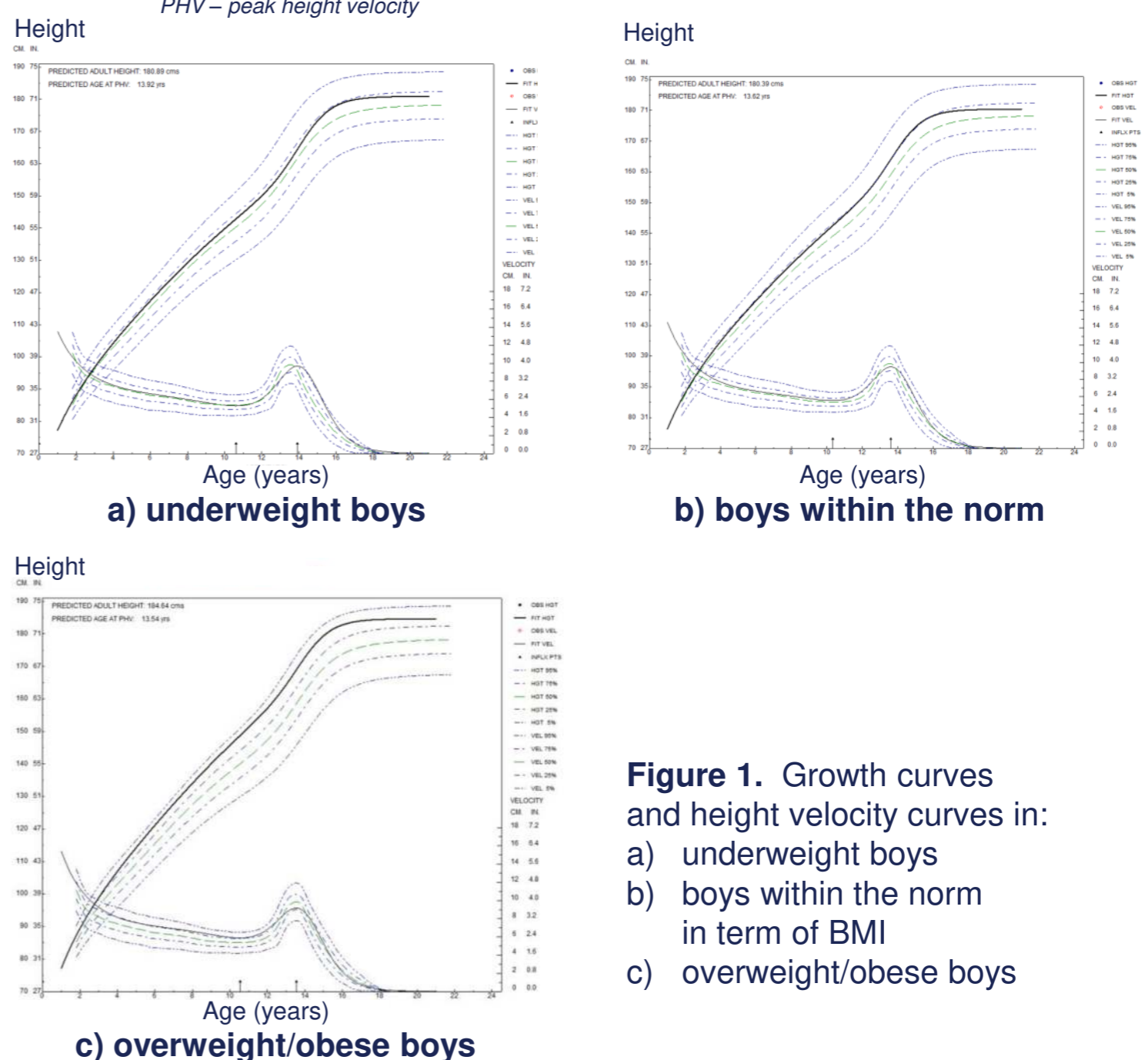


Figure 1. Growth curves and height velocity curves in: a) underweight boys b) boys within the norm in term of BMI c) overweight/obese boys

Conclusions

Prepubertal BMI in boys may not be critical for the initiation of the pubertal growth spurt but affects the progression of pubertal development resulting in earlier PHV, and does not affect final height.