

Italian cross-sectional growth charts for height, weight and BMI (2 to 20 yr)

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ABSTRACT. The aim of this study is to extend to pre-school ages the Italian Society for Pediatric Endocrinology and Diabetes (SIEDP)-2002 growth charts for height, weight and body mass index (BMI), to obtain charts (SIEDP-2006) that apply to the Italian population from 2 to 20 yr of age, taken as a whole, or separately in two geographical areas (Central-North Italy and South Italy). The charts are based on a sample of about 70,000 subjects attending infant, primary and secondary schools, between 1994 and 2004. The distribution of the sample by gender, age and geographic area was roughly similar to that of Italian school population in the last decade of the 20th century. Height and weight were measured using portable Harpenden stadiometers and properly calibrated scales, respectively. SIEDP-2006 references are presented both as centiles and as LMS curves for the calculation

of SD scores, and include the extra-centiles for overweight and obesity. Large differences in BMI growth pattern emerged between the SIEDP-2006, 2000 CDC and UK90 references: in Italy, BMI is higher and its distribution is more skewed during childhood and adolescence. At the end of growth, median values of the three references are similar, but the 97th centile of 2000 CDC charts is much higher and increases more steeply than that of SIEDP-2006 charts, which on the contrary reach a plateau. SIEDP-2006 references intend to supply pediatricians with a tool that avoids the use of charts that are outdated or that refer to other populations, and thus should be suitable for adequately monitoring the growth of their patients.

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INTRODUCTION

In 2002, under the sponsorship of the Italian Society for Pediatric Endocrinology and Diabetes (SIEDP), Cacciari et al. (1) published the first Italian reference charts for height, weight and body mass index (BMI), traced on the basis of a sample of over 54,000 schoolchildren aged 6 to 20 and covering 16 of the 20 Italian regions. SIEDP charts were presented as a tool that would avoid pediatricians the use of charts which were outdated or

not based on Italian populations, and thus would be suitable for adequately monitoring the growth of their patients.

The use of SIEDP reference, however, was limited by three drawbacks: (1) they did not consider children aged under 6; (2) charts for Central-North and South Italy were given, but not charts for the whole of Italy that could apply to a child who had one parent from the North and the other from the South; (3) the thresholds for height defined as "mean -2 SD" and "mean -3 SD" were not given, these are among the criteria included in the consensus for the diagnosis and treatment of GH deficiency in childhood and adolescence (2).

To overcome the above drawbacks a new edition of SIEDP growth charts is here presented, which includes a further sample of about 14,000 infants aged 2 to 6 and attending kindergarten.

Key-words: Italian growth charts, height centiles, weight centiles, BMI centiles, overweight.

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SUBJECTS AND METHODS

Sampling plan

In accordance with the protocols of the previous (1) and present study, in each region a sample proportional to the size of the school population had to be collected, schools being the sampling units. School and general population overlap between 6 and 14 yr, when the attendance at school is obligatory. From 2 to 6 yr of age the infant school population is about 95% of the general population, whereas from 15 to 19 yr the school population is about 80% of the general population. The prefixed sample size was suitable for providing the extreme centiles (ie the 3rd and 97th) of height and weight with standard errors <0.25 cm and 0.10 kg at 3 yr and <0.5 cm and 0.8 kg at the adult age.

During the study all schools selected participated in the study, and all children at school in the morning of the visit were measured. The protocol violations which occurred in the previous study are discussed in the paper by Cacciari et al. (1). As for the present study, the actual sample size (13,735 infants between 2 and 6 yr: 6623 girls and 7112 boys) was by about 13% lower than that prefixed by the protocol (15,824 babies: no data were collected in Trentino Alto Adige, Marche, Basilicata and Sardinia (these Regions were supposed to supply 1306 subjects), whereas the prefixed sample size was exceeded by Tuscany (92%), Campania (18%) and Sicily (19%). As already discussed at length in the previous paper we considered the bias arising from this protocol violation negligible.

The measurements were taken between 1996 and 2000 in the previous study (except for Campania which supplied data collected between 1990 and 1994), and between 1999 and 2004 in the present study. Growth references here presented are based on a sample of 69,917 subjects, 34,690 girls and 35,227 boys (SIEDP-2006 series). As for Central-North Italy (Piedmont, Lombardy, Veneto, Liguria, Emilia-Romagna, Tuscany, Marche, Umbria and Lazio), the sample was made up of 34,745 subjects, whereas South Italy sample (Abruzzo, Molise, Campania, Puglia, Calabria, Sicily and Sardinia) included 35,172 subjects. For age classes from 3 to 18 yr, 2 to 6 thousand subjects were recruited; sample size was smaller for age classes 2 (166 subjects), 19 (1,232 subjects) and 20 (198 subjects). Children of immigrants were excluded from the analysis.

The growth charts here presented refer to the whole of Italy and also to Central-North and South Italy, separately. Central-North and South Italy charts are often required (3), because of the large differences that still exist between Central-North Italy and South Italy as regards genetics, environment, socioeconomic conditions, life habits, diet and consequently somatic growth (1, 3).

Techniques of measurement

In each region, specifically trained personnel using appropriate equipment measured height and weight. Portable Harpenden stadiometers were used for height, and every child was measured three times in the same morning to the nearest completed mm according to the technique described by Cameron (4). In brief, the subject stood straight, with feet placed together and flat on the ground, heels, buttocks and scapulae against the vertical backboard, arms loose and relaxed with the palms facing medially. His head was carefully positioned in the Frankfurt plane, ie with the lower margins of the orbit in the same horizontal plane as the upper margin of external auditory meatus. Body weight was measured in minimal underclothes to the nearest 100 g on port-

able, accurate and properly calibrated scales. In about 20% of the samples, weight could be measured only clothed and estimated clothing weight was then deducted. BMI was calculated using the following formula: weight (kg)/height (m²).

Tracing growth charts

When data are derived from cross-sectional surveys, raw non-parametric centiles of height or weight distribution conditional on age show irregular patterns. To draw smooth growth charts, we resorted to the extended mechanistic growth function (EMGF) method, an extension of the Healy et al. (5) approach to the case of non-linear functions (6).

In the previous study, the EMGF functions were based on PB1 model (7), which is not appropriate to describe growth of children under 6. For this reason in the present study we resort to JPSS model (8) to trace height charts:

$$E(y(t,z)) = \mu_A + \gamma_A Z - \frac{\mu_A + \gamma_A Z}{1 + e^{\beta_I[\ln(x) - \ln(\tau)]} + e^{\beta_C[\ln(x) - \ln(\tau_C + \lambda_C Z)]} + e^{\beta_P[\ln(x) - \ln(\tau_P + \lambda_P Z)]}}$$

where $E(y(t,z))$ is the expected value at age t of the centile whose Z -score is z (eg Z -score for the 3rd centile is -1.88), x is post-menstrual age (ie chronological age +0.75 yr) and the 7 original parameters are mean adult height (μ_A) and a location parameter (τ) and a velocity constant (β) for each of the three growth cycles: infancy (I), childhood (C) and puberty (P). In particular, τ_C and τ_P approximate the mean age at the peak of the childhood and puberty components of growth velocity. The 4 extra-parameters are γ_A (which is the SD of adult height), γ (which models SD as a function of height), λ_C and λ_P (which allow each centile to have its own inflection points during childhood and puberty). An analogous function with the further inclusion of a quadratic term ($\gamma_2 z^2$), allowing for the skew distribution of weight, was used to fit, after log-transformation, weight.

To model BMI, which decreases from birth to about 4 yr old, PB1 growth function was *ad hoc* modified by inclusion of a 2-constant negative exponential term modelling the infancy cycle and of 5 extra-parameters modelling the distance between centiles:

$$E(\ln(y(z,t))) = \mu_I e^{-\beta_I(1+\lambda_I Z)t} + \mu_A + \gamma_A Z + \gamma_2 Z^2 - \frac{2[(\mu_A - \tau) + (\gamma_A - \gamma)Z]}{e^{\beta_C(t - \tau_P - \lambda_P Z)} + e^{\beta_P(t - \tau_P - \lambda_P Z)}}$$

where $E(\ln(y(z,t)))$ is the expected value of the logarithm of BMI at age t of the centile whose Z -score is z , and the parameters β_I , β_C , β_P , τ_P , λ_P have the same meaning as in (1); μ_t and μ_A are the mean $\ln(\text{BMI})$ at the age τ_P and at the end of growth; γ_A is the coefficient of variation of adult BMI, γ_t models the coefficient of variation as a function of BMI, and γ_2 allows for the skew distribution of $\ln(\text{BMI})$; λ_I allows each centile to have its own age at minimum; μ_I is the contribution to $\ln(\text{BMI})$ exerted by the infancy cycle at birth.

The mean absolute residual of the raw centiles from these references was as follows: 0.3 cm (height), 0.4 kg (weight), 0.22 kg/m² (BMI). Weighted least-squares estimates of the smooth centiles were obtained with Marquardt's algorithm (9), weights being the reciprocal of squared standard errors of raw centiles.

Computing SD scores

The growth charts traced with the EMGF method are completely defined by a limited number of constants (11 or 12 in our case),

which express the mean pattern of growth according to a prefixed growth model, as well as the SD and skewness of the auxometric trait (height, weight or BMI) distribution conditional on age. Though EMGF model differs in structure from Cole and Green's LMS model (10), the centiles estimated with EMGF can be expressed also in terms of smooth age-specific curves called L, M and S. The M and S curves correspond to the median and coefficient of variation of the auxometric trait at each age, while the L curve allows for the age dependent skewness of the distribution of the same trait. The value (y) of a trait measured on a child of a given age can be transformed into a SD score (SDS):

$$SDS = \frac{(y/M)^L - 1}{L \times S}$$

Vice versa, the value of a given centile at a given age can be computed from the L, M and S values for that age. For instance, for the 97th centile (whose SDS is 1.88) of BMI (for a boy aged 20, South Italy), we have L=-0.977, M=23.4, S=0.136,

$$y(97^{th}) = 23.4 \times [1 + 1.88 \times (-0.977) \times 0.136]^{1/(-0.977)} = 31.4$$

For BMI we calculated two extra centile curves passing through 25 and 30 kg/m² at age 18, to provide cut-off limits for childhood overweight and obesity, as suggested by Cole et al. (11).

RESULTS

Figure 1 compares SIEDP-2002 (1) charts to SIEDP-2006 charts here presented. The comparison is limited to the 3rd, 50th and 97th centiles of height, weight and BMI distribution for Italian girls and boys (whole Italy). Although based on different growth models, between 6 and 20 yr, the new charts overlap the previous charts as regards height and, to a slightly lesser extent, weight and BMI. The largest differences (about 2%) are observed in girls' BMI at 6 yr: namely, 0.32 (3rd), -0.27 (50th), -0.33 (97th) kg/m², the difference between the 97th and 3rd centile being narrower on the SIEDP-2006 charts.

Tables 1A-C give the numerical values of centiles by sex and age, for Central-North (A), South (B) and the whole

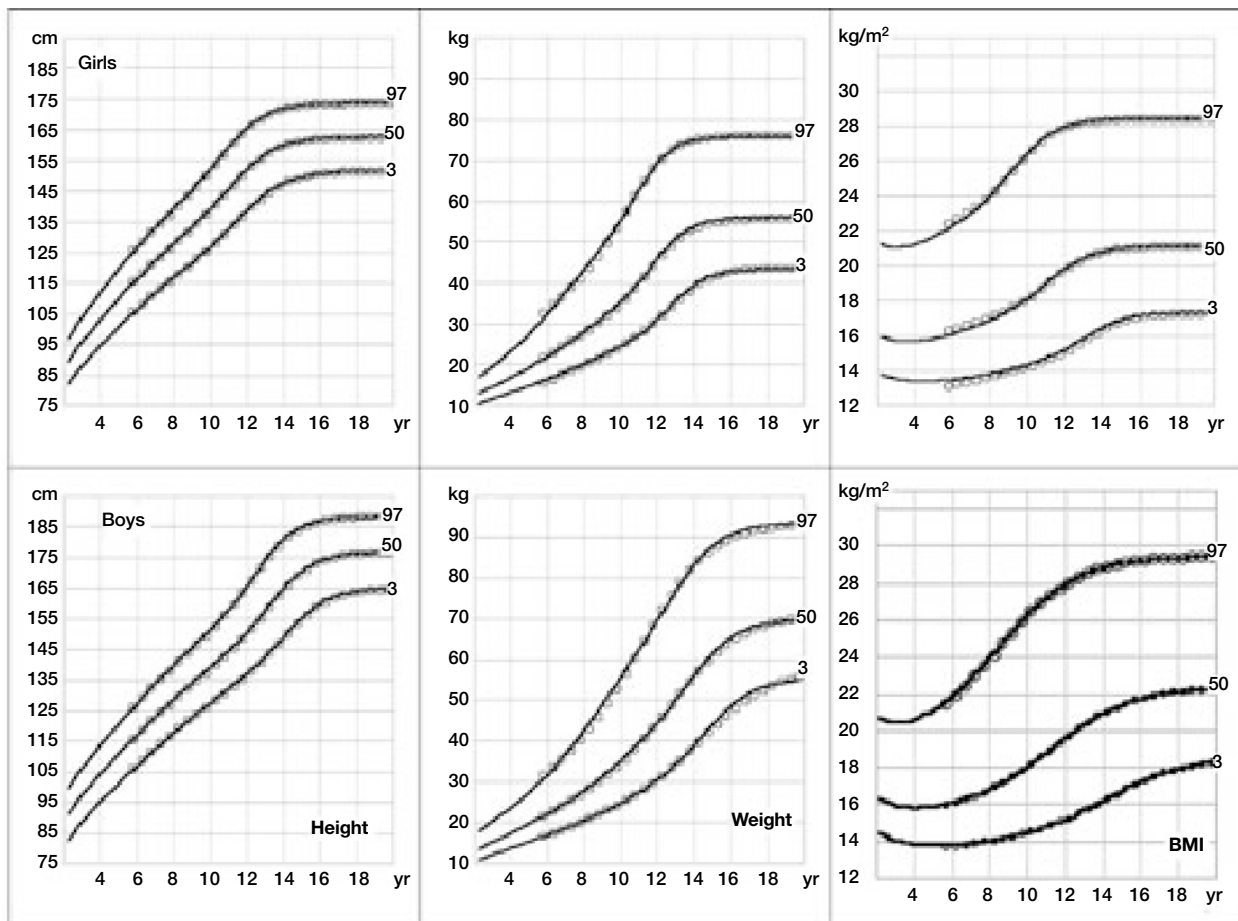


Fig. 1 - Comparison between the Italian Society for Pediatric Endocrinology and Diabetes (SIEDP)-2002 (open circles) and SIEDP-2006 (continuous line) charts: 3rd, 50th and 97th centiles of height (left), weight (middle) and bone mass index (BMI) (right) distribution for Italian girls (top) and boys (bottom).

Table 1A - Central-North Italy. Height, weight and body mass index (BMI) growth norms, expressed as -3 SD, -2 SD (only for height), 3^{rd} , 50^{th} and 97^{th} centiles, and extra-centiles for overweight (OW) and obesity (OB), only for BMI.

Age	Girls										Boys																			
	Height					Weight					BMI					Height					Weight					BMI				
	-3 SD	-2 SD	3 ^d	50 th	97 th	3 ^d	50 th	97 th	OW	OB	-3 SD	-2 SD	3 ^d	50 th	97 th	3 ^d	50 th	97 th	OW	OB	-3 SD	-2 SD	3 ^d	50 th	97 th	OW	OB			
(yr)																														
2.0	74.5	78.5	79.0	86.7	94.5	9.8	12.1	15.9	13.7	16.1	21.3	19.0	23.2	74.6	79.0	79.5	87.8	96.1	10.5	13.0	17.1	15.1	17.3	22.2	19.2	23.3				
2.5	78.4	82.6	83.1	91.1	99.3	10.7	13.3	17.6	13.5	15.8	21.0	18.7	23.0	79.0	83.5	84.0	92.5	101.1	11.4	14.1	18.7	14.2	16.4	21.1	18.2	22.1				
3.0	82.0	86.4	86.9	95.2	103.7	11.6	14.5	19.3	13.4	15.7	20.9	18.5	22.9	82.8	87.5	88.0	96.8	105.6	12.2	15.2	20.2	13.8	15.9	20.6	17.7	21.6				
3.5	85.4	89.9	90.5	99.2	108.0	12.4	15.6	21.1	13.4	15.6	20.9	18.5	23.0	86.3	91.1	91.6	100.6	109.7	13.0	16.2	21.8	13.6	15.7	20.4	17.5	21.5				
4.0	88.7	93.4	93.9	102.9	112.1	13.2	16.8	23.0	13.3	15.6	20.9	18.6	23.1	89.6	94.4	95.0	104.2	113.5	13.7	17.3	23.4	13.5	15.6	20.5	17.5	21.6				
4.5	91.9	96.7	97.3	106.6	116.0	14.0	18.0	25.0	13.3	15.6	21.1	18.7	23.3	92.7	97.6	98.2	107.6	117.2	14.5	18.3	25.2	13.5	15.6	20.7	17.6	21.9				
5.0	94.9	99.9	100.5	110.0	119.8	14.8	19.2	27.2	13.3	15.7	21.3	18.8	23.5	95.6	100.6	101.2	110.9	120.8	15.2	19.5	27.1	13.5	15.7	21.0	17.7	22.2				
5.5	97.9	103.0	103.6	113.4	123.5	15.6	20.5	29.5	13.4	15.8	21.6	19.0	23.8	98.4	103.6	104.2	114.1	124.2	16.0	20.7	29.2	13.5	15.8	21.3	17.9	22.7				
6.0	100.7	106.0	106.6	116.6	127.0	16.5	21.9	32.0	13.4	16.0	21.9	19.2	24.2	101.1	106.4	107.1	117.2	127.6	16.8	22.0	31.5	13.6	16.0	21.8	18.1	23.2				
6.5	103.5	108.8	109.5	119.7	130.3	17.4	23.3	34.5	13.5	16.1	22.2	19.5	24.5	103.8	109.2	109.9	120.3	131.0	17.7	23.3	34.0	13.7	16.2	22.2	18.4	23.7				
7.0	106.1	111.6	112.2	122.7	133.5	18.3	24.8	37.2	13.6	16.3	22.6	19.8	25.0	106.4	112.0	112.7	123.3	134.3	18.6	24.8	36.8	13.8	16.3	22.7	18.7	24.3				
7.5	108.6	114.2	114.9	125.6	136.6	19.3	26.4	39.9	13.6	16.5	23.1	20.2	25.5	109.0	114.7	115.4	126.3	137.5	19.6	26.4	39.7	13.9	16.6	23.3	19.1	25.0				
8.0	111.1	116.7	117.4	128.4	139.6	20.2	28.0	42.7	13.7	16.7	23.6	20.5	26.2	111.6	117.3	118.0	129.2	140.6	20.6	28.2	42.8	14.0	16.8	23.8	19.4	25.6				
8.5	113.5	119.2	119.9	131.1	142.7	21.3	29.7	45.5	13.8	16.9	24.1	21.0	26.8	114.0	119.9	120.6	132.0	143.7	21.7	30.0	45.9	14.1	17.1	24.4	19.8	26.2				
9.0	115.8	121.7	122.4	133.8	145.8	22.4	31.5	48.4	14.0	17.2	24.8	21.5	27.5	116.5	122.5	123.2	134.8	146.7	22.9	31.9	49.2	14.2	17.4	25.0	20.3	26.8				
9.5	118.2	124.2	124.9	136.7	149.0	23.5	33.4	51.4	14.1	17.6	25.4	22.0	28.2	118.8	124.9	125.7	137.5	149.6	24.1	33.9	52.4	14.3	17.7	25.5	20.7	27.3				
10.0	120.6	126.7	127.5	139.7	152.5	24.8	35.4	54.6	14.3	17.9	25.9	22.5	28.7	121.2	127.4	128.1	140.1	152.6	25.4	35.9	55.7	14.4	18.0	26.0	21.2	27.7				
10.5	123.0	129.4	130.2	142.8	156.1	26.1	37.6	58.0	14.4	18.3	26.5	23.1	29.1	123.5	129.7	130.5	142.8	155.6	26.8	38.0	58.9	14.6	18.4	26.5	21.6	28.1				
11.0	125.6	132.3	133.1	146.1	159.7	27.7	40.1	61.5	14.7	18.8	26.9	23.6	29.3	125.8	132.1	132.9	145.4	158.7	28.2	40.2	62.2	14.8	18.7	26.9	22.1	28.5				
11.5	128.4	135.3	136.1	149.4	163.1	29.4	42.8	64.9	14.9	19.2	27.2	24.0	29.5	128.0	134.5	135.3	148.2	162.1	29.7	42.4	65.4	15.0	19.1	27.2	22.5	28.8				
12.0	131.2	138.3	139.1	152.5	166.1	31.4	45.6	67.8	15.2	19.6	27.4	24.4	29.5	130.3	137.0	137.8	151.2	165.8	31.3	44.8	68.7	15.2	19.5	27.5	22.9	29.0				
12.5	134.0	141.1	142.0	155.3	168.5	33.6	48.2	70.2	15.5	20.0	27.6	24.6	29.5	132.7	139.6	140.5	154.5	169.9	33.0	47.3	72.0	15.4	19.8	27.8	23.3	29.2				
13.0	136.6	143.7	144.5	157.5	170.2	35.8	50.4	71.9	15.8	20.2	27.7	24.8	29.6	135.1	142.5	143.4	158.1	174.0	34.9	50.0	75.5	15.6	20.2	28.0	23.6	29.3				
13.5	138.9	145.8	146.6	159.2	171.5	37.8	52.2	73.0	16.1	20.5	27.7	24.9	29.6	137.8	145.6	146.5	161.8	177.9	36.9	52.8	79.0	15.8	20.5	28.2	23.9	29.5				
14.0	140.8	147.4	148.2	160.5	172.4	39.5	53.4	73.8	16.4	20.6	27.8	25.0	29.7	140.6	148.9	149.9	165.5	181.2	39.3	55.8	82.3	16.1	20.8	28.4	24.2	29.6				
14.5	142.2	148.7	149.5	161.4	173.0	40.8	54.3	74.3	16.7	20.7	27.8	25.0	29.8	143.7	152.2	153.2	168.7	183.6	41.8	58.8	85.2	16.4	21.0	28.5	24.4	29.6				
15.0	143.3	149.6	150.3	162.0	173.4	41.8	54.9	74.6	16.9	20.8	27.8	25.0	29.8	146.9	155.4	156.3	171.3	185.3	44.4	61.5	87.5	16.6	21.2	28.6	24.5	29.7				
15.5	144.1	150.2	151.0	162.4	173.7	42.4	55.2	74.8	17.0	20.8	27.8	25.0	29.9	150.0	158.0	158.9	173.2	186.5	46.9	63.8	89.2	16.9	21.4	28.7	24.7	29.8				
16.0	144.6	150.7	151.4	162.7	173.8	42.8	55.5	74.9	17.1	20.8	27.9	25.0	29.9	152.5	160.1	161.0	174.5	187.2	49.1	65.6	90.5	17.1	21.6	28.7	24.8	29.8				
16.5	145.0	151.0	151.7	162.9	174.0	43.1	55.6	74.9	17.2	20.9	27.9	25.0	30.0	154.4	161.6	162.4	175.3	187.6	50.8	66.8	91.3	17.3	21.7	28.8	24.9	29.9				
17.0	145.2	151.2	151.9	163.0	174.0	43.3	55.7	75.0	17.2	20.9	27.9	25.0	30.0	155.8	162.6	163.4	175.9	187.9	52.2	67.7	91.8	17.5	21.8	28.8	24.9	29.9				
17.5	145.4	151.3	152.0	163.1	174.1	43.4	55.8	75.0	17.3	20.9	27.9	25.0	30.0	156.7	163.3	164.1	176.2	188.0	53.1	68.3	92.1	17.7	21.9	28.9	25.0	30.0				
18.0	145.6	151.4	152.1	163.1	174.1	43.5	55.8	75.0	17.3	20.9	27.9	25.0	30.0	157.3	163.7	164.5	176.4	188.1	53.7	68.6	92.3	17.9	22.0	28.9	25.0	30.0				
19.0	145.7	151.5	152.2	163.2	174.2	43.6	55.8	75.1	17.3	20.9	27.9	25.0	30.0	157.9	164.2	164.9	176.6	188.2	54.4	69.0	92.6	18.1	22.1	28.9	25.0	30.0				
20.0	145.8	151.6	152.3	163.3	174.2	43.6	55.8	75.1	17.3	20.9	27.9	25.0	30.0	158.2	164.4	165.1	176.7	188.3	54.7	69.2	92.6	18.3	22.1	28.9	25.0	30.0				

SIEDP-2006 Italian growth charts.

Table 1B - South Italy. Height, weight and body mass index (BMI) growth norms, expressed as -3 SD, -2SD (only for height), 3rd, 50th and 97th centiles, and extra-centiles for overweight (OW) and obesity (OB), only for BMI.

Age	Girls										Boys																			
	Height					Weight					BMI					Height					Weight					BMI				
	-3 SD	-2 SD	3 ^d	50 th	97 th	-3 SD	-2 SD	3 ^d	50 th	97 th	OW	OB	-3 SD	-2 SD	3 ^d	50 th	97 th	OW	OB	-3 SD	-2 SD	3 ^d	50 th	97 th	OW	OB				
(yr)																														
2.0	76.2	80.0	80.5	87.7	95.0	9.9	12.3	16.6	13.7	16.1	21.4	17.9	21.1	76.2	80.7	81.3	89.7	98.2	10.0	12.6	16.9	14.2	15.8	19.8	16.7	19.2				
2.5	79.8	83.8	84.3	91.8	99.5	10.7	13.5	18.3	13.6	15.9	21.2	17.7	20.9	79.8	84.4	84.9	93.6	102.3	11.1	14.0	18.8	14.1	15.8	19.9	16.6	19.2				
3.0	83.1	87.3	87.8	95.7	103.7	11.6	14.6	20.1	13.5	15.8	21.2	17.6	20.9	83.1	87.8	88.4	97.3	106.2	12.1	15.3	20.6	14.0	15.7	20.0	16.6	19.3				
3.5	86.3	90.6	91.1	99.3	107.7	12.4	15.8	21.9	13.5	15.8	21.3	17.6	20.9	86.2	91.0	91.6	100.7	109.8	13.0	16.5	22.3	14.0	15.7	20.2	16.7	19.5				
4.0	89.2	93.7	94.2	102.8	111.5	13.1	16.9	23.7	13.4	15.8	21.4	17.6	21.0	89.2	94.1	94.7	104.0	113.4	13.8	17.6	24.0	13.9	15.8	20.5	16.7	19.7				
4.5	92.1	96.7	97.3	106.2	115.3	13.9	18.0	25.7	13.4	15.8	21.5	17.7	21.2	92.1	97.2	97.8	107.2	116.8	14.7	18.8	25.8	13.9	15.8	20.7	16.8	19.9				
5.0	94.9	99.7	100.2	109.4	118.9	14.7	19.2	27.9	13.4	15.9	21.8	17.8	21.4	95.0	100.1	100.7	110.4	120.2	15.5	19.9	27.6	13.9	15.9	21.1	16.9	20.2				
5.5	97.6	102.5	103.1	112.6	122.4	15.5	20.5	30.1	13.4	16.0	22.0	18.0	21.7	97.8	103.0	103.6	113.5	123.5	16.3	21.0	29.5	13.9	16.0	21.5	17.1	20.5				
6.0	100.2	105.3	105.9	115.7	125.8	16.3	21.8	32.6	13.4	16.1	22.3	18.2	22.0	100.5	105.8	106.5	116.6	126.7	17.1	22.2	31.6	13.9	16.1	21.9	17.3	20.9				
6.5	102.8	108.0	108.6	118.7	129.0	17.1	23.2	35.1	13.5	16.2	22.7	18.4	22.3	103.2	108.6	109.3	119.5	129.9	17.8	23.4	33.8	13.9	16.3	22.3	17.5	21.3				
7.0	105.3	110.6	111.2	121.6	132.2	18.0	24.6	37.8	13.5	16.4	23.1	18.7	22.7	105.8	111.3	112.0	122.4	132.9	18.7	24.7	36.3	14.0	16.5	22.8	17.8	21.8				
7.5	107.7	113.1	113.8	124.4	135.3	18.9	26.2	40.6	13.6	16.6	23.6	19.0	23.2	108.4	114.0	114.6	125.2	135.9	19.5	26.1	39.0	14.0	16.7	23.3	18.0	22.2				
8.0	110.0	115.6	116.3	127.2	138.4	19.8	27.7	43.5	13.7	16.9	24.1	19.4	23.7	110.9	116.5	117.2	128.0	138.9	20.4	27.6	42.0	14.1	16.9	23.9	18.4	22.7				
8.5	112.4	118.1	118.8	129.9	141.5	20.8	29.4	46.4	13.8	17.2	24.7	19.8	24.3	113.3	119.0	119.7	130.6	141.7	21.3	29.2	45.2	14.2	17.1	24.4	18.7	23.3				
9.0	114.7	120.6	121.3	132.7	144.8	21.9	31.2	49.5	14.0	17.5	25.3	20.2	24.8	115.6	121.4	122.1	133.2	144.6	22.3	30.9	48.6	14.3	17.4	25.0	19.1	23.8				
9.5	117.1	123.1	123.8	135.7	148.1	23.0	33.0	52.7	14.1	17.9	25.9	20.7	25.4	117.9	123.8	124.5	135.8	147.4	23.4	32.8	52.1	14.4	17.7	25.5	19.4	24.3				
10.0	119.5	125.7	126.5	138.7	151.6	24.2	35.1	56.1	14.3	18.2	26.5	21.1	26.0	120.1	126.0	126.8	138.3	150.3	24.5	34.8	55.8	14.5	18.1	26.1	19.8	24.9				
10.5	122.0	128.5	129.2	141.9	155.2	25.6	37.3	59.7	14.6	18.6	27.1	21.6	26.6	122.3	128.3	129.0	140.9	153.4	25.8	36.9	59.6	14.6	18.4	26.6	20.3	25.4				
11.0	124.6	131.3	132.1	145.2	158.7	27.1	39.8	63.4	14.8	19.0	27.6	22.1	27.1	124.4	130.6	131.3	143.5	156.7	27.1	39.1	63.3	14.8	18.7	27.1	20.7	25.9				
11.5	127.3	134.2	135.1	148.3	161.9	28.9	42.6	67.1	15.1	19.4	28.1	22.6	27.6	126.6	132.8	133.6	146.4	160.4	28.6	41.4	67.0	15.0	19.1	27.6	21.1	26.4				
12.0	130.0	137.1	137.9	151.2	164.6	30.8	45.4	70.5	15.4	19.8	28.6	23.0	28.1	128.7	135.2	136.0	149.4	164.4	30.3	43.9	70.6	15.1	19.5	28.0	21.5	26.9				
12.5	132.7	139.7	140.5	153.7	166.7	32.9	48.1	73.2	15.6	20.2	29.0	23.4	28.5	130.9	137.8	138.6	152.7	168.5	32.0	46.4	74.1	15.3	19.8	28.5	21.9	27.3				
13.0	135.0	142.0	142.8	155.7	168.3	35.1	50.4	75.3	15.9	20.5	29.3	23.7	28.8	133.2	140.5	141.4	156.2	172.5	34.0	48.9	77.3	15.6	20.2	28.8	22.3	27.7				
13.5	137.0	143.8	144.6	157.2	169.5	37.1	52.3	76.8	16.2	20.7	29.6	24.0	29.1	135.6	143.3	144.3	159.7	176.1	36.0	51.5	80.3	15.8	20.6	29.2	22.7	28.1				
14.0	138.7	145.3	146.1	158.3	170.3	38.7	53.7	77.8	16.4	21.0	29.8	24.2	29.3	138.1	146.3	147.3	163.0	179.1	38.2	54.0	83.1	16.0	20.9	29.5	23.1	28.4				
14.5	139.9	146.4	147.1	159.1	170.9	40.0	54.6	78.4	16.6	21.2	29.9	24.4	29.5	140.8	149.2	150.2	165.9	181.4	40.4	56.5	85.7	16.3	21.2	29.8	23.4	28.7				
15.0	140.9	147.2	147.9	159.7	171.3	41.0	55.3	78.8	16.8	21.4	30.1	24.6	29.6	143.5	151.9	152.9	168.3	183.0	42.7	58.9	88.1	16.5	21.5	30.0	23.7	29.0				
15.5	141.5	147.7	148.5	160.1	171.5	41.6	55.7	79.1	17.0	21.5	30.2	24.7	29.7	146.0	154.3	155.3	170.1	184.2	44.9	61.1	90.2	16.8	21.8	30.3	24.0	29.2				
16.0	142.0	148.1	148.9	160.3	171.7	42.1	55.9	79.2	17.1	21.6	30.3	24.8	29.8	148.3	156.2	157.2	171.4	185.0	47.0	63.2	92.1	17.0	22.1	30.5	24.2	29.4				
16.5	142.3	148.4	149.2	160.5	171.8	42.4	56.1	79.3	17.2	21.7	30.4	24.9	29.9	150.1	157.7	158.6	172.4	185.5	48.9	65.1	93.9	17.3	22.3	30.6	24.5	29.6				
17.0	142.6	148.6	149.3	160.7	171.9	42.5	56.2	79.4	17.3	21.7	30.4	24.9	29.9	151.6	158.9	159.7	173.0	185.8	50.5	66.8	95.4	17.5	22.5	30.8	24.7	29.7				
17.5	142.8	148.8	149.5	160.7	172.0	42.7	56.3	79.4	17.4	21.8	30.4	25.0	30.0	152.6	159.7	160.5	173.5	186.1	52.0	68.3	96.7	17.7	22.7	30.9	24.8	29.9				
18.0	142.9	148.9	149.6	160.8	172.0	42.7	56.3	79.4	17.4	21.8	30.5	25.0	30.0	153.4	160.3	161.1	173.8	186.2	53.2	69.6	97.8	17.9	22.9	31.0	25.0	30.0				
19.0	143.0	149.0	149.7	160.9	172.1	42.8	56.4	79.5	17.5	21.9	30.5	25.0	30.0	154.3	160.9	161.7	174.1	186.4	55.0	71.5	99.7	18.3	23.1	31.2	25.0	30.0				
20.0	143.1	149.0	149.7	160.9	172.1	42.9	56.4	79.5	17.5	21.9	30.5	25.0	30.0	154.7	161.3	162.1	174.3	186.5	56.1	72.9	101.0	18.6	23.4	31.4	25.0	30.0				

SIEDP-2006 Italian growth charts.

Table 1C - Whole Italy. Height, weight and body mass index (BMI) growth norms, expressed as -3 SD, -2 SD (only for height), 3^{rd} , 50^{th} and 97^{th} centiles, and extra-centiles for overweight (OW) and obesity (OB), only for BMI.

Age	Girls										Boys																			
	Height					Weight					BMI					Height					Weight					BMI				
	-3 SD	-2 SD	3 rd	50 th	97 th	-3 SD	-2 SD	3 rd	50 th	97 th	OW	OB	-3 SD	-2 SD	3 rd	50 th	97 th	OW	OB	-3 SD	-2 SD	3 rd	50 th	97 th	OW	OB				
(yr)																														
2.0	76.0	79.7	80.1	87.2	94.3	9.9	12.3	16.1	13.8	16.1	21.4	18.7	22.9	75.6	80.0	80.5	88.8	97.0	10.3	12.8	17.0	14.6	16.5	20.8	18.0	21.4				
2.5	79.6	83.5	83.9	91.4	99.0	10.8	13.4	17.8	13.6	15.8	21.1	18.4	22.6	79.6	84.1	84.6	93.1	101.6	11.2	14.0	18.7	14.3	16.1	20.5	17.7	21.1				
3.0	83.0	87.1	87.5	95.4	103.4	11.6	14.5	19.5	13.5	15.7	21.0	18.3	22.6	83.2	87.8	88.3	97.0	105.8	12.1	15.2	20.3	14.0	15.9	20.4	17.5	21.0				
3.5	86.2	90.5	91.0	99.2	107.7	12.4	15.7	21.3	13.4	15.6	21.1	18.3	22.7	86.5	91.2	91.7	100.7	109.7	13.0	16.3	22.0	13.9	15.8	20.4	17.4	21.0				
4.0	89.3	93.7	94.2	102.8	111.7	13.2	16.8	23.2	13.4	15.6	21.2	18.4	22.9	89.6	94.4	95.0	104.1	113.4	13.8	17.4	23.7	13.8	15.8	20.5	17.4	21.2				
4.5	92.3	96.9	97.4	106.4	115.6	13.9	18.0	25.3	13.4	15.7	21.4	18.5	23.1	92.5	97.5	98.1	107.4	117.0	14.6	18.5	25.5	13.7	15.8	20.7	17.5	21.4				
5.0	95.1	99.9	100.5	109.7	119.4	14.7	19.2	27.5	13.4	15.8	21.6	18.7	23.3	95.4	100.4	101.0	110.7	120.4	15.3	19.6	27.4	13.7	15.8	21.0	17.6	21.7				
5.5	97.9	102.8	103.4	113.0	123.0	15.5	20.5	29.9	13.4	15.9	21.9	18.9	23.6	98.2	103.3	103.9	113.8	123.8	16.1	20.8	29.4	13.7	15.9	21.3	17.8	22.1				
6.0	100.6	105.6	106.3	116.1	126.5	16.4	21.9	32.3	13.5	16.1	22.2	19.1	23.9	100.9	106.1	106.8	116.8	127.1	16.9	22.0	31.7	13.7	16.0	21.7	18.0	22.5				
6.5	103.1	108.4	109.0	119.2	129.7	17.2	23.3	34.9	13.5	16.2	22.6	19.4	24.3	103.5	108.9	109.5	119.8	130.3	17.8	23.3	34.1	13.8	16.2	22.2	18.2	23.0				
7.0	105.6	111.0	111.6	122.0	132.9	18.1	24.8	37.6	13.6	16.4	23.0	19.7	24.7	106.1	111.6	112.2	122.8	133.5	18.6	24.7	36.7	13.8	16.3	22.7	18.5	23.6				
7.5	108.0	113.5	114.2	124.8	136.0	19.1	26.4	40.4	13.7	16.6	23.4	20.1	25.3	108.6	114.2	114.9	125.6	136.6	19.5	26.2	39.5	13.9	16.5	23.2	18.8	24.2				
8.0	110.4	116.0	116.6	127.6	139.0	20.1	28.0	43.2	13.8	16.9	23.9	20.4	25.8	111.1	116.8	117.5	128.4	139.6	20.5	27.8	42.5	14.0	16.8	23.8	19.2	24.8				
8.5	112.6	118.4	119.1	130.3	142.0	21.1	29.6	46.0	13.9	17.1	24.5	20.8	26.5	113.5	119.3	120.0	131.1	142.5	21.5	29.5	45.6	14.1	17.0	24.4	19.6	25.4				
9.0	114.9	120.8	121.5	133.1	145.2	22.1	31.4	48.9	14.0	17.4	25.1	21.3	27.2	115.9	121.8	122.5	133.8	145.4	22.5	31.3	48.8	14.2	17.3	25.0	20.0	26.1				
9.5	117.3	123.3	124.0	135.9	148.5	23.2	33.2	52.0	14.1	17.7	25.8	21.8	27.8	118.2	124.2	124.9	136.4	148.3	23.6	33.2	52.1	14.3	17.6	25.6	20.5	26.6				
10.0	119.7	125.9	126.7	139.0	152.0	24.4	35.2	55.3	14.3	18.1	26.4	22.4	28.4	120.5	126.5	127.2	139.0	151.2	24.8	35.1	55.5	14.4	18.0	26.1	20.9	27.2				
10.5	122.2	128.7	129.5	142.2	155.6	25.7	37.5	58.8	14.5	18.5	26.9	22.9	28.9	122.7	128.8	129.5	141.6	154.3	26.1	37.2	58.9	14.6	18.3	26.6	21.4	27.7				
11.0	124.9	131.6	132.4	145.5	159.2	27.2	40.0	62.5	14.7	18.9	27.3	23.4	29.2	124.9	131.1	131.9	144.3	157.5	27.4	39.4	62.3	14.7	18.7	27.1	21.9	28.1				
11.5	127.7	134.6	135.5	148.8	162.5	28.9	42.7	66.0	14.9	19.4	27.7	23.9	29.4	127.1	133.5	134.2	147.1	161.1	28.9	41.7	65.7	14.9	19.1	27.5	22.4	28.4				
12.0	130.5	137.6	138.5	151.9	165.4	30.9	45.6	69.1	15.2	19.8	27.9	24.3	29.5	129.4	135.9	136.7	150.2	165.1	30.4	44.2	69.2	15.1	19.5	27.9	22.8	28.7				
12.5	133.3	140.4	141.3	154.6	167.7	33.1	48.4	71.4	15.5	20.1	28.1	24.6	29.6	131.7	138.5	139.4	153.5	169.4	32.2	46.9	72.8	15.3	19.9	28.2	23.2	29.0				
13.0	135.9	142.9	143.8	156.8	169.5	35.4	50.7	73.1	15.8	20.4	28.2	24.8	29.7	134.0	141.4	142.3	157.2	173.6	34.2	49.7	76.3	15.6	20.2	28.4	23.6	29.2				
13.5	138.1	145.0	145.8	158.4	170.8	37.5	52.5	74.2	16.1	20.6	28.3	24.9	29.7	136.6	144.4	145.4	161.0	177.5	36.4	52.7	79.7	15.8	20.6	28.6	23.9	29.4				
14.0	140.0	146.6	147.4	159.7	171.7	39.3	53.7	74.8	16.4	20.8	28.3	25.0	29.8	139.3	147.7	148.7	164.6	180.7	38.8	55.8	82.8	16.1	20.9	28.8	24.1	29.5				
14.5	141.4	147.8	148.6	160.6	172.4	40.7	54.6	75.2	16.7	20.9	28.3	25.0	29.8	142.3	150.9	152.0	167.8	183.1	41.3	58.7	85.4	16.4	21.1	28.9	24.4	29.6				
15.0	142.4	148.7	149.5	161.2	172.8	41.6	55.1	75.5	16.9	21.0	28.4	25.0	29.9	145.4	154.0	155.0	170.4	184.9	43.9	61.3	87.6	16.6	21.3	29.0	24.5	29.7				
15.5	143.2	149.4	150.1	161.7	173.1	42.3	55.4	75.6	17.0	21.0	28.4	25.0	29.9	148.3	156.7	157.7	172.3	186.0	46.3	63.5	89.3	16.9	21.5	29.1	24.7	29.8				
16.0	143.7	149.8	150.6	162.0	173.3	42.7	55.6	75.7	17.1	21.0	28.4	25.0	30.0	150.9	158.8	159.8	173.7	186.8	48.5	65.2	90.5	17.1	21.7	29.2	24.8	29.8				
16.5	144.1	150.1	150.9	162.2	173.4	42.9	55.7	75.7	17.2	21.1	28.4	25.0	30.0	153.0	160.5	161.4	174.7	187.3	50.3	66.6	91.4	17.4	21.8	29.2	24.9	29.9				
17.0	144.4	150.4	151.1	162.3	173.5	43.1	55.8	75.8	17.2	21.1	28.4	25.0	30.0	154.6	161.7	162.5	175.3	187.6	51.7	67.5	92.0	17.6	21.9	29.3	24.9	29.9				
17.5	144.5	150.5	151.2	162.4	173.6	43.2	55.8	75.8	17.2	21.1	28.4	25.0	30.0	155.7	162.5	163.3	175.8	187.8	52.7	68.2	92.4	17.7	22.0	29.3	25.0	30.0				
18.0	144.7	150.6	151.3	162.5	173.6	43.3	55.9	75.8	17.3	21.1	28.4	25.0	30.0	156.5	163.1	163.9	176.0	188.0	53.5	68.7	92.7	17.9	22.0	29.3	25.0	30.0				
19.0	144.8	150.8	151.5	162.6	173.7	43.4	55.9	75.8	17.3	21.1	28.4	25.0	30.0	157.3	163.7	164.5	176.4	188.1	54.4	69.2	93.0	18.1	22.1	29.3	25.0	30.0				
20.0	144.9	150.8	151.5	162.6	173.7	43.4	55.9	75.8	17.3	21.1	28.4	25.0	30.0	157.7	164.0	164.8	176.5	188.2	54.8	69.5	93.1	18.3	22.2	29.4	25.0	30.0				

SIEDP-2006 Italian growth charts.

of Italy (C). Tables 2A-C report the values of power (L), median (M) and coefficient of variation (S), suitable for computing SDS of height, weight and BMI, or for deriving the centiles reported in Tables 1A-C as well as other centiles (eg, the 10th or the 90th centile).

Height

At the age of 2 yr the median stature of girls and boys is higher in the South than in Central-North Italy by 1 and 2 cm, respectively: this difference decreases up to 4 yr. After this age children born in Central-North Italy

tend to be taller. In girls, the difference increases up to 7.5 yr (1.2 cm), decreases up to 10.5 yr (0.9 cm) and increases again up to adulthood (2.3 cm): this pattern of differences is due to the fact that peak height velocity occurs 6 months earlier among girls of South Italy (10.75 yr) than among those of Central-North Italy (11.25 yr). In boys, the difference in median stature increases up to 15.5 yr (3.1 cm) and becomes about 2.4 cm at adulthood. Peak height velocity occurs 3 months earlier among boys of South Italy (13.00 yr) than among those of Central-North Italy (13.25 yr).

Table 2A - Central-North Italy. Height, weight and body mass index (BMI) growth norms, expressed as LMS. The SD score corresponding to the value (y) of the auxometric trait is computed according to formula 3 (see text).

Age (yrs)	Height (cm)						Weight (kg)						BMI (kg/m ²)					
	Girls			Boys			Girls			Boys			Girls			Boys		
	L	M	S	L	M	S	L	M	S	L	M	S	L	M	S	L	M	S
2.0	0.886	86.7	0.048	0.969	87.8	0.050	-0.944	12.1	0.126	-1.039	13.0	0.127	-2.507	16.1	0.108	-3.082	17.3	0.093
2.5	0.850	91.1	0.047	0.950	92.5	0.049	-0.946	13.3	0.130	-1.037	14.1	0.129	-2.690	15.8	0.106	-3.035	16.4	0.094
3.0	0.814	95.2	0.047	0.927	96.8	0.048	-0.952	14.5	0.134	-1.038	15.2	0.131	-2.771	15.7	0.106	-2.995	15.9	0.096
3.5	0.782	99.2	0.047	0.899	100.6	0.048	-0.957	15.6	0.139	-1.040	16.2	0.135	-2.776	15.6	0.107	-2.960	15.7	0.098
4.0	0.755	102.9	0.047	0.869	104.2	0.047	-0.957	16.8	0.145	-1.040	17.3	0.139	-2.730	15.6	0.109	-2.927	15.6	0.100
4.5	0.734	106.6	0.047	0.837	107.6	0.047	-0.950	18.0	0.151	-1.037	18.3	0.143	-2.654	15.6	0.111	-2.892	15.6	0.103
5.0	0.718	110.0	0.047	0.805	110.9	0.047	-0.933	19.2	0.158	-1.027	19.5	0.149	-2.564	15.7	0.113	-2.851	15.7	0.105
5.5	0.707	113.4	0.047	0.774	114.1	0.047	-0.907	20.5	0.165	-1.009	20.7	0.155	-2.469	15.8	0.116	-2.801	15.8	0.108
6.0	0.700	116.6	0.046	0.746	117.2	0.047	-0.873	21.9	0.172	-0.982	22.0	0.162	-2.375	16.0	0.119	-2.738	16.0	0.111
6.5	0.693	119.7	0.046	0.722	120.3	0.047	-0.832	23.3	0.178	-0.947	23.3	0.169	-2.286	16.1	0.122	-2.660	16.2	0.115
7.0	0.684	122.7	0.046	0.702	123.3	0.047	-0.787	24.8	0.184	-0.904	24.8	0.176	-2.204	16.3	0.125	-2.565	16.3	0.119
7.5	0.667	125.6	0.046	0.686	126.3	0.047	-0.739	26.4	0.190	-0.857	26.4	0.183	-2.125	16.5	0.128	-2.452	16.6	0.123
8.0	0.638	128.4	0.046	0.674	129.2	0.047	-0.691	28.0	0.194	-0.806	28.2	0.189	-2.044	16.7	0.132	-2.323	16.8	0.128
8.5	0.592	131.1	0.046	0.662	132.0	0.046	-0.643	29.7	0.199	-0.754	30.0	0.194	-1.953	16.9	0.137	-2.178	17.1	0.133
9.0	0.530	133.8	0.046	0.647	134.8	0.046	-0.594	31.5	0.202	-0.702	31.9	0.199	-1.842	17.2	0.141	-2.022	17.4	0.138
9.5	0.462	136.7	0.047	0.622	137.5	0.046	-0.545	33.4	0.205	-0.653	33.9	0.202	-1.705	17.6	0.146	-1.855	17.7	0.142
10.0	0.414	139.7	0.048	0.576	140.1	0.046	-0.491	35.4	0.208	-0.606	35.9	0.205	-1.539	17.9	0.151	-1.684	18.0	0.146
10.5	0.420	142.8	0.048	0.499	142.8	0.047	-0.428	37.6	0.211	-0.561	38.0	0.207	-1.353	18.3	0.154	-1.511	18.4	0.150
11.0	0.508	146.1	0.048	0.382	145.4	0.047	-0.351	40.1	0.211	-0.519	40.2	0.208	-1.161	18.8	0.156	-1.341	18.7	0.153
11.5	0.677	149.4	0.048	0.236	148.2	0.048	-0.262	42.8	0.210	-0.479	42.4	0.208	-0.989	19.2	0.157	-1.180	19.1	0.155
12.0	0.893	152.5	0.047	0.103	151.2	0.049	-0.175	45.6	0.204	-0.439	44.8	0.207	-0.864	19.6	0.155	-1.033	19.5	0.156
12.5	1.104	155.3	0.045	0.062	154.5	0.051	-0.111	48.2	0.196	-0.397	47.3	0.206	-0.809	20.0	0.151	-0.906	19.8	0.155
13.0	1.260	157.5	0.043	0.188	158.1	0.052	-0.094	50.4	0.185	-0.352	50.0	0.205	-0.834	20.2	0.146	-0.804	20.2	0.154
13.5	1.339	159.2	0.042	0.502	161.8	0.052	-0.131	52.2	0.175	-0.303	52.8	0.201	-0.930	20.5	0.141	-0.730	20.5	0.152
14.0	1.349	160.5	0.040	0.942	165.5	0.050	-0.212	53.4	0.166	-0.256	55.8	0.196	-1.072	20.6	0.136	-0.687	20.8	0.149
14.5	1.313	161.4	0.039	1.386	168.7	0.048	-0.311	54.3	0.159	-0.224	58.8	0.189	-1.229	20.7	0.132	-0.675	21.0	0.146
15.0	1.258	162.0	0.038	1.707	171.3	0.045	-0.406	54.9	0.153	-0.223	61.5	0.180	-1.375	20.8	0.128	-0.693	21.2	0.143
15.5	1.201	162.4	0.037	1.839	173.2	0.042	-0.484	55.2	0.150	-0.264	63.8	0.171	-1.494	20.8	0.126	-0.739	21.4	0.139
16.0	1.151	162.7	0.037	1.801	174.5	0.040	-0.542	55.5	0.147	-0.344	65.6	0.162	-1.583	20.8	0.124	-0.805	21.6	0.136
16.5	1.111	162.9	0.036	1.665	175.3	0.038	-0.583	55.6	0.146	-0.446	66.8	0.155	-1.644	20.9	0.123	-0.888	21.7	0.133
17.0	1.081	163.0	0.036	1.504	175.9	0.037	-0.611	55.7	0.145	-0.549	67.7	0.149	-1.683	20.9	0.122	-0.980	21.8	0.130
17.5	1.058	163.1	0.036	1.359	176.2	0.036	-0.630	55.8	0.144	-0.636	68.3	0.145	-1.707	20.9	0.122	-1.075	21.9	0.127
18.0	1.042	163.1	0.036	1.248	176.4	0.036	-0.642	55.8	0.144	-0.704	68.6	0.142	-1.720	20.9	0.121	-1.169	22.0	0.125
19.0	1.022	163.2	0.036	1.112	176.6	0.035	-0.656	55.8	0.143	-0.787	69.0	0.139	-1.729	20.9	0.121	-1.337	22.1	0.121
20.0	1.012	163.2	0.036	1.050	176.7	0.035	-0.662	55.8	0.143	-0.825	69.2	0.138	-1.727	20.9	0.121	-1.469	22.1	0.118

SIEDP-2006 Italian growth charts.

Table 2B - South Italy. Height, weight and body mass index (BMI) growth norms, expressed as LMS. The SD score corresponding to the value (y) of the auxometric trait is computed according to formula 3 (see text).

Age (yrs)	Height (cm)						Weight (kg)						BMI (kg/m ²)					
	Girls			Boys			Girls			Boys			Girls			Boys		
	L	M	S	L	M	S	L	M	S	L	M	S	L	M	S	L	M	S
2.0	0.883	87.7	0.044	0.981	89.7	0.050	-1.083	12.3	0.135	-0.914	12.6	0.137	-2.611	16.1	0.108	-4.261	15.8	0.078
2.5	0.841	91.8	0.044	0.972	93.6	0.049	-1.063	13.5	0.139	-0.906	14.0	0.138	-2.683	15.9	0.108	-4.184	15.8	0.080
3.0	0.799	95.7	0.044	0.963	97.3	0.049	-1.048	14.6	0.143	-0.903	15.3	0.140	-2.698	15.8	0.108	-4.081	15.7	0.082
3.5	0.760	99.3	0.045	0.954	100.7	0.048	-1.035	15.8	0.148	-0.905	16.5	0.142	-2.669	15.8	0.110	-3.958	15.7	0.085
4.0	0.725	102.8	0.045	0.944	104.0	0.048	-1.020	16.9	0.153	-0.911	17.6	0.144	-2.609	15.8	0.112	-3.816	15.8	0.088
4.5	0.695	106.2	0.045	0.934	107.2	0.047	-1.002	18.0	0.159	-0.921	18.8	0.147	-2.530	15.8	0.115	-3.660	15.8	0.092
5.0	0.672	109.4	0.045	0.925	110.4	0.047	-0.978	19.2	0.166	-0.932	19.9	0.150	-2.438	15.9	0.118	-3.492	15.9	0.096
5.5	0.655	112.6	0.045	0.917	113.5	0.046	-0.949	20.5	0.172	-0.944	21.0	0.155	-2.339	16.0	0.121	-3.315	16.0	0.100
6.0	0.642	115.7	0.046	0.909	116.6	0.046	-0.914	21.8	0.179	-0.952	22.2	0.160	-2.236	16.1	0.124	-3.132	16.1	0.105
6.5	0.630	118.7	0.046	0.902	119.5	0.046	-0.875	23.2	0.186	-0.954	23.4	0.165	-2.131	16.2	0.128	-2.945	16.3	0.110
7.0	0.616	121.6	0.046	0.893	122.4	0.046	-0.833	24.6	0.192	-0.949	24.7	0.172	-2.025	16.4	0.132	-2.757	16.5	0.115
7.5	0.597	124.4	0.046	0.882	125.2	0.045	-0.789	26.2	0.198	-0.934	26.1	0.179	-1.920	16.6	0.136	-2.569	16.7	0.121
8.0	0.567	127.2	0.046	0.863	128.0	0.045	-0.744	27.7	0.203	-0.910	27.6	0.186	-1.814	16.9	0.140	-2.385	16.9	0.126
8.5	0.526	129.9	0.047	0.830	130.6	0.045	-0.699	29.4	0.208	-0.877	29.2	0.193	-1.709	17.2	0.144	-2.205	17.1	0.131
9.0	0.479	132.7	0.047	0.775	133.2	0.045	-0.655	31.2	0.212	-0.836	30.9	0.200	-1.607	17.5	0.148	-2.031	17.4	0.137
9.5	0.438	135.7	0.048	0.686	135.8	0.045	-0.609	33.0	0.216	-0.791	32.8	0.207	-1.508	17.9	0.152	-1.865	17.7	0.142
10.0	0.426	138.7	0.048	0.552	138.3	0.045	-0.559	35.1	0.220	-0.743	34.8	0.213	-1.416	18.2	0.155	-1.706	18.1	0.146
10.5	0.468	141.9	0.049	0.368	140.9	0.046	-0.504	37.3	0.223	-0.695	36.9	0.217	-1.333	18.6	0.157	-1.558	18.4	0.150
11.0	0.574	145.2	0.049	0.152	143.5	0.047	-0.441	39.8	0.224	-0.651	39.1	0.220	-1.262	19.0	0.159	-1.420	18.7	0.154
11.5	0.733	148.3	0.048	-0.051	146.4	0.049	-0.373	42.6	0.223	-0.611	41.4	0.222	-1.207	19.4	0.159	-1.293	19.1	0.156
12.0	0.914	151.2	0.047	-0.173	149.4	0.050	-0.311	45.4	0.219	-0.578	43.9	0.222	-1.168	19.8	0.159	-1.179	19.5	0.158
12.5	1.076	153.7	0.045	-0.152	152.7	0.052	-0.271	48.1	0.212	-0.556	46.4	0.220	-1.147	20.2	0.158	-1.078	19.8	0.160
13.0	1.189	155.7	0.044	0.038	156.2	0.053	-0.268	50.4	0.203	-0.544	48.9	0.216	-1.142	20.5	0.157	-0.990	20.2	0.160
13.5	1.243	157.2	0.042	0.365	159.7	0.053	-0.306	52.3	0.193	-0.545	51.5	0.211	-1.151	20.7	0.155	-0.916	20.6	0.160
14.0	1.249	158.3	0.041	0.761	163.0	0.052	-0.373	53.7	0.184	-0.559	54.0	0.204	-1.170	21.0	0.153	-0.856	20.9	0.160
14.5	1.225	159.1	0.040	1.140	165.9	0.050	-0.452	54.6	0.177	-0.585	56.5	0.197	-1.196	21.2	0.151	-0.810	21.2	0.158
15.0	1.187	159.7	0.039	1.431	168.3	0.048	-0.525	55.3	0.172	-0.620	58.9	0.190	-1.225	21.4	0.149	-0.778	21.5	0.157
15.5	1.148	160.1	0.038	1.594	170.1	0.045	-0.584	55.7	0.169	-0.659	61.1	0.183	-1.254	21.5	0.148	-0.760	21.8	0.155
16.0	1.113	160.3	0.038	1.636	171.4	0.043	-0.628	55.9	0.166	-0.698	63.2	0.176	-1.282	21.6	0.146	-0.753	22.1	0.153
16.5	1.085	160.5	0.038	1.590	172.4	0.041	-0.660	56.1	0.165	-0.732	65.1	0.171	-1.306	21.7	0.145	-0.758	22.3	0.151
17.0	1.063	160.7	0.037	1.500	173.0	0.040	-0.681	56.2	0.164	-0.757	66.8	0.166	-1.326	21.7	0.144	-0.773	22.5	0.148
17.5	1.046	160.7	0.037	1.398	173.5	0.039	-0.695	56.3	0.163	-0.772	68.3	0.162	-1.343	21.8	0.144	-0.796	22.7	0.146
18.0	1.034	160.8	0.037	1.304	173.8	0.038	-0.705	56.3	0.162	-0.779	69.6	0.159	-1.356	21.8	0.143	-0.825	22.9	0.144
19.0	1.018	160.9	0.037	1.166	174.1	0.038	-0.716	56.4	0.162	-0.773	71.5	0.156	-1.374	21.9	0.142	-0.897	23.1	0.140
20.0	1.010	160.9	0.037	1.087	174.3	0.037	-0.721	56.4	0.162	-0.758	72.9	0.154	-1.384	21.9	0.142	-0.977	23.4	0.136

SIEDP-2006 Italian growth charts.

The differences in the 3rd and 97th centiles between the two geographic areas mimic the pattern of the differences in median, but are larger for the 3rd centile and smaller for the 97th. The centile corresponding to -2 SD is, as expected, very close to the 3rd centile, whereas the centile at -3 SD is progressively lower than the 3rd centile: from 4.1 cm at 2 yr to 8.0 cm at 12.25 yr (girls), and from 4.9 cm at 2 yr to 9.7 cm at 14.75 yr (boys). At adulthood the difference is 6.6 cm in girls and 7.0 cm in boys.

Figure 2 (left) compares SIEDP-2006, 2000-CDC (12) and UK90 (13) height charts. The differences between the three references are generally rather small. On the average, Italian girls are taller than USA girls by no more than 1.8 cm up to 7 yr, and between 9.5 and 12 yr with a maximum of 1.3 cm at 11 yr; at the end of growth they are shorter by 0.8 cm. Italian girls are also taller than UK girls up to 14 yr, with a minimum of 0.1 cm at 8.5 yr and a maximum of 2.1 cm at 12 yr; at the end of growth they are shorter by

Table 2C - Whole Italy. Height, weight and body mass index (BMI) growth norms, expressed as LMS. The SD score corresponding to the value (y) of the auxometric trait is computed according to formula 3 (see text).

Age (yrs)	Height (cm)						Weight (kg)						BMI (kg/m ²)					
	Girls			Boys			Girls			Boys			Girls			Boys		
	L	M	S	L	M	S	L	M	S	L	M	S	L	M	S	L	M	S
2.0	0.768	87.2	0.043	0.964	88.8	0.050	-0.982	12.3	0.127	-0.974	12.8	0.131	-2.743	16.1	0.106	-3.721	16.5	0.084
2.5	0.708	91.4	0.044	0.947	93.1	0.049	-0.982	13.4	0.131	-0.978	14.0	0.133	-2.900	15.8	0.104	-3.622	16.1	0.086
3.0	0.656	95.4	0.044	0.926	97.0	0.048	-0.985	14.5	0.136	-0.987	15.2	0.135	-2.934	15.7	0.105	-3.507	15.9	0.089
3.5	0.612	99.2	0.045	0.903	100.7	0.047	-0.987	15.7	0.141	-0.998	16.3	0.138	-2.886	15.6	0.107	-3.392	15.8	0.091
4.0	0.579	102.8	0.045	0.880	104.1	0.047	-0.984	16.8	0.148	-1.010	17.4	0.141	-2.791	15.6	0.110	-3.284	15.8	0.094
4.5	0.556	106.4	0.046	0.856	107.4	0.047	-0.972	18.0	0.154	-1.020	18.5	0.145	-2.672	15.7	0.113	-3.184	15.8	0.097
5.0	0.541	109.7	0.046	0.834	110.7	0.047	-0.950	19.2	0.162	-1.026	19.6	0.150	-2.548	15.8	0.116	-3.089	15.8	0.101
5.5	0.534	113.0	0.046	0.813	113.8	0.046	-0.920	20.5	0.169	-1.025	20.8	0.155	-2.426	15.9	0.119	-2.996	15.9	0.104
6.0	0.531	116.1	0.046	0.795	116.8	0.046	-0.881	21.9	0.176	-1.015	22.0	0.161	-2.312	16.1	0.122	-2.900	16.0	0.108
6.5	0.530	119.2	0.046	0.779	119.8	0.046	-0.836	23.3	0.183	-0.995	23.3	0.168	-2.210	16.2	0.125	-2.796	16.2	0.112
7.0	0.528	122.0	0.046	0.766	122.8	0.046	-0.789	24.8	0.189	-0.965	24.7	0.175	-2.118	16.4	0.128	-2.682	16.3	0.117
7.5	0.520	124.8	0.046	0.753	125.6	0.046	-0.740	26.4	0.195	-0.927	26.2	0.182	-2.036	16.6	0.132	-2.554	16.5	0.121
8.0	0.503	127.6	0.047	0.739	128.4	0.046	-0.691	28.0	0.200	-0.881	27.8	0.189	-1.957	16.9	0.136	-2.412	16.8	0.127
8.5	0.474	130.3	0.047	0.719	131.1	0.046	-0.644	29.6	0.204	-0.831	29.5	0.195	-1.873	17.1	0.140	-2.257	17.0	0.132
9.0	0.438	133.1	0.047	0.686	133.8	0.046	-0.598	31.4	0.208	-0.778	31.3	0.201	-1.775	17.4	0.144	-2.091	17.3	0.137
9.5	0.406	135.9	0.048	0.630	136.4	0.046	-0.553	33.2	0.211	-0.724	33.2	0.206	-1.653	17.7	0.149	-1.916	17.6	0.143
10.0	0.399	139.0	0.048	0.539	139.0	0.046	-0.503	35.2	0.215	-0.668	35.1	0.210	-1.504	18.1	0.154	-1.736	18.0	0.148
10.5	0.443	142.2	0.049	0.401	141.6	0.046	-0.442	37.5	0.218	-0.612	37.2	0.213	-1.333	18.5	0.158	-1.557	18.3	0.152
11.0	0.551	145.5	0.049	0.220	144.3	0.047	-0.361	40.0	0.220	-0.556	39.4	0.215	-1.151	18.9	0.160	-1.382	18.7	0.155
11.5	0.717	148.8	0.048	0.026	147.1	0.048	-0.260	42.7	0.219	-0.499	41.7	0.217	-0.983	19.4	0.161	-1.217	19.1	0.157
12.0	0.909	151.9	0.047	-0.116	150.2	0.050	-0.153	45.6	0.214	-0.439	44.2	0.217	-0.854	19.8	0.159	-1.069	19.5	0.159
12.5	1.085	154.6	0.045	-0.126	153.5	0.052	-0.070	48.4	0.205	-0.379	46.9	0.216	-0.789	20.1	0.156	-0.943	19.9	0.159
13.0	1.211	156.8	0.044	0.050	157.2	0.053	-0.041	50.7	0.193	-0.317	49.7	0.213	-0.797	20.4	0.152	-0.844	20.2	0.157
13.5	1.274	158.4	0.042	0.401	161.0	0.053	-0.080	52.5	0.181	-0.260	52.7	0.208	-0.874	20.6	0.147	-0.776	20.6	0.155
14.0	1.283	159.7	0.040	0.855	164.6	0.052	-0.172	53.7	0.171	-0.214	55.8	0.202	-0.997	20.8	0.142	-0.740	20.9	0.153
14.5	1.257	160.6	0.039	1.305	167.8	0.049	-0.285	54.6	0.163	-0.189	58.7	0.193	-1.137	20.9	0.137	-0.738	21.1	0.149
15.0	1.215	161.2	0.038	1.649	170.4	0.047	-0.391	55.1	0.157	-0.197	61.3	0.184	-1.270	21.0	0.134	-0.765	21.3	0.146
15.5	1.170	161.7	0.038	1.829	172.3	0.044	-0.475	55.4	0.154	-0.240	63.5	0.174	-1.380	21.0	0.131	-0.818	21.5	0.142
16.0	1.130	162.0	0.037	1.847	173.7	0.041	-0.536	55.6	0.151	-0.314	65.2	0.165	-1.463	21.0	0.129	-0.890	21.7	0.139
16.5	1.098	162.2	0.037	1.754	174.7	0.039	-0.578	55.7	0.150	-0.406	66.6	0.158	-1.520	21.1	0.128	-0.974	21.8	0.136
17.0	1.072	162.3	0.037	1.612	175.3	0.038	-0.605	55.8	0.149	-0.501	67.5	0.152	-1.557	21.1	0.127	-1.065	21.9	0.133
17.5	1.053	162.4	0.037	1.466	175.8	0.037	-0.623	55.8	0.148	-0.588	68.2	0.148	-1.581	21.1	0.127	-1.156	22.0	0.130
18.0	1.039	162.5	0.036	1.341	176.0	0.036	-0.635	55.9	0.148	-0.660	68.7	0.145	-1.594	21.1	0.126	-1.242	22.0	0.128
19.0	1.021	162.6	0.036	1.172	176.4	0.036	-0.647	55.9	0.147	-0.758	69.2	0.141	-1.604	21.1	0.126	-1.391	22.1	0.124
20.0	1.012	162.6	0.036	1.084	176.5	0.035	-0.653	55.9	0.147	-0.811	69.5	0.139	-1.605	21.1	0.126	-1.501	22.2	0.122

SIEDP-2006 Italian growth charts.

1.0 cm. The differences in the 3rd centile are included between -0.6 and +1.7 cm vs 2000 CDC charts, and between -1.2 and +2.1 cm versus UK90 charts. The differences in the 97th centile are included between -1.8 and +2.4 cm vs 2000 CDC charts, and between -1.4 and +2.7 vs UK90 charts. Italian boys are taller than their USA peers by no more than 1.9 cm during most of the growth period, but at adulthood they are shorter by 0.4 cm. Italian boys are also taller than UK boys up to 16 yr, with a maximum of 2.4 cm at 13 yr; at the end of growth they are shorter by about 1.0

cm. The differences in the 3rd centile are included between 0.0 and +1.4 cm vs 2000 CDC charts, and between -0.5 and +2.2 cm vs UK90 charts. The differences in the 97th centile are in the range -2.0 to +3.6 cm vs 2000 CDC charts, and -2.3 to 4.4 vs UK90 charts.

Weight

In girls the 3rd and 50th centile of Central-North and South Italy growth references display similar values at all ages, the differences being <1.0 kg. On the

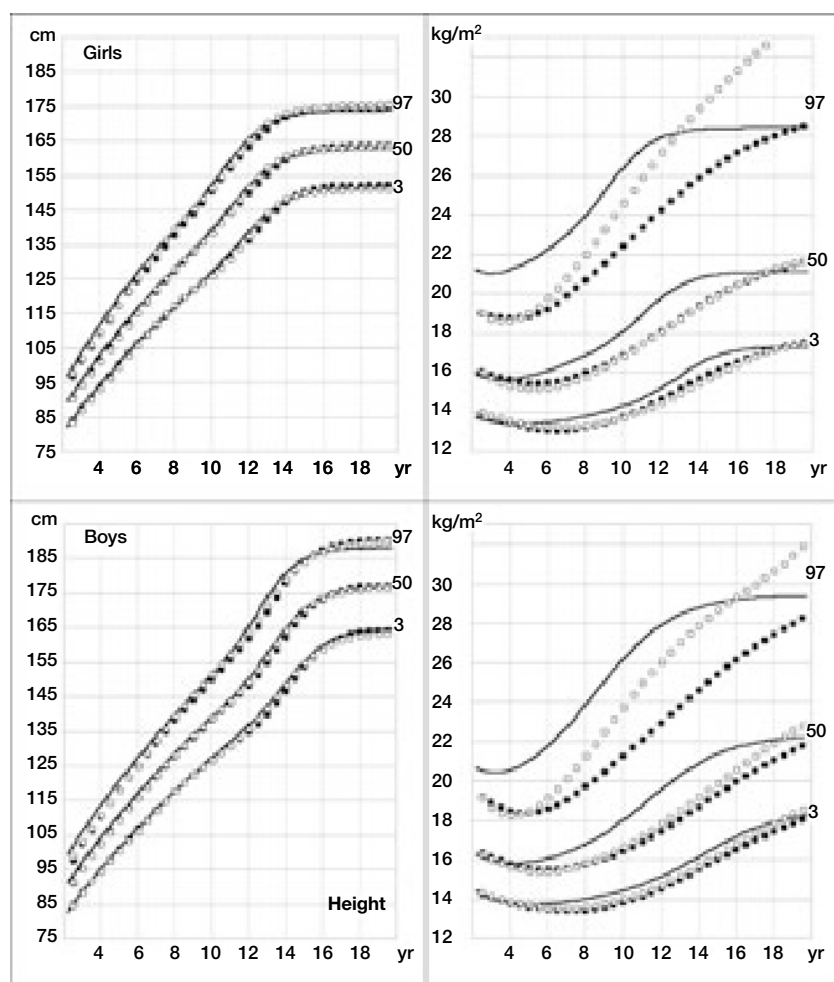


Fig. 2 - Comparison between the Italian Society for Pediatric Endocrinology and Diabetes (SIEDP)-2006 (continuous line), 2000-CDC (open circles) and UK90 (solid circles) charts: 3rd, 50th and 97th centiles of height (left) and bone mass index (BMI) (right) distribution for Italian girls (top) and boys (bottom).

contrary, the 97th centile of South Italy girls becomes progressively higher than that of Central-North girls, with a difference of 4.4 kg at adulthood. The median difference between Central-North and South Italy boys is within ± 0.4 kg up to 7 yr, after which Central-North boys become heavier up to 17.5 yr, with a maximum of 2.7 kg at 15.5 yr. At adulthood, South Italy boys are heavier by about 3 kg. The differences in the 3rd centile of boys' weight are less pronounced but follow an analogous pattern. The difference in the 97th centile between the two geographic areas is within ± 0.8 kg till 10.5 yr, after which the 97th centile of South Italy chart remains above that of Central-North chart with a maximum difference at adulthood (about 8 kg).

BMI

Before the age of 3, the 3rd, 50th and 97th centiles of Central-North chart are higher than those of South

Italy chart only for boys. Then Central-North and South Italy references do not differ substantially (± 0.5 kg/m²) in the 3rd centile of BMI for both sexes. A moderate difference emerges in median values after 13 and 15 yr of age in girls and boys respectively: at the end of growth BMI is higher by 1.0 kg/m² in South Italy girls and 1.3 kg/m² in South Italy boys. As for the 97th centile, South Italy children generally show BMI values higher than Central-North children. In girls the difference increases from 0.1 at 2 yr to 2.0 kg/m² at 14 yr and is 2.6 kg/m² at the end of growth. In boys the difference is negligible from 3.5 to 12 yr of age and increases up to 2.5 kg/m² at 20 yr. At 18 yr, the estimated prevalence of overweight subjects (BMI > 25 kg/m²) is higher in boys (Central-North: 17.1%; South Italy: 27.8%) than in girls (Central-North: 10.2%; S: 19.2%). A similar tendency can be observed for obesity (BMI > 30 kg/m²), the prevalence being 1.9% (Central-North) and 4.6% (South

Italy) in boys, and 1.3% (Central-North) and 3.5% South Italy) in girls.

The differences between SIEDP-2006, 2000-CDC (12) and UK90 (14) BMI charts are strikingly large. In girls, the 3rd and 50th centiles of Italian charts are close to the corresponding centiles of USA and UK charts during pre-school age and then become higher up to about 18 yr, with a maximum difference of 1.7 kg/m² at about 12.5. The 97th centile of Italian charts (girls) is higher than those of the other references from 2 to 13 (USA) and 19 yr (UK), the maximum difference being at 11 yr (+4.0 kg/m²) vs UK charts and at 20 yr (-6.7 kg/m²) vs USA charts. As for boys, the differences in the 3rd centile are within ± 0.6 kg/m². On average, Italian boys are heavier than both USA and UK boys between 4 and 18 (USA) or 20 yr (UK), with a maximum difference of 1.8 (USA) and 2.2 kg/m² (UK) at 13 yr. The 97th centile of Italian charts (boys) is higher than those of the other references up to 16 (USA) and 20 yr (UK), the maximum difference being at 11 yr (+5.0 kg/m²) vs UK charts and at 20 yr (-3 kg/m²) vs USA charts.

At 18 yr, the prevalence of overweight is 12.5 (girls) and 17.9% (boys) in SIEDP-2006 series, whereas it is 17.9 (girls) 18.7 (boys) in 2000 CDC series and 11.7 (girls) and 9.5% (boys) in UK90 series. The prevalence of obesity is 1.7 (girls) and 2.2% (boys) in SIEDP-2006 series, whereas it is 5.4 (girls) 3.6 (boys) in 2000 CDC series and 1.2 (girls) and 0.9% (boys) in UK90 series. To sum up, Italian children and adolescents tend to be fatter and appear to approach adult body proportion faster than their USA or UK peers, but they do not show a higher prevalence of overweight and obesity as adults.

DISCUSSION

The SIEDP-2006 cross-sectional charts for height, weight and BMI presented in this paper, which extend the SIEDP-2002 charts to pre-school ages (1), are based on a sample of about 70,000 subjects attending infant, primary and secondary schools. The distribution of the sample by gender, age and geographic area was roughly similar to that of Italian school population in the last decade of the twentieth century. The SIEDP-2006 charts apply to the Italian population from 2 to 20 yr of age, taken as a whole, or separately in two geographical areas (Central-North Italy and South Italy). These references are presented both in terms of centiles and LMS curves based on the EMGF method (1): the classic charts displaying centiles vs age can be easily interpreted by parents as well as by health personnel; LMS values enable auxologists to express auxometric traits as SDS, even in the case of skewed distribution.

The use of EMGF method instead of the Cole and Green's LMS method (10) provides smooth centiles while preserving the typical shape of longitudinal data as modelled by classical growth functions such as PB1 (7) or JPPS (8).

As discussed thoroughly in the previous paper (1) there are still auxological differences between the North and South of Italy during late childhood, adolescence and adulthood. After 4 yr of age girls and boys are taller in Central-North Italy than in South Italy, at 18 yr the average difference is about 2.5 cm. In contrast, from 2 to 4 yr children are taller in South Italy by 1 to 2 cm. During infancy and childhood there are no differences in girls' BMI between the two geographical areas, whereas boys' BMI is slightly higher in Central-North Italy up to 3 yr. After puberty, BMI values of children in South Italy become progressively higher than those of children in Central-North Italy. As a consequence, at 18 yr of age, the difference in the prevalence of overweight and obesity is 9.0 and 2.2% in girls, and 10.7 and 2.7% in boys. As for height, these differences are unlikely due to socioeconomic reasons: nutritional intake and life habits being suitable for allowing all children to reach their target height, at least in the last two decades; whereas important genetic differences between Central-North and South Italy are known to still exist, for instance in the incidence of some genetic disease, such as cystic fibrosis or thalassemia, or in the distribution of blood groups. By contrast, wide differences in diet and physical activity could be the reason why the prevalence of overweight and obesity is much higher in South Italy.

In the previous paper, SIEDP-2002 charts have been compared to Tanner et al.'s charts (17) for height, since these were still in use among most paediatricians, and to Rolland-Cachera et al.'s (18) for BMI. As a result, Tanner et al.'s charts were found to fail in detecting, when applied to Italian children, 70 to 90% of short children (ie with stature below the 3rd centile of their reference population) aged 6 to 8 yr, and 50 to 70% of short children aged 9 to 11 yr. Rolland-Cachera et al.'s BMI charts were observed to have lower values than the Italian reference, mainly as regards the 97th centile. For the above reasons, the use of British and French reference to assess Italian children appeared to be inappropriate.

In this paper, SIEDP-2006 charts were compared to 2000 CDC (12) and UK90 (13, 14) charts, which at present are among the most popular international references. As for height, the differences between the Italian reference and the USA and UK references are generally small: on average Italian girls and boys are slightly taller than their USA and UK peers up to the end of adolescence and only slightly shorter (<1

cm) at the end of growth. This finding is not unexpected since adult height in Italy has increased by about 8 cm in the last 50 yr because of secular trend (19). As for BMI, the pattern of growth in Italy appears to be very different from those observed in USA and UK: in Italy BMI is higher, and its distribution is more skewed, during childhood and adolescence. At the end of growth, median values of the three references are similar but the 97th centile of 2000 CDC charts is much higher and increases more steeply than that of SIEDP 2006 charts, which on the contrary reaches a plateau. The reason for this difference could be ascribed to diet and life habits: Spanish (20) and Italian children who share a similar Mediterranean diet and life-styles show an analogous pattern of BMI growth. The two extra-centiles traced on SIEDP-2006 charts, and passing through 25 kg/m² (for overweight) and 30 kg/m² (for obesity) at 18 yr of age, were computed according to Cole et al.'s (11) criterion who followed the suggestion of the International Obesity Task Force (15, 16). As clearly stated by Bellizzi and Dietz (16), an ideal index of obesity should predict early morbidity or mortality from chronic diseases; however, because excess weight in children is rarely associated with morbidity or mortality, an index of excess weight during growth period should be predictive of overweight and obesity in adulthood. The predictive value of the thresholds computed according to Cole et al.'s (11) criterion rests essentially upon two implicit assumptions: (1) a high degree of tracking for BMI, ie that BMI growth follows the same centile from infancy to adulthood; (2) a substantial stationary weight distribution over time, ie that the prevalence of obesity and overweight will not change in the next years. Since BMI distribution varies with gender, age and reference population, Cole et al.'s criterion applied to different growth charts leads to different thresholds. This is not surprising since, for a child of a given age and BMI, the risk of becoming overweight or obese as an adult depends on the BMI increase with age in the population to which the child belongs: the higher the increase, the lower the current BMI values regarded as at risk. To sum up, these extra-centiles should be regarded as thresholds not to detect a child that is currently overweight or obese, but to predict adult overweight or obesity. By contrast, if the aim is to detect current excess weight in childhood, the thresholds could be set equal to the 95th or 75th centiles of SIEDP 2006 charts that, up to the onset of puberty, roughly correspond to the overweight or obesity thresholds of Cole et al.'s charts (11).

SIEDP-2006 references intend to supply pediatricians with a tool that avoids the use of charts that are outdated or that refer to other populations, and

thus should be suitable for adequately monitoring the growth of their patients. However, the differences between the charts in use and SIEDP charts are expected to result in different estimates of the prevalence of subjects labelled as short stature or overweight or obese: this fact should be clearly explained to Italian clinicians when they begin to adopt SIEDP charts.

IN COLLABORATION WITH:

2 to 6 yr data set: G. Aloï (NA), S. Arrigoni (MI), A. Bergomi (Pavullo, MO), V. Bianco (NA), M. Cappa* (RM), E. Carlin (UD), R. Cera (Cerignola, FG), F. Chiarelli (CH), L. Ciacci (RN), A. Cohen* (IM), D. Colabianchi (RM), M. Deiana (VA), F. De Luca* (ME), M. Del Vecchio (BA), S. Di Maio* (NA), B. Di Natale* (MI), M. Di Pietro* (Atri, TE), A. Falorni* (PG), G. Federico (PI), P. Gallo (NA), L. Iughetti (MO), M.T. La Vecchia (NA), R. Limauro (NA), A. Liotta (PA), A. Lorusso (PD), A. Luciano (VR), M. Maccherini (Treviglio, BG), M.C. Maggio (PA), A. Meo (PD), E. Modestini (Atri, TE), M.R. Nardella (San Severo, FG), E. Pagliato (MI), A. Petri (NO), A. Pilotta (BS), I. Rulli (ME), V. Russo (BA), G. Saggese* (PI), E. Sempellegri (Treviglio, BG), A. Salvatoni (VA), A. Tenore* (UD), G. Ubertini (RM), V. Vecchi (RN), E. Vidal (UD), M. Zampolli (CO), G. Zirilli (ME);

6 to 20 yr data set: Directive Council of SIEDP/ISPED 1996-97 (E. Cacciari (BO), F. Dammacco* (BA), F. De Luca* (ME), F. Chiarelli* (CH), A.M. Pasquino (RM), G. Tonini (TS), M. Vanelli (PR), G. Aicardi* (GE), F. Antoniazzi (VR), A. Balsamo* (BO), E. Bartolotta (MC), L. Benso (TO), S. Bernasconi (PR), G. Bona* (NO), G. Bonora (SO), N. Bozzato (MI), M. Bozzola (PV), G. Bussi (AT), F. Buzi (BS), M. Cappa* (RM), L. Carcione (RC), M. Caruso-Nicoletti (CT), L. Ciacci (RN), V. De Sanctis (FE), S. Di Maio* (NA), A. Falorni* (PG), L. Gobio-Casali (MN), L. Greco (NA), S. Lauriola (VR), A. Liotta (PA), S. Loche* (CA), R. Longhi (CO), M.C. Maggio (PA), M.F. Messina (ME), S. Milani (MI), A. Naselli (GE), R. Pecorari (FE), A. Petri (NO), C. Pintor (CA), G. Pozzobon (MI), A. Salvatoni (VA), M. Scrivano (FI), S. Seminara* (FI), C. Sgattoni (MC), L. Tatò* (VR), S. Tumini (CH), E. Urso (VR), M. Valenzise (VV), V. Vecchi (RN), G. Viganò (MI).

CONTRIBUTORS

E. Cacciari and A. Balsamo originated and coordinated the study; S. Milani and E. Spada designed the study and did data analysis; A. Balsamo, A. Cicognani, G. Bona, L. Cavallo, L. Gargantini, and N. Greggio coordinated the Emilia-Romagna, Piemonte, Puglia, Lombardia and Veneto data collection, respectively; *regional coordinator; the other coworkers contributed to local data organization and/or measurements; E. Cacciari wrote the paper with co-authors.

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