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SCIENTIFIC REPORT submitted to EFSA

Collection, collation and analysis of data in relation to reference heights and reference weights for female and male children and adolescents (0-18 years) in the EU, as well as in relation to the age of onset of puberty and the age at which different stages of puberty are reached in adolescents in the EU[1]

CT/EFSA/NDA/2010/01

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Summary

Growth references of children 0-18 years living in the European Union (EU) are needed for the derivation of Dietary Reference Values (DRVs) for nutrients and other substances with a nutritional or physiological effect. This report presents harmonised growth references for height, weight and body mass index (BMI) at the EU-level, and an inventory of the available information on pubertal development at the EU-level.

Harmonised growth references were calculated using existing material available from the individual EU Member States covering the period 1990-2011. The coverage of the European population was high: 90.1% for height-for-age, 87.5% for weight-for-age, and 85.2% for BMI-for-age. Mean height of European boys at age 18 years was equal to 177.6 cm (SD: 7.1), girls 164.7 cm (SD: 6.7). Median weight at 18 years was estimated as 69.3 kg (boys) and 57.4 kg (girls). Median BMI-values at 18 years were 21.9 kg/m^2 (boys) and 21.1 kg/m^2 (girls), respectively. Reference charts and tables 0-18 years were calculated. Most heterogeneity between Member States was observed for height, whereas differences in BMI tended to be small.

Mean age of menarche at the EU-level was 12.7 years (coverage 91.8%). Data on Tanner stages (boys: genital development and pubic hair; girls: breast development and pubic hair) and data on testicular volume were available for a minority of EU Member States, and lacked sufficient quality and consistency to calculate references at the EU-level.

We recommend applying the harmonised EU growth references in deriving DRVs. Also, we recommend updating the harmonised EU growth references once every 10 years.

Key words: growth references, harmonisation, European Union, height, body weight, body mass index, Tanner stages, puberty

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Background

In 2005, the European Food Safety Authority (EFSA) received a mandate from the European Commission to review the existing advice of the Scientific Committee on Food (SCF) on Dietary Reference Values (DRVs) for energy, macro- and micronutrients and other substances with a nutritional or physiological effect. The work on micronutrients was launched at the end of 2010.

For the setting of DRVs for different age groups, the NDA Panel needs to gather data on references for heights and weights for female and male infants, children and adolescents (0-18 years) in the Member States of the European Union (EU). In addition, data on the age of onset and different stages of puberty of female and male adolescents are needed.

Terms of reference

The terms of reference were published as EFSA (2010), TENDER SPECIFICATIONS CFT/EFSA/NDA/2010/01: "Data collection, collation and analysis related to specific preparatory work in the establishment of Dietary Reference Values".

Acknowledgements

This contract was awarded by EFSA to:

Contractor:	TNO, Leiden, The Netherlands
Contract title:	Collection, collation and analysis of data in relation to reference heights and reference weights for female and male children and adolescents (0-18 years) in the EU, as well in relation to the age of onset of puberty and the age at which different stages of puberty are reached in adolescents in the EU
Contract number:	CT/EFSA/NDA/2010/01

We thank Michael Hermanussen, Jani Söderhäll, Andreas Lehman, Alessandro Sartorio and all the Member States that provided requested data and details.

1. Introduction and Objectives

1.1. Introduction

For the setting of DRVs in different age groups, references for height and weight are needed for infants, children and adolescents (0-18 years) in EU Member States. The reference values used up to now consist of a table of mean height by age and a table of mean weight by age, pooled from data from several EU Member States.[1,2] The NDA Panel recommends to update these references with the following words: "The Panel recognises that the reference weights used in the SCF report were based upon pooling of national data from a limited number of EU Member States. These data are relatively old and not necessarily representative for the newer EU Member States …. The Panel would recommend the development of a database with reference weights and heights representative for the total European population." [3]

1.2. Overall objectives

The overall objectives, as stated in the tender CFT/EFSA/NDA/2010/01, are as follows:

(1) To provide EFSA with a report containing height-for-age, weight-for-age and body mass index (BMI)-for-age references for female and male children and adolescents (0-18 years) in the EU based on appropriate data available in EU Member States.

(2) To provide EFSA with a report on the age of onset of puberty and the age at which different stages of puberty are reached in adolescents in the EU based on data available in EU Member States.

Objective (1) is called 'growth', and objective (2) is called 'pubertal development'.

1.3. Specific objectives: growth

The specific objectives for growth are as follows:

The contractor should identify existing data sets in EU Member States upon which height-for-age, weight-for-age and BMI-for-age curves for female and male children and adolescents (0-18 years) could be based. The contractor should calculate Z-score curves, percentile curves and tables for male and female children and adolescents (0-18 years) for height-for-age, weight-for-age and BMI-for-age and shall submit them in a report to EFSA.

The contractor should identify appropriate data sets which are available in EU Member States which can be used for the calculation of Z-score curves, percentile curves and tables for male and female children and adolescents (0-18 years) for height-for-age, weight-for-age and BMI-for-age. The data sets should have preferably been developed after 1990.

The contractor should analyse the data sets retrieved for the homogeneity and the possibility to pool data in order to develop harmonised EU Z-score curves, percentile curves and tables for male and female children and adolescents (0-18 years) for height-for-age, weight-for-age and BMI-for-age. If the data can be pooled the contractor should calculate harmonised EU Z-score

curves, percentile curves and tables for male and female children and adolescents (0-18 years) for height-for-age, weight-for-age and BMI-for-age.

In case not all data can be pooled the contractor should analyse whether a selection of data could be pooled and still would be representative of the European Union population. If this is the case, the contractor should calculate Z-score curves, percentile curves and tables for male and female children and adolescents (0-18 years) for height-for-age, weight-for-age and BMI-for-age based on the selected data sets.

In case data cannot be pooled, the contractor should calculate Z-score curves, percentile curves and tables for male and female children and adolescents (0-18 years) for height-for- age, weight-for-age and BMI-for-age for a representative number of EU Member States and EU populations. In case the data is already available in the form of Z-score curves, percentile curves and tables in a Member State, the already calculated data sets should be used.

The contractor should prepare a report containing the Z-score curves, percentile curves and tables for male and female children and adolescents (0-18 years) for height-for-age, weight-for-age and BMI-for-age. In the report the contractor should also indicate how the data sets used for the calculation had been obtained, the sample sizes, the age categories, the socioeconomic status of the subjects and the quality of the data sets. The report should also include an analysis of the reliability of the harmonised EU growth curves, in case these have been developed. In case these were based on a selection of data, the contractor should outline to which extent these curves can be regarded as representative of the EU population. In case no harmonised growth curves can be developed, the contractor should outline the reasons for this inability in the report.

1.4. Specific objectives: pubertal development

The specific objectives for pubertal development are as follows:

The contractor should identify existing data on the age of onset of puberty and the age at which different stages of puberty are reached in adolescents in EU Member States. The data should be analysed for each Member State where data was available. If possible, data should be pooled to derive a harmonised value for the onset of puberty and the age at which different stages of puberty are reached in adolescents in the EU. The contractor should prepare a report containing the analysis of data for each Member State and the derived harmonised value for the onset of puberty and the age at which different stages of puberty are reached in adolescents in the EU. The report should also contain an overview about the quality and reliability of data.

2. Materials and Methods

2.1. Data collection process

For each Member State, we identified investigators knowledgeable of and responsible for the national growth charts. We started from two collections of growth charts: the collection maintained by professor Michael Hermanussen, an expert on international growth references, and the collection references maintained by Jani Söderhäll of the software company PC PAL. We searched the literature to identify groups that we might have missed and contacted the relevant investigators. For some Member States we contacted the Ministry of Health for further information.

We asked every group to send us the most recent age-related reference values for height-for-age, weight-for-age and BMI-for-age, preferably in the form of a table of LMS-values per age (c.f. section 2.3), though other forms (mean and standard deviation, percentiles, Z-scores) were also accepted. We collected meta data on the sampling design, measurements taken, and other relevant characteristics of the studies. In addition, we obtained the population sizes of the Member States per 1.1.2011, as published by Eurostat (http://epp.eurostat.ec.europa.eu/).

2.2. Quality evaluation

Growth

Only data of high quality were considered for inclusion into harmonised EU references. Each data source for height-for-age, weight-for-age and BMI-for-age was judged against a list of criteria:

- Only measured height and weight are acceptable (no self-reported data);
- The data should be published, or come from an official authority;
- The data can be considered representative for the Member State;
- The data should have been developed after the year 1990;
- The ages are point ages (no age intervals);
- The age range is 0-18 years.

Most criteria were met, but for some Member States we also accepted data that spanned an age range shorter than 0-18 years.

Table 1 and Appendix D.1 provide a detailed assessment of each accepted data source. Most of the reference data were appropriately documented. Bulgaria (height) and Greece (height and weight) contributed references that are regarded as representative for the respective population, but that lacked documentation. Since these were the only growth data that we were able to obtain from this region of the EU, we decided to accept these data sources. Some studies were based on data obtained from geographic sub-regions, by self-reports or before 1990, but that are nevertheless considered representative for the Member State.

Puberty

Dorn et al. (2006) presented an overview of the many variations in obtaining pubertal measurements.[4] This report is restricted to Tanner Stages, the gold standard of objective pubertal measurements. For boys, we selected the following measures: genital development (5 stages: G1-G5), pubic hair (5 stages: PH1-PH5) and testicular volume (12 categories).[5] For girls, we selected breast development (5 stages: B1-B5), pubic hair (5 stages: PH1-PH5) and menarche (2 categories: yes-no).[6] The references are typically reported as the age at which 10, 50 and 90% of the population are in or beyond a particular stage. Each data source was judged against a list of criteria:

- For menarcheal age, the status quo method is used. For the other measures only measures based on physical examination are acceptable (no self-reported data);
- The data should be published, or come from an official authority;
- The data can be considered representative for the Member State;
- The data should have been developed after the year 1990;
- The reported ages should be statistically valid estimates;
- The age range is 9-18 years.

Not all criteria could be met for all Member States. In particular, in some Member States the pubertal data were collected by self-assessment rather than physical examination, or had shorter age ranges. Tables 3-6 and appendices D.2-D.5 provide a detailed assessment of the accepted data sources.

2.3. Data preparation and harmonisation

A first step of the analysis is to code the reference data as published into a common format, so that the software could read them. The age grid used, the way in which the outcomes are calculated, the use of logarithmic scales, and the publication format (LMS-values, percentiles (P), mean-standard deviations (MS), Z-scores) widely varied between countries. We programmed dedicated routines that convert percentiles, Z-curves and mean-standard deviation pairs into LMS-values on the published age grid. Since the conversion is complicated for skewed variables (weight, BMI) that are published in the mean-standard deviation format, such data were treated as missing.

Prior to modeling, all data values were plotted and examined by two experts. We checked for errors, inconsistencies and aberrant patterns in the data. Appropriate action (e.g. correcting typos, set highly suspect values to missing) was taken to eliminate obvious errors.

LMS-values are the *de facto* standard for modeling growth curves. The LMS-table consists of four columns: age, L-curve, M-curve, and S-curve. At a given age, the M-curve describes the median (P50) of the outcome, the S-curve describes the coefficient of variation, and the L-curve models the skewness as the exponent in the Box-Cox transformation. The Box-Cox transformation brings skewed data closer toward normality. The L-, M- and S-curve vary smoothly with age. When taken together, the LMS-values model the entire distribution of the outcome for a Member State.[7]

2.4. Methodology used to calculate harmonised LMS-values

Starting from the LMS-values per Member State, the method to calculate harmonised EU growth references consists of the following steps:

1. Interpolate all reference distributions to a common age grid by linear interpolation of the L, M and S values;
2. For a Member State with an incomplete age range, find the best matching Member State (see below) using the jointly observed ages, and take the L, M and S values from the matched Member State to copy the L, M and S values at the missing ages;
3. For Member States with entirely missing data, define a donor Member State (see below), and copy the L, M and S values from the donor;
4. For each Member State, create a synthetic dataset by randomly drawing data from the local LMS-distribution, where the number of drawn records is proportional to the Member States population size, and where the total sample size equals 50,000. The number of 50,000 corresponds to a sample of 1 record for every 10,000 inhabitants;
5. Estimate the LMS-values for the common EU growth reference by fitting a statistical model on the synthetic data for all 27 Member States.

Suppose that L, M and S values are needed for age t, but that the tabulated reference does not contain an entry at age t. The linear interpolation method used in step 1 first finds the neighboring ages t_{min} and t_{max} in the tabulated data, as well as the corresponding values of the M-curve: M_{min} and M_{max}. Linear interpolation calculates the required M-value at age t as $M_t = M_{min} + (t - t_{min})/(t_{max} - t_{min}) * (M_{max} - M_{min})$. The same calculation is used for L and S. The common age grid used consists of weeks (w) 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 32, 36, 40, 44, 48, 52, 56, 60 and 64, followed by every half year throughout the age interval 1.5 – 18 years.

The "best matching Member State" in step 2 is defined as the Member State that has the smallest sum of squared difference between their observed M-values.

Step 3 deals with Member States with entirely missing data. This may occur if we are unable to obtain any reference data for a Member State, or if the published references in the Member State cannot be converted into LMS-format. An obvious way to handle this problem would be to eliminate the Member State from the calculations. This strategy would, however, require the additional assumption that the growth in the incomplete Member States is similar to growth in the complete Member States. This assumption is somewhat implausible, since the factors that affect growth and the factors that determine whether the data are missing could, in fact, be the same (e.g. north-south gradient, gross national product *per capita*). This study uses an alternative strategy that replaces the incomplete parts in the data by information borrowed from a 'similar' Member State. Usually, 'similar' means close in geography. For example, suppose that we cannot find appropriate reference data for Portugal. Since Portugal borders only Spain and since growth is known to be clustered geographically, we may argue that growth in Portugal will be more similar to that in Spain than to that in any other Member State. Thus, in the absence of the appropriate reference information, the most plausible donor Portugal would be Spain. The set of donor Member States will be defined explicitly.

In contrast to the finite mixture model[8], the simulation method used in step 4 will produce a valid LMS-solution at the EU-level from which any desired centiles can be calculated with simple formulas.

Step 5 fits the data by a GAMLSS model in R.[9,10] This results in a growth reference at the EU-level. All data of sufficient quality as defined in section 2.2 will be pooled.

Realize that Member States are likely to be heterogeneous with respect to growth. For example, the Dutch population is the tallest in the world, and considerably taller than people in Southern Europe. Pooling all Member States will increase the spread between the centiles. Thus, an increase of spread is an immediate consequence of pooling heterogeneous populations. In order to have a measure of heterogeneity of the countries, we will calculate the difference between the most extreme populations at 18 years, and express this in the number of standard deviations in the newly fitted reference.

In this report, we start from the premise that an increase in spread is acceptable and, in fact, inescapable. The main criterion to evaluate whether data from the Member States can be pooled is whether the resulting references can be considered representative at the EU-level.

3. Results

3.1. Coverage of the EU-27 Member States

Table 1 summarizes the types of growth references on height, weight and BMI available in the 27 EU Member States. The information takes various forms. For example, the Belgium growth references 0-21 years consist of mean-standard deviation (MS) for height, and LMS-values (LMS) for weight and BMI, whereas the Czech references have all been published as a set of age-conditional percentiles (P). For some Member States, e.g., in Cyprus, the references are available in two formats, or only for a subset of the age range 0-18 years.

The overall *population coverage* depends on the number of references. We were unable to find any representative growth references for the following Member States: Austria, Ireland, Luxembourg, Latvia, Malta, Portugal, Romania and Slovenia. The number of inhabitants in these eight Member States is equal to 9.9% of the total population size of the EU.

Height: For height, the available information covers all other Member States. The coverage for height thus equals 90.1% of the EU population.

Weight: References of body weight for Bulgaria and Slovakia were available only as means and standard deviations. This pair of statistics is insufficient to describe skewness in the distribution of body weight, and thus cannot be used for the harmonised European data. The population coverage for body weight therefore slightly decreases from 90.1% to 87.5%.

BMI: In addition, for Greece only mean BMI was known. Since mean BMI is insufficient to be used in the harmonised data, we disregard the Greek BMI data. The population coverage for BMI thus decreased to 85.2%.

Table 1 Availability of representative reference data for height, body weight and body mass index (BMI) in the 27 Member States of the European Union (EU).

Code	Member State	Pop (m)	Age min	max	Height	Weight	BMI	Year	Source
AT	Austria	8.4							
BE	Belgium	10.8	0	21	MS	LMS	LMS	2009	11
BG	Bulgaria	7.6	0	18	MS	MS		2011	12
CY	Cyprus	0.8	6	17	MS	MS, P	MS, P	2001	13
CZ	Czech Republic	10.5	0	18	P	P	P	2004	14
								2001	15
								2011	16
DE	Germany	81.8	0	18	LMS	P	LMS	2010	17
DK	Denmark	5.6	0	5	MS, P	MS, P	MS, P	2010	18
EE	Estonia	1.3	2	18	MS, P	P	P	1998	19
ES	Spain	46.0	0	18	MS	P	P	2008	20
FI	Finland	5.4	0	18	MS	LMS	LMS	2011	21
FR	France	64.7	0	18	MS	P	P	2004	22
GR	Greece	11.3	0	18	MS	P	M	2001	23
HU	Hungary	10.0	0	18	MS, P	MS, P	MS, P	2006	24
IE	Ireland	4.5							
IT	Italy	60.3	2	20	MS	LMS	LMS	2006	25
LT	Lithuania	3.3	0	18	MS	P	P	2010	26
LU	Luxembourg	0.5							
LV	Latvia	2.2							
MT	Malta	0.4							
NL	Netherlands	16.6	0	21	MS	LMS	LMS	2011	27
PL	Poland	38.2	7	18	LMS	LMS	LMS	2011	28
PT	Portugal	10.6							
RO	Romania	21.5							
								2002	29
SE	Sweden	9.3	0	19	MS	MS*	P	2000	30
SI	Slovenia	2.0							
SK	Slovakia	5.4	0	18	MS	MS	MS	2001	31
UK	United Kingdom	62.0	0	21	MS	LMS	LMS	1998	32
EU	EU27	501.1							

Pop = population size in millions, Age (min, max) = Age range (years), MS = mean/standard deviation, MS* (log scale), P=percentiles, LMS = LMS-curves

Table 2 Donee-Donor pairs of EU-Member States that indicate the Member States are used to replace missing reference data in the donee Member States.

Donee	Donor		
	Height	Weight	BMI
Austria	Germany	Germany	Germany
Bulgaria		Greece	Hungary
Greece			Italy
Ireland	UK	UK	UK
Luxembourg	France	France	France
Latvia	Lithuania	Lithuania	Lithuania
Malta	UK	UK	UK
Portugal	Spain	Spain	Spain
Romania	Hungary	Hungary	Hungary
Slovenia	Italy	Italy	Italy
Slovakia		Czech Republic	Czech Republic

Table 2 specifies the Member States that are used as donors for those Member States that have inadequate reference data. The central assumption of the imputation model is that population distributions of height, weight or BMI are identical for donor and donee, so Member States have been paired such that they are expected to have a similar growth distribution. Often, neighbouring countries are sought that are close in geography, food and culture. For example, the missing Austrian growth references (donee) are replaced by the German references (donor). Thouh not close in geography, the UK has chosen as the donor for Malta since Malta is member of the Commonwealth of Nations and has English as one of its two official languages. Bulgaria has different donors for weight and BMI (Greece and Hungary), due to the fact that the Greek BMI references are missing. Note that even though the list contains 11 out of 27 Member States, the missing information concerns only 10-15% of the EU-population.

All smoothing across age was done by penalized splines. For height and weight, age was transformed by a monotone transformation to make the M curve linear in age. Height-for-age was modeled by a normal model, using 8 and 3 degrees of freedom to smooth the mean and standard deviation curves, respectively. Weight-for-age was modeled by the LMS model using 8, 5 and 2 degrees of freedom for the M, S and L curves, respectively. The BMI-for-age distribution was modeled by the LMS model in the square root of age, using 8, 5 and 4 degrees of freedom for the M, S and L curves, respectively.

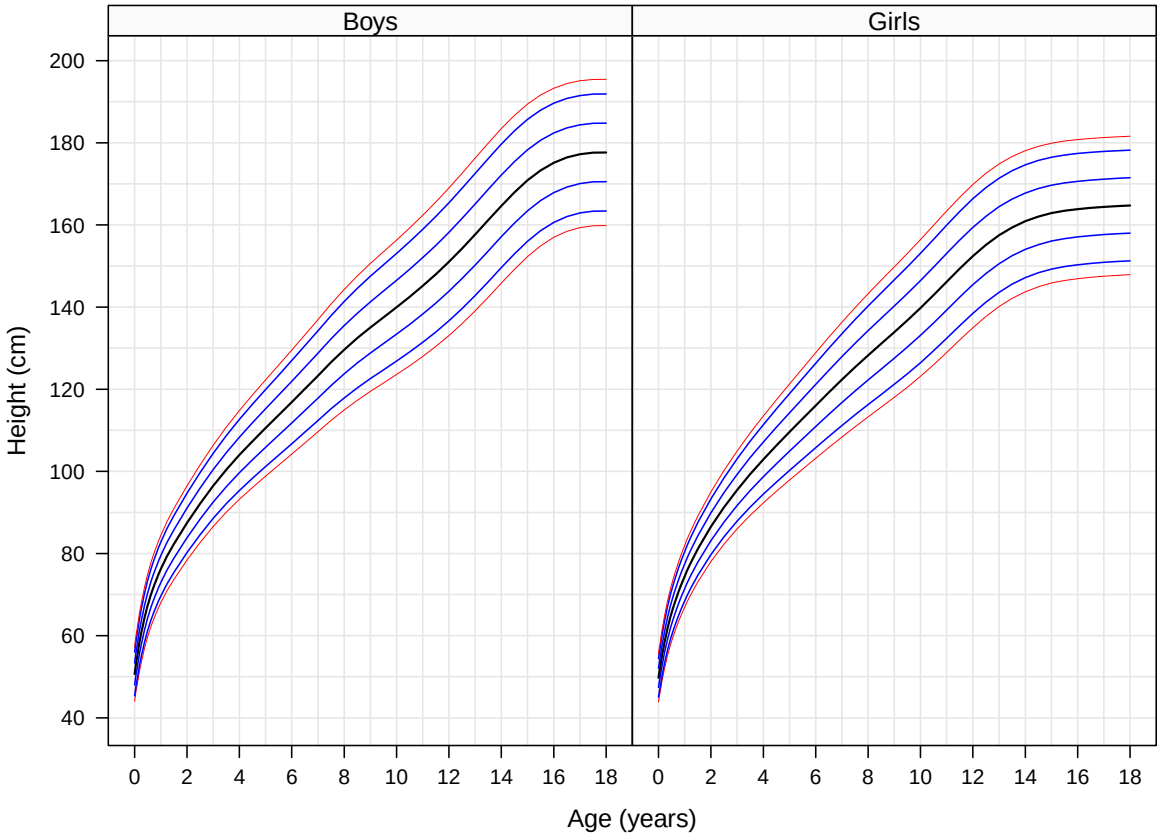

Figure 1 Height (cm) distribution by age (years) for the EU-population. The lines correspond to the following centiles (from bottom to top): -2.5, -2, -1, 0 (median), +1, +2 and +2.5 SD.

3.2. Height-for-age

Figure 1 illustrates the age-conditional height distribution for the EU-population as calculated from the simulated data. The shape of the centile curve is typical for height references, with a clearly noticeable growth spurts during puberty, followed by a halt in growth at adult age. Mean height at 18 years of the EU-population is equal to 177.6 cm (boys) and 164.7 cm (girls).

The difference in mean height at 18 years between the tallest (Netherlands) and the shortest (Bulgaria) population is large (boys: 10.1 cm, girls: 8.3 cm), about 1.4 SD (boys) and 1.2 SD (girls). Since the EU-population is more heterogeneous than the populations found within Member States, we may expect that the standard deviations in the EU-distribution will exceed those of the Member State references. This turned indeed to be the case. The SD of height at 18 years in the harmonised EU reference is equal to 7.1 cm and 6.7 cm for boys and girls, respectively. The averages of the Member State-specific standard deviation are smaller: 6.5 cm

and 6.3 cm, respectively. Thus, we 'pay' for the increased heterogeneity in the EU-population by a raised standard deviation.

Appendix A contains the LMS-values, Z-scores and percentiles of the harmonised EU height-for-age references.

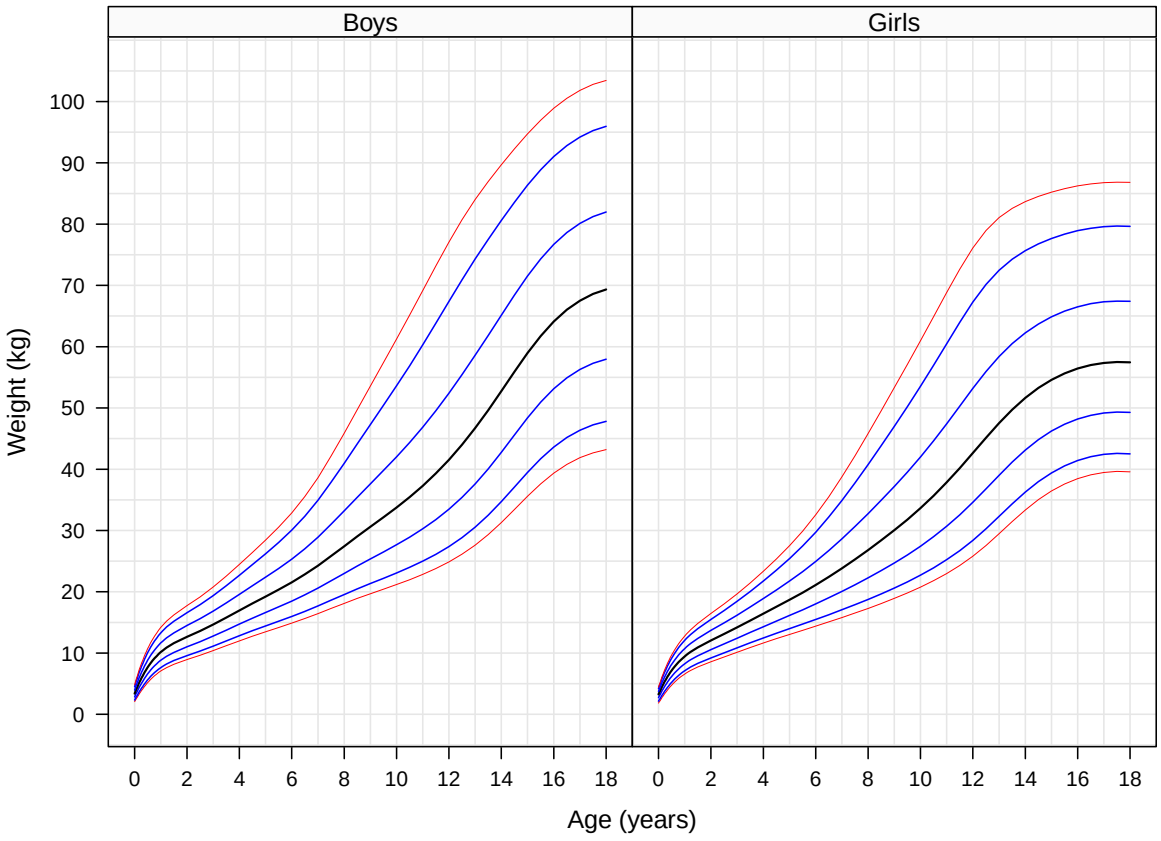

Figure 2 Weight (kg) distribution by age (years) for the EU-population. The lines correspond to the following centiles (from bottom to top): -2.5, -2, -1, 0 (median), +1, +2 and +2.5 SD.

3.3. Weight-for-age

Figure 2 displays the fitted EU-references of weight-for-age. Note that the weight distribution is skewed to the right. The median (P50) at 18 years is equal to 69.3 kg (boys) and 57.4 (girls). The shape of the centile lines corresponds very well to that of other references, with a huge increase in variability with age, and with a steep increase during puberty.

The Member States are more homogeneous in terms of weight than in terms of height. The difference in P50 at 18 years between the lightest Member State (boys: UK, girls: France) and heaviest Member State (boys: Bulgaria, girls: Sweden) population is 11.0 kg (boys) and 5.8 kg (girls), corresponding to 0.9 SD and 0.6 SD, respectively. The median weight at 18 years in all

other Member States were actually very similar, all within a range of ±3 kg from the European references.

Appendix B contains the LMS-values, Z-scores and percentiles of the harmonised EU weight-for-age references.

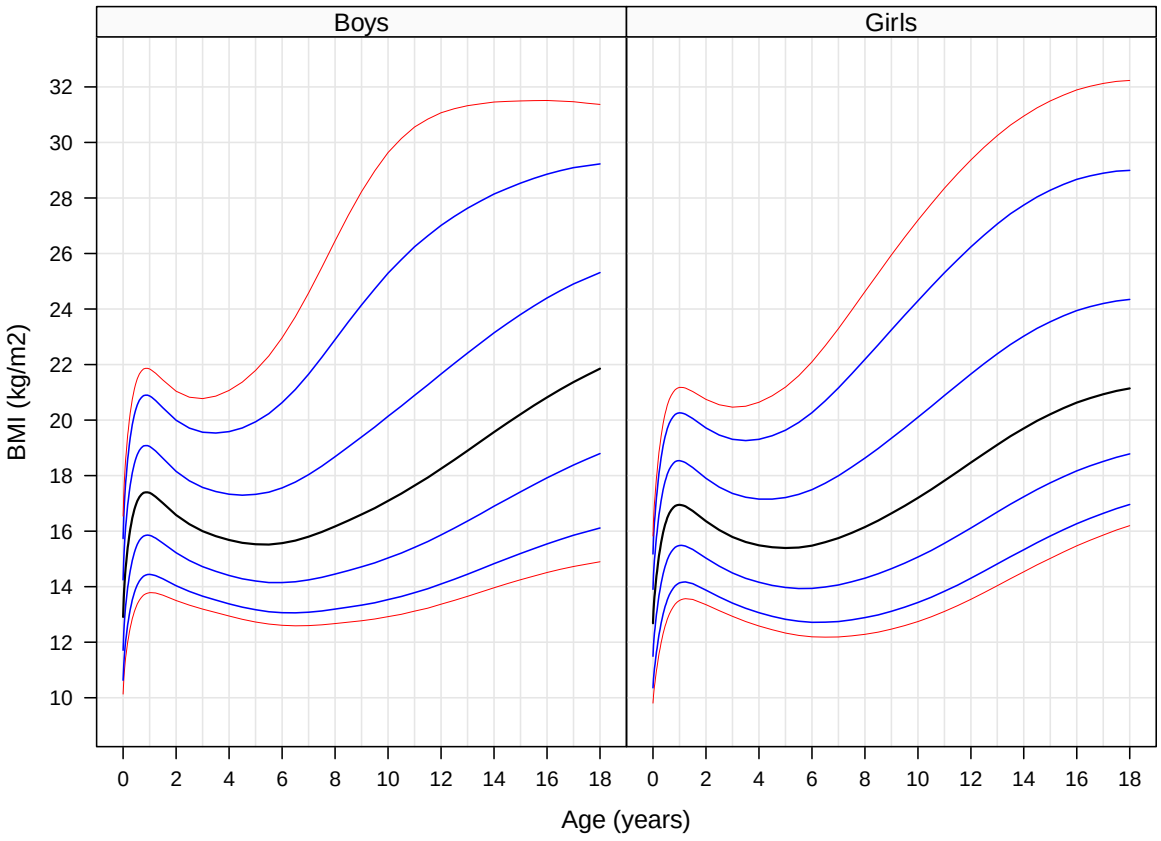

Figure 3 Body mass index (BMI) (kg/m^2) distribution by age (years) for the EU-population. The lines correspond to the following centiles (from bottom to top): -2.5, -2, -1, 0 (median), +1, +2 and +2.5 SD.

3.4. BMI-for-age

Figure 3 displays the fitted EU-references of BMI-for-age. The BMI distribution is strongly skewed to the right. The median (P50) at 18 years is equal to 21.9 kg/m^2 (boys) and 21.1 kg/m^2 (girls). The shape of the centiles resembles the typical shape of BMI-references, with a quick uptake during the first year, a period of adiposity rebound around the age of 6 years, and with a varying inter-centile distance. The +2 SD line roughly corresponds to the IOTF cut-off values for obesity that increase from about 20 kg/m^2 (at age 2 years) to 30 kg/m^2 (at age 18 years). The +1 SD line is slightly lower than the IOTF cut-off value for overweight, that increases roughly from 18.5 kg/m^2 (at age 2 years) to 25 kg/m^2 (at age 18 years).

The European Member States are more homogeneous in terms of BMI than in terms of height or weight. In particular, the difference in P50 at 18 years between populations with the lowest (France) and highest (boys: Cyprus, girls: Spain) BMI is 1.2 kg/m^2 (boys) and 1.3 kg/m^2 (girls), corresponding to 0.2 SD and 0.5 SD, respectively. The medians at 18 years from the individual Member States all fall within a range of ±1 kg/m^2 of the European references. Thus, the median BMI within the Member States is very similar.

Appendix C contains the LMS-values, Z-scores and percentiles of the harmonised EU BMI-for-age references.

3.5. Menarche

Table 3 Mean/median age of menarche in the 27 Member States of the European Union.

Code	Member State	Mean/Median	Year	Source
AT	Austria			
BE	Belgium	13.0	2009	11
BG	Bulgaria	12.0	2009	33
CY	Cyprus			
CZ	Czech Republic	13.0	2006	34
DE	Germany	12.8	2007	35
DK	Denmark	13.1	2009	36
EE	Estonia	13.0	2005	37
ES	Spain	12.6	2002	38
FI	Finland	13.3	1993	38
FR	France	12.6	2001	39
GR	Greece	12.3	2008	40
HU	Hungary	12.7	2002	41
IE	Ireland	12.5	2006	42
IT	Italy	12.4	2010	43
LT	Lithuania	13.4	2005	44
LU	Luxembourg			
LV	Latvia			
MT	Malta			
NL	Netherlands	13.0	2011	27
PL	Poland	12.8	2011	45
PT	Portugal	12.0	2003	46
RO	Romania			
SE	Sweden	13.2	1991	47
SI	Slovenia			
SK	Slovakia			
UK	United Kingdom	12.9	2010	48

Table 3 lists the median age (or mean age if the median age was not reported) at menarche in 27 Member States. The information is available for 19 Member States. The coverage of the EU population is high: 91.8%. We calculated the mean menarcheal age over all 27 Member States, using the same donors as in Table 2. The mean age at menarche in the EU population is estimated as 12.7 years. The distribution of menarchael age is close to normal. The standard deviation around this mean is typically somewhere around 1 year, and depends on menarcheal age. It was, however, not possible to estimate the standard deviation on the EU level since the information needed was missing in many of the published references from the Member States.

3.6. Tanner stages: boys

Table 4 Age at which 50% of the reference boys reaches a Tanner stage in EU Member States (PH=pubic hair, G=genital).

	min	max	PH2	PH3	PH4	PH5	G2	G3	G4	G5	Year	Source
BE	6	18	11.9	13.0	13.9	15.2	11.4	12.9	13.9	15.3	2009	11
DE	10	17	10.9	12.6	13.4	14.1					2007	35
DK	6	19	12.4	13.3	13.7	14.5	11.6	13.1	13.6	14.3	2010	49
ES										15.6	2010	38
HU			11.7	13.2	14.1	15.1	11.6	13.0	14.3	15.6	2000	50
IT	6	14	11.5	12.7			11.2	12.6			2004	59
NL	8	18	11.7	12.9	13.8	15.0	11.5	12.9	13.9	15.3	2011	27
PL	7	18					11.4	13.0	14.0	15.1	2011	45
UK	8	14	11.5	13.0	13.7						2011	60
Mean age			11.7	13.0	13.8	14.8	11.4	12.9	13.9	15.2		

Table 4 lists the ages at which 50% of the reference population reaches a particular Tanner stage. Appropriate data are available for 9 out of 27 Member States. A wide variety exists in data collection methods, analysis techniques and reporting formats. Some studies use self-reported data, combine pubic hair and genital development into one measure, report only a subset of the Tanner stages, report no age range, restrict the sample to a specific city, and so on. The statistical analyses used differed between the studies, sometimes assuming normality or ignoring censoring processes. Because of the low coverage and the lack of reporting consistency, we refrained from attempting to fit a model at the EU level. The bottom row of the table lists the unweighted means of the age as a *crude* approximation for an analysis at the EU level.

Table 5 Age at which 50% of the reference boys reaches a testicular volume (ml) in EU Member States.

	min	max	T4	T6	T8	T10	T12	T15	T20	Year	Source
BE	6	18	11.4	12.3	12.8	13.2	13.5	13.9	14.9	2009	11
DK	6	19	11.7							2010	49
NL	8	18	11.4	12.3	12.8	13.3	13.7	14.3	15.5	2001	51

Reference ages per testicular volume were published in Belgium, Denmark and The Netherlands. Table 5 lists the ages at which 50% of the reference population reached the particular volume. The Belgium and Dutch references agree quite well, especially at the lower volumes. Continuous references for testicular volumes have also been derived.[49,51,52] The Dutch references have also been published in the form of age-conditional references.[53,54] Since the information on testicular volume is so sparse, no attempt was made to model it at the EU level.

3.7. Tanner stages: girls

Table 6 Age at which 50% of the reference girls reaches a Tanner stage in EU Member States (PH=pubic hair, B=breast).

	min	max	PH2	PH3	PH4	PH5	B2	B3	B4	B5	Year	Source
BE	6	18	11.0	11.9	12.7	14.5	10.7	11.8	12.8	14.8	2009	11
DE	10	17	10.8	11.7	12.3	13.4					2007	35
DK	6	19	11.1	11.7	12.5		9.9	11.0	12.3		2009	36
ES							10.1			12.0	2002	38
GR	7	16					10.0				2008	40
HU			10.3	11.6	12.5	13.4	10.1	11.2	12.6	14.0	2002	50
IT	6	14	10.4	12.1	13.1	16.3	10.3	12.4	13.3	16.1	2004	55
LT	7	12	11.2				10.2	11.3	13.9		2005	44
NL	8	18	11.0	11.9	12.7	13.8	10.7	11.9	12.8	14.2	2000	51
PL	7	18					10.5	11.5	13.0	14.3	2011	45
UK	8	14	11.0	12.0	12.9		10.2	11.7	13.2		2010	48
mean			10.9	11.8	12.6	13.8	10.3	11.5	12.8	13.9		

Table 6 lists the ages at which 50% of the reference population reaches a particular Tanner stage. Appropriate data are available for 11 out of 27 Member States. Similar to the boys, a wide variety exists in data collection methods, publishing formats, and so on. Note that the Italian and Lithuanian data are unreliable (and in fact too high) since both are based on extreme extrapolation beyond the age range. Because of the low coverage and the lack of reporting consistency, we refrained from attempting to fit a model at the EU level. The bottom row of the table lists the unweighted means (excluding Italy and Lithuania) of the age as a *crude* approximation for an analysis at the EU level.

3.8. Precision of the harmonised growth curves

Ideally we would like to know in how far the growth curves are affected by sampling errors. Publications that present reference data typically do not provide estimates of precision. An estimate of the precision of the harmonized growth curves is technically challenging and would require the number of children measured per age group in each Member State to be known. Such detailed information is often not published. Unless reporting practices improve, it will not be possible to derive a well-defendable estimate of the precision. Note that the total number of children present in the studies in Table 1 is equal to 469,558. When taken together the sample size is huge, and thus sampling errors are likely to be small.

3.9. Reliability on harmonised growth curves

The harmonised EU growth curves can only be as reliable as the data that went into their construction. The specific objectives outlined in section 1.3 stress the need to use Member State-specific references where they exist. We were unable to obtain reference data in 8

(height), 9 (weight) and 10 (BMI) Member States out of the 27 EU Member States. Since these were Member States with small populations, the coverage of the EU-population was actually very high: between 85-90%. The missing 10-15% were analysed taking a similar Member State as a donor (c.f. Table 2).

The quantitative analysis uses state-of-the-art statistical harmonisation technology to iron out data incomparability caused by differences in the reporting formats. The Member State-references were used to generate a synthetic dataset from a random sample of children at the European level. As the Member State references are representative for their populations, the harmonised EU growth references are representative at the EU level.

There might have been secular changes in growth between 1990 and 2010. In principle, we could correct for this, bringing everything to the year 2011. However, this requires a relatively precise estimate of the secular change for a given country, information that is typically not available. We therefore have done no attempts to correct for secular change. The impact of secular change on the harmonised EU growth references is highly dependent on whether the same change occurs simultaneously across Europe. For example, secular height increase has come to a halt in the Nordic and Western countries. Any secular changes will have to come from Eastern Europe. The reunification of Germany spawned a rapid secular trend (of about five years) in height of children living in former Democratic Republic. Similar phenomena may have occurred, perhaps at a slower pace, for other Member States located in Eastern Europe. Such trends are likely to lead to smaller differences in height between EU Member States. Strong secular height trends in highly populated Eastern countries, such as Poland and Romania, eventually translate into higher harmonised EU references. However, because there are large populations in the EU with a small or no trend, the impact of a strong trend in only a few Member States will be small and slow.

Heterogeneity at the EU level increases the variability of the harmonised EU growth references. For example, the standard deviation of height of 18-year-old boys is 7.1 cm, whereas the average standard deviation over the Member States is only 6.5 cm. As a consequence, heterogeneity in height causes a (slight) increase in variability in practical application of the harmonised EU height references by EFSA or others.

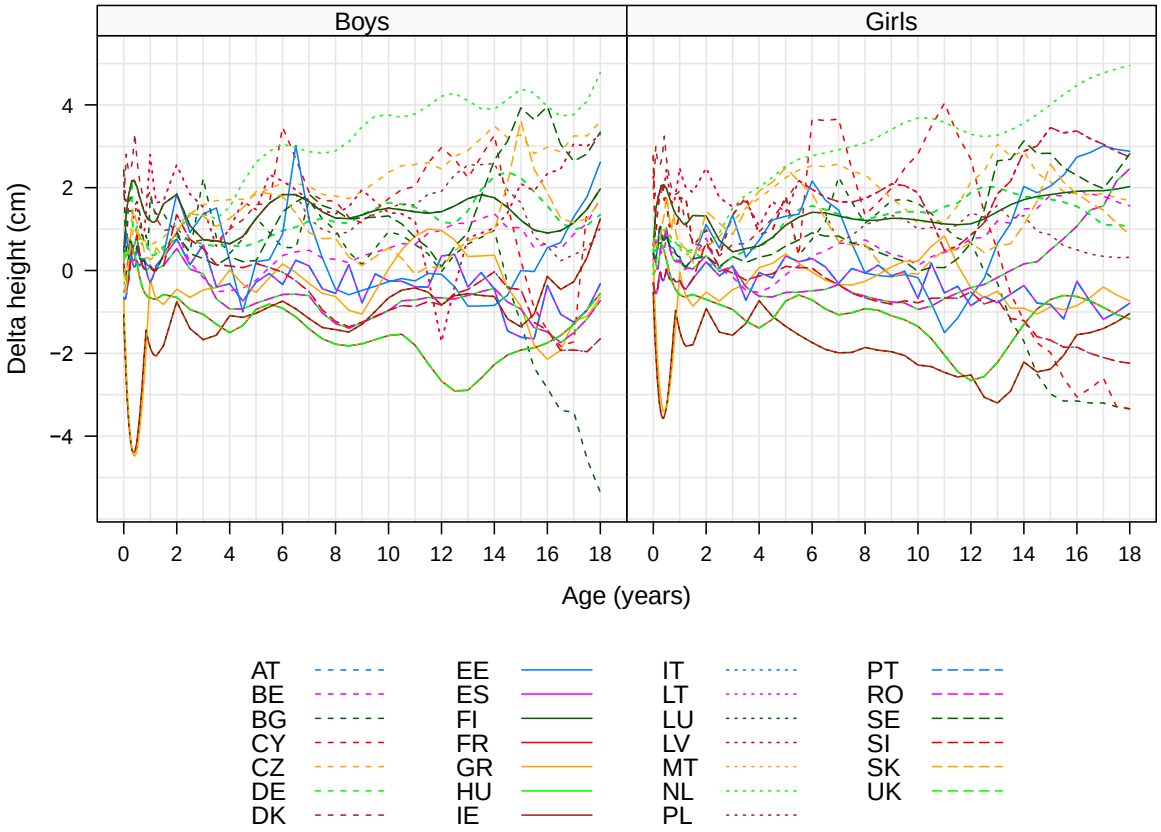

Figure 4 Difference in mean height between the EU reference and the Member State-specific references.

As an illustration, Figure 4 shows the differences in mean heights between the harmonised EU reference and the individual Member States. As expected, the mean height difference of the Member States is about zero. Some Member States have taller populations at 18 years, e.g. the Netherlands, Czech Republic, Sweden, Latvia (boys), and the Netherlands, Estonia, Sweden, Latvia, Lithuania and Denmark (girls). Shorter populations at 18 years are found in Bulgaria, Italy, Slovenia, Hungary, Romania, Greece (boys), and Bulgaria, Cyprus, Italy and Slovenia (girls). This finding generally corresponds to the known north-south height gradient in Europe, and thus this additional variation is present in the harmonised references. In principle, it is possible to decrease the standard deviation of 7.1 by restricting to a homogeneous set of countries, e.g. by selecting all Member States with shorter populations. While such references will be more precise (i.e. the distance between the extreme centiles will decrease), they will not be representative at the EU level. Moreover, Figure 4 indicates that there is no consistent natural clustering of Member States.

Heterogeneity was small for body weight and BMI. For these outcomes, the additional uncertainty caused by the heterogeneity is likely to be irrelevant in most practical applications of the EU growth references.

Occasionally, the worm plot[56] and other diagnostic tools highlighted potential problems with the country-specific references. For example, consider Figure 4. This is one of the diagnostic plots we used to explore any difference between the harmonised references and the references of the Member States. Observe that the mean height of Bulgarian 18-year old boys (172.3 cm) is extremely low relative to the other Member States. It is not clear whether this number is a genuine reflection of the actual heights in Bulgaria. Also, note the fairly large discrepancy in heights of 0-1 year old children living in France and Greece and the other countries. It is not known whether these differences are genuine. Since the differences were systematic for boys and girls, and since these did not show up in the weight or BMI references, we decided to keep these Member States in the analysis. However, suppose that the Bulgarian, French or Greek data eventually turn out to be wrong. In that case, our inclusion may have caused a downward bias in mean height during the first year. The extent of the bias is likely to be small, not more than 2-3 mm (or less than 0.5%) on the M-curve during the first year only. The impact of the Bulgarian data on the estimate of final height is negligible because of the small population size. Similar country-specific issues occured for weight-for-age and BMI-for-age, but we never had the impression that these would undermine the validity of the harmonised references.

The new references do not discriminate between breast-feeding modes. The proportion of breast-fed children by age is likely to differ between Member States. The standard practice is to mix different feeding modes into the references. Roelants et al.[61] studied the potential use of separate references for breast-fed and formula-fed infants, and advised to use the same curves for both breast-fed and formula-fed infants. Lighter children are more likely to receive complementary feeding. References for exclusively breast-fed children are potentially subject to bias because of selective drop out.[62] Thus, the additional value of discriminating between breast-feeding modes appears somewhat unclear.

All in all, we believe that the derived harmonised EU growth references represent the best possible solution given the currently available information. As updated information from the Member States will appear in the future, we could – of course – use this to our advantage to improve upon the solution. However, unless the changes are large and unless they occur simultaneously in the most highly populated Member States they cannot have a major impact on the references at the EU level.

3.10. Reliability of the puberty references

Menarche

The coverage of the EU-population for menarche was very high: 91.8%. Mean age of menarche at the EU level was estimated as 12.7 years using the *status quo* method. As the standard deviation was reported inconsistently across in different studies, we refrained from attempting to make an estimate of the standard deviation at the EU level. Since the estimate of 12.7 years summarizes all relevant sources, it represents the most reliable estimate at the EU level to date.

Tanner stages

Given the current information, it is not feasible to construct references of Tanner stages at the European level. The gold standard of Tanner staging is physical examination using palpitation. Some of the studies (e.g. U.K. and Germany) used self-reports using line drawings in order to facilitate data collection. Dorn and Biro[57] discourage this method since self-reports provide "an

estimate of maturation that often is biased". On the other hand, our tables do not provide evidence for a systematic bias of the German or U.K. data in a certain direction. The mean ages provide a rough indication of pubertal timing at the EU-level, but they are not representative and should thus be interpreted with care.

The best quality data on Tanner stages were collected in The Netherlands, Belgium and Denmark. In The Netherlands, secular changes in puberty have been small in the period 1980-2000. The Dutch and Belgian growth studies, while almost a decade apart, found comparable pubertal timings. On the other hand, a strong and still unexplained secular trend occurred in Denmark during the last decade in the start of puberty in girls.[36] As there are no other European studies that provide insight into the secular changes during the period 2000-2010, it is not yet clear whether the secular trend is restricted to Denmark, or applies more widely to EU Member States.

Tanner stages are still not widely used within the EU. Part of the reason could be that the traditional method of comparing the scores of a given child to the reference is awkward. A better alternative is to use a format for pubertal data that is akin conventional age-conditional reference charts, that allows for calculation of standard deviation scores, and that is implemented online (http://vps.stefvanbuuren.nl/puberty/).[53] Wider use of these tools may stimulate the application of Tanner stages.

Testicular Volume

Given the current data, it is not feasible to construct references on testicular volume on the EU-level. European references on testicular volume are sparse, and have been reported in different formats.

4. Conclusions and Recommendations

4.1. Conclusions

Our main conclusion is that it is feasible to create EU harmonised growth curves from existing Member State-specific growth references. The achieved coverage of the EU-population was very high: 85-90%. As the Member State-specific references are representative for their populations, the harmonised EU growth references are representative at the EU level. On the other hand, current information is insufficient to obtain references for pubertal development that are representative at the EU level.

The harmonised EU growth references, as developed here, represent an improvement over the references published in SCF.[1,2] The harmonised EU growth references cover a much higher percentage of the EU-population, use the most actual reference data and are calculated using state-of-the-art statistical methods. We thus recommend adopting the new harmonised EU growth references for application in food safety policy at the EU level.

In order to keep abreast of secular trend in growth and development, and in order to account for new members of the EU, it is wise to periodically update the references. Using an update frequency of once every 10 years will keep the references up-to-date.

The harmonised EU growth references may also aid in improving Member State-specific growth references. High-quality growth surveys are expensive to conduct. It has been shown that by using a well-chosen set of ages, one may approximate the results of a full-blown study to an almost arbitrary degree.[8,58] Thus, the combined use of the harmonised EU growth references is a viable cost-cutting strategy in deriving Member State-specific references.

4.2. Recommendations

1. Apply the harmonised EU growth references in deriving DRVs
2. Update the harmonised EU growth references every 10 years
3. Stimulate initiation and maintenance of a data archive of EU growth studies
4. Stimulate the use of the LMS-format for publishing growth references
5. Stimulate the development of cost-effective methods to derive Member State-specific references
6. Stimulate surveys that collect reference information on pubertal development
7. Stimulate the use of novel charts that ease that assessment of puberty.

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Appendices

APPENDIX A.1 HEIGHT (CM) FOR AGE, BOYS 0-18 YEARS (LMS, SD, PERCENTILES, Z-SCORE CURVES)

Age	L	M	S	SD	P1	P3	P5	P10	P25	P50	P75	P90	P95	P97	P99
0w	1	50.67	0.0525	2.66	44.5	45.7	46.3	47.3	48.9	50.7	52.5	54.1	55.0	55.7	56.9
1w	1	51.55	0.0520	2.68	45.3	46.5	47.1	48.1	49.7	51.5	53.4	55.0	56.0	56.6	57.8
2w	1	52.41	0.0515	2.70	46.1	47.3	48.0	49.0	50.6	52.4	54.2	55.9	56.9	57.5	58.7
3w	1	53.25	0.0510	2.72	46.9	48.1	48.8	49.8	51.4	53.2	55.1	56.7	57.7	58.4	59.6
4w	1	54.06	0.0506	273	47.7	48.9	49.6	50.6	52.2	54.1	55.9	57.6	58.6	59.2	60.4
5w	1	54.85	0.0502	2.75	48.4	49.7	50.3	51.3	53.0	54.9	56.7	58.4	59.4	60.0	61.3
6w	1	55.63	0.0498	2.77	49.2	50.4	51.1	52.1	53.8	55.6	57.5	59.2	60.2	60.8	62.1
7w	1	56.38	0.0494	2.79	49.9	51.1	51.8	52.8	54.5	56.4	58.3	59.9	61.0	61.6	62.9
8w	1	57.11	0.0491	2.80	50.6	51.8	52.5	53.5	55.2	57.1	59.0	60.7	61.7	62.4	63.6
9w	1	57.82	0.0487	2.82	51.3	52.5	53.2	54.2	55.9	57.8	59.7	61.4	62.5	63.1	64.4
10w	1	58.51	0.0484	2.83	51.9	53.2	53.9	54.9	56.6	58.5	60.4	62.1	63.2	63.8	65.1
12w	1	59.83	0.0479	2.86	53.2	54.4	55.1	56.2	57.9	59.8	61.8	63.5	64.5	65.2	66.5
14w	1	61.08	0.0473	2.89	54.4	55.6	56.3	57.4	59.1	61.1	63.0	64.8	65.8	66.5	67.8
16w	1	62.27	0.0469	2.92	55.5	56.8	57.5	58.5	60.3	62.3	64.2	66.0	67.1	67.8	69.1
18w	1	63.39	0.0465	2.95	56.5	57.9	58.5	59.6	61.4	63.4	65.4	67.2	68.2	68.9	70.2
20w	1	64.44	0.0461	2.97	57.5	58.9	59.6	60.6	62.4	64.4	66.4	68.2	69.3	70.0	71.4
22w	1	65.44	0.0458	2.99	58.5	59.8	60.5	61.6	63.4	65.4	67.5	69.3	70.4	71.1	72.4
24w	1	66.39	0.0455	3.02	59.4	60.7	61.4	62.5	64.4	66.4	68.4	70.3	71.4	72.1	73.4
26w	1	67.29	0.0452	3.04	60.2	61.6	62.3	63.4	65.2	67.3	69.3	71.2	72.3	73.0	74.4
28w	1	68.14	0.0449	3.06	61.0	62.4	63.1	64.2	66.1	68.1	70.2	72.1	73.2	73.9	75.3
32w	1	69.74	0.0445	3.10	62.5	63.9	64.6	65.8	67.6	69.7	71.8	73.7	74.8	75.6	77.0
36w	1	71.20	0.0441	3.14	63.9	65.3	66.0	67.2	69.1	71.2	73.3	75.2	76.4	77.1	78.5
40w	1	72.55	0.0438	3.18	65.2	66.6	67.3	68.5	70.4	72.5	74.7	76.6	77.8	78.5	79.9
44w	1	73.81	0.0435	3.21	66.3	67.8	68.5	69.7	71.6	73.8	76.0	77.9	79.1	79.9	81.3
48w	1	75.00	0.0433	3.25	67.4	68.9	69.7	70.8	72.8	75.0	77.2	79.2	80.3	81.1	82.6
52w	1	76.12	0.0431	3.28	68.5	70.0	70.7	71.9	73.9	76.1	78.3	80.3	81.5	82.3	83.7
56w	1	77.19	0.0429	3.31	69.5	71.0	71.7	73.0	75.0	77.2	79.4	81.4	82.6	83.4	84.9
60w	1	78.21	0.0427	3.34	70.4	71.9	72.7	73.9	76.0	78.2	80.5	82.5	83.7	84.5	86.0
64w	1	79.18	0.0425	3.36	71.4	72.9	73.6	74.9	76.9	79.2	81.4	83.5	84.7	85.5	87.0
1.5y	1	82.32	0.0420	3.45	74.3	75.8	76.6	77.9	80.0	82.3	84.7	86.7	88.0	88.8	90.4
2.0y	1	87.45	0.0413	3.62	79.0	80.7	81.5	82.8	85.0	87.5	89.9	92.1	93.4	94.2	95.9
2.5y	1	92.15	0.0410	3.78	83.4	85.0	85.9	87.3	89.6	92.2	94.7	97.0	98.4	99.3	100.9
3.0y	1	96.47	0.0410	3.96	87.3	89.0	90.0	91.4	93.8	96.5	99.1	101.5	103.0	103.9	105.7
3.5y	1	100.41	0.0412	4.14	90.8	92.6	93.6	95.1	97.6	100.4	103.2	105.7	107.2	108.2	110.0
4.0y	1	103.99	0.0416	4.32	93.9	95.9	96.9	98.5	101.1	104.0	106.9	109.5	111.1	112.1	114.0
4.5y	1	107.33	0.0420	4.50	96.9	98.9	99.9	101.6	104.3	107.3	110.4	113.1	114.7	115.8	117.8
5.0y	1	110.53	0.0424	4.69	99.6	101.7	102.8	104.5	107.4	110.5	113.7	116.5	118.2	119.3	121.4
5.5y	1	113.68	0.0429	4.87	102.3	104.5	105.7	107.4	110.4	113.7	117.0	119.9	121.7	122.8	125.0
6.0y	1	116.84	0.0433	5.06	105.1	107.3	108.5	110.4	113.4	116.8	120.3	123.3	125.2	126.4	128.6
6.5y	1	120.05	0.0438	5.26	107.8	110.2	111.4	113.3	116.5	120.0	123.6	126.8	128.7	129.9	132.3
7.0y	1	123.31	0.0443	5.47	110.6	113.0	114.3	116.3	119.6	123.3	127.0	130.3	132.3	133.6	136.0
7.5y	1	126.55	0.0448	5.67	113.4	115.9	117.2	119.3	122.7	126.5	130.4	133.8	135.9	137.2	139.7
8.0y	1	129.63	0.0453	5.87	116.0	118.6	120.0	122.1	125.7	129.6	133.6	137.2	139.3	140.7	143.3
8.5y	1	132.46	0.0457	6.06	118.4	121.1	122.5	124.7	128.4	132.5	136.5	140.2	142.4	143.9	146.6

Age	L	M	S	SD	P1	P3	P5	P10	P25	P50	P75	P90	P95	P97	P99
9.0y	1	135.05	0.0461	6.23	120.6	123.3	124.8	127.1	130.8	135.1	139.3	143.0	145.3	146.8	149.5
9.5y	1	137.51	0.0465	6.39	122.6	125.5	127.0	129.3	133.2	137.5	141.8	145.7	148.0	149.5	152.4
10.0y	1	139.96	0.0468	6.55	124.7	127.6	129.2	131.6	135.5	140.0	144.4	148.4	150.7	152.3	155.2
10.5y	1	142.50	0.0471	6.71	126.9	129.9	131.5	133.9	138.0	142.5	147.0	151.1	153.5	155.1	158.1
11.0y	1	145.17	0.0474	6.87	129.2	132.2	133.9	136.4	140.5	145.2	149.8	154.0	156.5	158.1	161.2
11.5y	1	148.00	0.0475	7.03	131.6	134.8	136.4	139.0	143.3	148.0	152.7	157.0	159.6	161.2	164.4
12.0y	1	151.03	0.0476	7.19	134.3	137.5	139.2	141.8	146.2	151.0	155.9	160.2	162.8	164.5	167.7
12.5y	1	154.26	0.0475	7.32	137.2	140.5	142.2	144.9	149.3	154.3	159.2	163.6	166.3	168.0	171.3
13.0y	1	157.66	0.0472	7.43	140.4	143.7	145.4	148.1	152.6	157.7	162.7	167.2	169.9	171.6	175.0
13.5y	1	161.15	0.0466	7.50	143.7	147.0	148.8	151.5	156.1	161.2	166.2	170.8	173.5	175.3	178.6
14.0y	1	164.63	0.0457	7.52	147.1	150.5	152.3	155.0	159.6	164.6	169.7	174.3	177.0	178.8	182.1
14.5y	1	167.92	0.0446	7.49	150.5	153.8	155.6	158.3	162.9	167.9	173.0	177.5	180.2	182.0	185.3
15.0y	1	170.86	0.0435	7.42	153.6	156.9	158.6	161.3	165.9	170.9	175.9	180.4	183.1	184.8	188.1
15.5y	1	173.30	0.0424	7.34	156.2	159.5	161.2	163.9	168.3	173.3	178.2	182.7	185.4	187.1	190.4
16.0y	1	175.14	0.0414	7.26	158.3	161.5	163.2	165.8	170.2	175.1	180.0	184.4	187.1	188.8	192.0
16.5y	1	176.43	0.0408	7.19	159.7	162.9	164.6	167.2	171.6	176.4	181.3	185.6	188.3	190.0	193.2
17.0y	1	177.22	0.0403	7.15	160.6	163.8	165.5	168.1	172.4	177.2	182.0	186.4	189.0	190.7	193.9
17.5y	1	177.61	0.0401	7.13	161.0	164.2	165.9	168.5	172.8	177.6	182.4	186.7	189.3	191.0	194.2
18.0y	1	177.65	0.0401	7.12	161.1	164.3	165.9	168.5	172.8	177.7	182.5	186.8	189.4	191.0	194.2

Age	-3	-2.67	-2.5	-2	-1.33	-1	-0.67	0	0.67	1	1.33	2	2.5	2.67	3
0w	42.7	43.6	44.0	45.3	47.1	48.0	48.9	50.7	52.5	53.3	54.2	56.0	57.3	57.8	58.7
1w	43.5	44.4	44.8	46.2	48.0	48.9	49.8	51.5	53.3	54.2	55.1	56.9	58.3	58.7	59.6
2w	44.3	45.2	45.7	47.0	48.8	49.7	50.6	52.4	54.2	55.1	56.0	57.8	59.2	59.6	60.5
3w	45.1	46.0	46.5	47.8	49.6	50.5	51.4	53.2	55.1	56.0	56.9	58.7	60.0	60.5	61.4
4w	45.9	46.8	47.2	48.6	50.4	51.3	52.2	54.1	55.9	56.8	57.7	59.5	60.9	61.4	62.3
5w	46.6	47.5	48.0	49.3	51.2	52.1	53.0	54.9	56.7	57.6	58.5	60.4	61.7	62.2	63.1
6w	47.3	48.2	48.7	50.1	51.9	52.9	53.8	55.6	57.5	58.4	59.3	61.2	62.6	63.0	63.9
7w	48.0	48.9	49.4	50.8	52.7	53.6	54.5	56.4	58.2	59.2	60.1	62.0	63.3	63.8	64.7
8w	48.7	49.6	50.1	51.5	53.4	54.3	55.2	57.1	59.0	59.9	60.8	62.7	64.1	64.6	65.5
9w	49.4	50.3	50.8	52.2	54.1	55.0	55.9	57.8	59.7	60.6	61.6	63.5	64.9	65.3	66.3
10w	50.0	50.9	51.4	52.8	54.7	55.7	56.6	58.5	60.4	61.3	62.3	64.2	65.6	66.1	67.0
12w	51.2	52.2	52.7	54.1	56.0	57.0	57.9	59.8	61.7	62.7	63.6	65.6	67.0	67.5	68.4
14w	52.4	53.4	53.9	55.3	57.2	58.2	59.1	61.1	63.0	64.0	64.9	66.9	68.3	68.8	69.8
16w	53.5	54.5	55.0	56.4	58.4	59.4	60.3	62.3	64.2	65.2	66.2	68.1	69.6	70.1	71.0
18w	54.6	55.5	56.0	57.5	59.5	60.4	61.4	63.4	65.4	66.3	67.3	69.3	70.8	71.3	72.2
20w	55.5	56.5	57.0	58.5	60.5	61.5	62.5	64.4	66.4	67.4	68.4	70.4	71.9	72.4	73.4
22w	56.5	57.4	58.0	59.5	61.5	62.4	63.4	65.4	67.4	68.4	69.4	71.4	72.9	73.4	74.4
24w	57.3	58.3	58.8	60.4	62.4	63.4	64.4	66.4	68.4	69.4	70.4	72.4	73.9	74.4	75.4
26w	58.2	59.2	59.7	61.2	63.2	64.2	65.3	67.3	69.3	70.3	71.3	73.4	74.9	75.4	76.4
28w	59.0	60.0	60.5	62.0	64.1	65.1	66.1	68.1	70.2	71.2	72.2	74.3	75.8	76.3	77.3
32w	60.4	61.5	62.0	63.5	65.6	66.6	67.7	69.7	71.8	72.8	73.9	75.9	77.5	78.0	79.1
36w	61.8	62.8	63.3	64.9	67.0	68.1	69.1	71.2	73.3	74.3	75.4	77.5	79.1	79.6	80.6
40w	63.0	64.1	64.6	66.2	68.3	69.4	70.4	72.5	74.7	75.7	76.8	78.9	80.5	81.0	82.1
44w	64.2	65.2	65.8	67.4	69.5	70.6	71.7	73.8	76.0	77.0	78.1	80.2	81.8	82.4	83.5
48w	65.3	66.3	66.9	68.5	70.7	71.8	72.8	75.0	77.2	78.2	79.3	81.5	83.1	83.7	84.7
52w	66.3	67.4	67.9	69.6	71.8	72.8	73.9	76.1	78.3	79.4	80.5	82.7	84.3	84.9	86.0
56w	67.3	68.4	68.9	70.6	72.8	73.9	75.0	77.2	79.4	80.5	81.6	83.8	85.5	86.0	87.1
60w	68.2	69.3	69.9	71.5	73.8	74.9	76.0	78.2	80.4	81.5	82.6	84.9	86.6	87.1	88.2
64w	69.1	70.2	70.8	72.5	74.7	75.8	76.9	79.2	81.4	82.5	83.7	85.9	87.6	88.2	89.3
1.5y	72.0	73.1	73.7	75.4	77.7	78.9	80.0	82.3	84.6	85.8	86.9	89.2	91.0	91.5	92.7
2.0y	76.6	77.8	78.4	80.2	82.6	83.8	85.0	87.5	89.9	91.1	92.3	94.7	96.5	97.1	98.3
2.5y	80.8	82.1	82.7	84.6	87.1	88.4	89.6	92.2	94.7	95.9	97.2	99.7	101.6	102.2	103.5
3.0y	84.6	85.9	86.6	88.6	91.2	92.5	93.8	96.5	99.1	100.4	101.7	104.4	106.4	107.0	108.3
3.5y	88.0	89.4	90.1	92.1	94.9	96.3	97.6	100.4	103.2	104.5	105.9	108.7	110.8	111.5	112.8
4.0y	91.0	92.5	93.2	95.3	98.2	99.7	101.1	104.0	106.9	108.3	109.7	112.6	114.8	115.5	117.0
4.5y	93.8	95.3	96.1	98.3	101.3	102.8	104.3	107.3	110.3	111.8	113.3	116.3	118.6	119.4	120.8
5.0y	96.5	98.0	98.8	101.2	104.3	105.8	107.4	110.5	113.7	115.2	116.8	119.9	122.2	123.0	124.6
5.5y	99.1	100.7	101.5	103.9	107.2	108.8	110.4	113.7	116.9	118.6	120.2	123.4	125.9	126.7	128.3
6.0y	101.7	103.3	104.2	106.7	110.1	111.8	113.4	116.8	120.2	121.9	123.6	127.0	129.5	130.4	132.0
6.5y	104.3	106.0	106.9	109.5	113.1	114.8	116.5	120.0	123.6	125.3	127.0	130.6	133.2	134.1	135.8
7.0y	106.9	108.7	109.6	112.4	116.0	117.8	119.6	123.3	127.0	128.8	130.6	134.2	137.0	137.9	139.7
7.5y	109.5	111.4	112.4	115.2	119.0	120.9	122.8	126.5	130.3	132.2	134.1	137.9	140.7	141.7	143.6
8.0y	112.0	114.0	114.9	117.9	121.8	123.8	125.7	129.6	133.6	135.5	137.4	141.4	144.3	145.3	147.2
8.5y	114.3	116.3	117.3	120.3	124.4	126.4	128.4	132.5	136.5	138.5	140.5	144.6	147.6	148.6	150.6
9.0y	116.4	118.4	119.5	122.6	126.8	128.8	130.9	135.1	139.2	141.3	143.3	147.5	150.6	151.7	153.7
9.5y	118.3	120.4	121.5	124.7	129.0	131.1	133.2	137.5	141.8	143.9	146.0	150.3	153.5	154.6	156.7
10.0y	120.3	122.5	123.6	126.9	131.2	133.4	135.6	140.0	144.3	146.5	148.7	153.1	156.3	157.4	159.6
10.5y	122.4	124.6	125.7	129.1	133.6	135.8	138.0	142.5	147.0	149.2	151.4	155.9	159.3	160.4	162.6

Age	-3	-2.67	-2.5	-2	-1.33	-1	-0.67	0	0.67	1	1.33	2	2.5	2.67	3
11.0y	124.5	126.8	128.0	131.4	136.0	138.3	140.6	145.2	149.8	152.0	154.3	158.9	162.4	163.5	165.8
11.5y	126.9	129.2	130.4	133.9	138.6	141.0	143.3	148.0	152.7	155.0	157.4	162.1	165.6	166.8	169.1
12.0y	129.5	131.8	133.1	136.7	141.5	143.8	146.2	151.0	155.8	158.2	160.6	165.4	169.0	170.2	172.6
12.5y	132.3	134.7	136.0	139.6	144.5	146.9	149.4	154.3	159.2	161.6	164.0	168.9	172.6	173.8	176.2
13.0y	135.4	137.8	139.1	142.8	147.8	150.2	152.7	157.7	162.6	165.1	167.5	172.5	176.2	177.5	180.0
13.5y	138.6	141.1	142.4	146.1	151.2	153.6	156.1	161.2	166.2	168.7	171.1	176.2	179.9	181.2	183.7
14.0y	142.1	144.6	145.8	149.6	154.6	157.1	159.6	164.6	169.7	172.2	174.6	179.7	183.4	184.7	187.2
14.5y	145.4	147.9	149.2	152.9	158.0	160.4	162.9	167.9	172.9	175.4	177.9	182.9	186.6	187.9	190.4
15.0y	148.6	151.0	152.3	156.0	161.0	163.4	165.9	170.9	175.8	178.3	180.7	185.7	189.4	190.7	193.1
15.5y	151.3	153.7	155.0	158.6	163.5	166.0	168.4	173.3	178.2	180.6	183.1	188.0	191.6	192.9	195.3
16.0y	153.4	155.8	157.0	160.6	165.5	167.9	170.3	175.1	180.0	182.4	184.8	189.7	193.3	194.5	196.9
16.5y	154.9	157.2	158.4	162.0	166.9	169.2	171.6	176.4	181.2	183.6	186.0	190.8	194.4	195.6	198.0
17.0y	155.8	158.1	159.3	162.9	167.7	170.1	172.4	177.2	182.0	184.4	186.7	191.5	195.1	196.3	198.7
17.5y	156.2	158.6	159.8	163.4	168.1	170.5	172.8	177.6	182.4	184.7	187.1	191.9	195.4	196.6	199.0
18.0y	156.3	158.6	159.8	163.4	168.2	170.5	172.9	177.7	182.4	184.8	187.1	191.9	195.5	196.7	199.0

APPENDIX A.2 HEIGHT (CM) FOR AGE, GIRLS 0-18 YEARS (LMS, SD, PERCENTILES, Z-SCORE CURVES)

Age	L	M	S	SD	P1	P3	P5	P10	P25	P50	P75	P90	P95	P97	P99
0w	1	49.73	0.0472	2.35	44.3	45.3	45.9	46.7	48.1	49.7	51.3	52.7	53.6	54.1	55.2
1w	1	50.56	0.0468	2.37	45.1	46.1	46.7	47.5	49.0	50.6	52.2	53.6	54.5	55.0	56.1
2w	1	51.37	0.0464	2.39	45.8	46.9	47.4	48.3	49.8	51.4	53.0	54.4	55.3	55.9	56.9
3w	1	52.16	0.0461	2.41	46.6	47.6	48.2	49.1	50.5	52.2	53.8	55.2	56.1	56.7	57.8
4w	1	52.93	0.0458	2.42	47.3	48.4	48.9	49.8	51.3	52.9	54.6	56.0	56.9	57.5	58.6
5w	1	53.68	0.0455	2.44	48.0	49.1	49.7	50.5	52.0	53.7	55.3	56.8	57.7	58.3	59.4
6w	1	54.41	0.0453	2.46	48.7	49.8	50.4	51.3	52.7	54.4	56.1	57.6	58.5	59.0	60.1
7w	1	55.12	0.0450	2.48	49.4	50.5	51.0	51.9	53.4	55.1	56.8	58.3	59.2	59.8	60.9
8w	1	55.81	0.0448	2.50	50.0	51.1	51.7	52.6	54.1	55.8	57.5	59.0	59.9	60.5	61.6
9w	1	56.48	0.0445	2.52	50.6	51.8	52.3	53.3	54.8	56.5	58.2	59.7	60.6	61.2	62.3
10w	1	57.13	0.0443	2.53	51.2	52.4	53.0	53.9	55.4	57.1	58.8	60.4	61.3	61.9	63.0
12w	1	58.39	0.0439	2.56	52.4	53.6	54.2	55.1	56.7	58.4	60.1	61.7	62.6	63.2	64.4
14w	1	59.58	0.0436	2.60	53.5	54.7	55.3	56.3	57.8	59.6	61.3	62.9	63.9	64.5	65.6
16w	1	60.71	0.0433	2.63	54.6	55.8	56.4	57.3	58.9	60.7	62.5	64.1	65.0	65.6	66.8
18w	1	61.78	0.0430	2.65	55.6	56.8	57.4	58.4	60.0	61.8	63.6	65.2	66.1	66.8	68.0
20w	1	62.79	0.0427	2.68	56.6	57.7	58.4	59.4	61.0	62.8	64.6	66.2	67.2	67.8	69.0
22w	1	63.74	0.0425	2.71	57.4	58.6	59.3	60.3	61.9	63.7	65.6	67.2	68.2	68.8	70.0
24w	1	64.65	0.0423	2.73	58.3	59.5	60.2	61.1	62.8	64.7	66.5	68.2	69.1	69.8	71.0
26w	1	65.52	0.0421	2.76	59.1	60.3	61.0	62.0	63.7	65.5	67.4	69.1	70.1	70.7	71.9
28w	1	66.35	0.0419	2.78	59.9	61.1	61.8	62.8	64.5	66.3	68.2	69.9	70.9	71.6	72.8
32w	1	67.91	0.0416	2.82	61.3	62.6	63.3	64.3	66.0	67.9	69.8	71.5	72.6	73.2	74.5
36w	1	69.37	0.0413	2.86	62.7	64.0	64.7	65.7	67.4	69.4	71.3	73.0	74.1	74.8	76.0
40w	1	70.73	0.0410	2.90	64.0	65.3	66.0	67.0	68.8	70.7	72.7	74.4	75.5	76.2	77.5
44w	1	72.03	0.0408	2.94	65.2	66.5	67.2	68.3	70.0	72.0	74.0	75.8	76.9	77.6	78.9
48w	1	73.26	0.0406	2.97	66.3	67.7	68.4	69.4	71.3	73.3	75.3	77.1	78.2	78.9	80.2
52w	1	74.45	0.0404	3.01	67.5	68.8	69.5	70.6	72.4	74.5	76.5	78.3	79.4	80.1	81.4
56w	1	75.58	0.0402	3.04	68.5	69.9	70.6	71.7	73.5	75.6	77.6	79.5	80.6	81.3	82.7
60w	1	76.67	0.0401	3.07	69.5	70.9	71.6	72.7	74.6	76.7	78.7	80.6	81.7	82.4	83.8
64w	1	77.71	0.0399	3.10	70.5	71.9	72.6	73.7	75.6	77.7	79.8	81.7	82.8	83.5	84.9
1.5y	1	81.11	0.0395	3.21	73.7	75.1	75.8	77.0	78.9	81.1	83.3	85.2	86.4	87.1	88.6
2.0y	1	86.52	0.0392	3.39	78.6	80.1	80.9	82.2	84.2	86.5	88.8	90.9	92.1	92.9	94.4
2.5y	1	91.24	0.0393	3.59	82.9	84.5	85.3	86.6	88.8	91.2	93.7	95.8	97.1	98.0	99.6
3.0y	1	95.46	0.0397	3.79	86.6	88.3	89.2	90.6	92.9	95.5	98.0	100.3	101.7	102.6	104.3
3.5y	1	99.33	0.0404	4.01	90.0	91.8	92.7	94.2	96.6	99.3	102.0	104.5	105.9	106.9	108.7
4.0y	1	102.93	0.0411	4.23	93.1	95.0	96.0	97.5	100.1	102.9	105.8	108.4	109.9	110.9	112.8
4.5y	1	106.33	0.0419	4.46	96.0	98.0	99.0	100.6	103.3	106.3	109.3	112.0	113.7	114.7	116.7
5.0y	1	109.60	0.0427	4.68	98.7	100.8	101.9	103.6	106.4	109.6	112.8	115.6	117.3	118.4	120.5
5.5y	1	112.83	0.0435	4.91	101.4	103.6	104.8	106.5	109.5	112.8	116.1	119.1	120.9	122.1	124.2
6.0y	1	116.04	0.0443	5.14	104.1	106.4	107.6	109.5	112.6	116.0	119.5	122.6	124.5	125.7	128.0
6.5y	1	119.23	0.0450	5.37	106.7	109.1	110.4	112.4	115.6	119.2	122.8	126.1	128.1	129.3	131.7
7.0y	1	122.34	0.0457	5.59	109.3	111.8	113.1	115.2	118.6	122.3	126.1	129.5	131.5	132.9	135.3
7.5y	1	125.35	0.0463	5.80	111.9	114.4	115.8	117.9	121.4	125.3	129.3	132.8	134.9	136.3	138.8
8.0y	1	128.26	0.0468	6.00	114.3	117.0	118.4	120.6	124.2	128.3	132.3	136.0	138.1	139.5	142.2
8.5y	1	131.10	0.0472	6.19	116.7	119.5	120.9	123.2	126.9	131.1	135.3	139.0	141.3	142.7	145.5
9.0y	1	133.91	0.0475	6.36	119.1	122.0	123.5	125.8	129.6	133.9	138.2	142.1	144.4	145.9	148.7
9.5y	1	136.78	0.0476	6.52	121.6	124.5	126.1	128.4	132.4	136.8	141.2	145.1	147.5	149.0	151.9

Age	L	M	S	SD	P1	P3	P5	P10	P25	P50	P75	P90	P95	P97	P99
10.0y	1	139.78	0.0477	6.66	124.3	127.3	128.8	131.2	135.3	139.8	144.3	148.3	150.7	152.3	155.3
10.5y	1	142.92	0.0475	6.79	127.1	130.2	131.8	134.2	138.3	142.9	147.5	151.6	154.1	155.7	158.7
11.0y	1	146.16	0.0471	6.89	130.1	133.2	134.8	137.3	141.5	146.2	150.8	155.0	157.5	159.1	162.2
11.5y	1	149.37	0.0465	6.95	133.2	136.3	137.9	140.5	144.7	149.4	154.1	158.3	160.8	162.4	165.5
12.0y	1	152.42	0.0458	6.97	136.2	139.3	140.9	143.5	147.7	152.4	157.1	161.4	163.9	165.5	168.6
12.5y	1	155.16	0.0449	6.97	138.9	142.0	143.7	146.2	150.5	155.2	159.9	164.1	166.6	168.3	171.4
13.0y	1	157.50	0.0441	6.94	141.3	144.4	146.1	148.6	152.8	157.5	162.2	166.4	168.9	170.6	173.7
13.5y	1	159.41	0.0433	6.91	143.3	146.4	148.0	150.6	154.8	159.4	164.1	168.3	170.8	172.4	175.5
14.0y	1	160.91	0.0427	6.87	144.9	148.0	149.6	152.1	156.3	160.9	165.5	169.7	172.2	173.8	176.9
14.5y	1	162.05	0.0422	6.84	146.1	149.2	150.8	153.3	157.4	162.1	166.7	170.8	173.3	174.9	178.0
15.0y	1	162.88	0.0418	6.81	147.0	150.1	151.7	154.2	158.3	162.9	167.5	171.6	174.1	175.7	178.7
15.5y	1	163.45	0.0415	6.79	147.7	150.7	152.3	154.7	158.9	163.4	168.0	172.2	174.6	176.2	179.2
16.0y	1	163.85	0.0413	6.77	148.1	151.1	152.7	155.2	159.3	163.8	168.4	172.5	175.0	176.6	179.6
16.5y	1	164.15	0.0412	6.76	148.4	151.4	153.0	155.5	159.6	164.2	168.7	172.8	175.3	176.9	179.9
17.0y	1	164.40	0.0411	6.75	148.7	151.7	153.3	155.7	159.8	164.4	169.0	173.1	175.5	177.1	180.1
17.5y	1	164.59	0.0410	6.74	148.9	151.9	153.5	155.9	160.0	164.6	169.1	173.2	175.7	177.3	180.3
18.0y	1	164.74	0.0409	6.74	149.1	152.1	153.7	156.1	160.2	164.7	169.3	173.4	175.8	177.4	180.4

Age	-3	-2.67	-2.5	-2	-1.33	-1	-0.67	0	0.67	1	1.33	2	2.5	2.67	3
0w	42.7	43.5	43.9	45.0	46.6	47.4	48.2	49.7	51.3	52.1	52.8	54.4	55.6	56.0	56.8
1w	43.5	44.2	44.6	45.8	47.4	48.2	49.0	50.6	52.1	52.9	53.7	55.3	56.5	56.9	57.7
2w	44.2	45.0	45.4	46.6	48.2	49.0	49.8	51.4	53.0	53.8	54.5	56.1	57.3	57.7	58.5
3w	44.9	45.7	46.1	47.3	49.0	49.8	50.5	52.2	53.8	54.6	55.4	57.0	58.2	58.6	59.4
4w	45.7	46.5	46.9	48.1	49.7	50.5	51.3	52.9	54.6	55.4	56.2	57.8	59.0	59.4	60.2
5w	46.3	47.2	47.6	48.8	50.4	51.2	52.0	53.7	55.3	56.1	56.9	58.6	59.8	60.2	61.0
6w	47.0	47.8	48.3	49.5	51.1	51.9	52.8	54.4	56.1	56.9	57.7	59.3	60.6	61.0	61.8
7w	47.7	48.5	48.9	50.2	51.8	52.6	53.5	55.1	56.8	57.6	58.4	60.1	61.3	61.7	62.6
8w	48.3	49.1	49.6	50.8	52.5	53.3	54.1	55.8	57.5	58.3	59.1	60.8	62.1	62.5	63.3
9w	48.9	49.8	50.2	51.5	53.1	54.0	54.8	56.5	58.2	59.0	59.8	61.5	62.8	63.2	64.0
10w	49.5	50.4	50.8	52.1	53.8	54.6	55.4	57.1	58.8	59.7	60.5	62.2	63.5	63.9	64.7
12w	50.7	51.5	52.0	53.3	55.0	55.8	56.7	58.4	60.1	61.0	61.8	63.5	64.8	65.2	66.1
14w	51.8	52.6	53.1	54.4	56.1	57.0	57.8	59.6	61.3	62.2	63.0	64.8	66.1	66.5	67.4
16w	52.8	53.7	54.1	55.5	57.2	58.1	59.0	60.7	62.5	63.3	64.2	66.0	67.3	67.7	68.6
18w	53.8	54.7	55.1	56.5	58.2	59.1	60.0	61.8	63.6	64.4	65.3	67.1	68.4	68.9	69.7
20w	54.7	55.6	56.1	57.4	59.2	60.1	61.0	62.8	64.6	65.5	66.4	68.2	69.5	69.9	70.8
22w	55.6	56.5	57.0	58.3	60.1	61.0	61.9	63.7	65.6	66.4	67.3	69.2	70.5	71.0	71.9
24w	56.5	57.4	57.8	59.2	61.0	61.9	62.8	64.7	66.5	67.4	68.3	70.1	71.5	71.9	72.8
26w	57.3	58.2	58.6	60.0	61.9	62.8	63.7	65.5	67.4	68.3	69.2	71.0	72.4	72.9	73.8
28w	58.0	58.9	59.4	60.8	62.7	63.6	64.5	66.3	68.2	69.1	70.0	71.9	73.3	73.8	74.7
32w	59.4	60.4	60.9	62.3	64.2	65.1	66.0	67.9	69.8	70.7	71.7	73.6	75.0	75.4	76.4
36w	60.8	61.7	62.2	63.6	65.6	66.5	67.5	69.4	71.3	72.2	73.2	75.1	76.5	77.0	78.0
40w	62.0	63.0	63.5	64.9	66.9	67.8	68.8	70.7	72.7	73.6	74.6	76.5	78.0	78.5	79.4
44w	63.2	64.2	64.7	66.2	68.1	69.1	70.1	72.0	74.0	75.0	75.9	77.9	79.4	79.9	80.8
48w	64.3	65.3	65.8	67.3	69.3	70.3	71.3	73.3	75.3	76.2	77.2	79.2	80.7	81.2	82.2
52w	65.4	66.4	66.9	68.4	70.5	71.4	72.4	74.5	76.5	77.5	78.4	80.5	82.0	82.5	83.5
56w	66.5	67.5	68.0	69.5	71.5	72.5	73.5	75.6	77.6	78.6	79.6	81.7	83.2	83.7	84.7
60w	67.5	68.5	69.0	70.5	72.6	73.6	74.6	76.7	78.7	79.7	80.8	82.8	84.3	84.9	85.9
64w	68.4	69.4	70.0	71.5	73.6	74.6	75.6	77.7	79.8	80.8	81.8	83.9	85.5	86.0	87.0
1.5y	71.5	72.6	73.1	74.7	76.8	77.9	79.0	81.1	83.3	84.3	85.4	87.5	89.1	89.7	90.7
2.0y	76.3	77.5	78.0	79.7	82.0	83.1	84.2	86.5	88.8	89.9	91.0	93.3	95.0	95.6	96.7
2.5y	80.5	81.7	82.3	84.1	86.5	87.7	88.8	91.2	93.6	94.8	96.0	98.4	100.2	100.8	102.0
3.0y	84.1	85.3	86.0	87.9	90.4	91.7	92.9	95.5	98.0	99.3	100.5	103.0	104.9	105.6	106.8
3.5y	87.3	88.6	89.3	91.3	94.0	95.3	96.6	99.3	102.0	103.3	104.7	107.3	109.4	110.0	111.4
4.0y	90.2	91.6	92.4	94.5	97.3	98.7	100.1	102.9	105.8	107.2	108.6	111.4	113.5	114.2	115.6
4.5y	93.0	94.4	95.2	97.4	100.4	101.9	103.3	106.3	109.3	110.8	112.3	115.2	117.5	118.2	119.7
5.0y	95.6	97.1	97.9	100.2	103.4	104.9	106.5	109.6	112.7	114.3	115.8	119.0	121.3	122.1	123.6
5.5y	98.1	99.7	100.6	103.0	106.3	107.9	109.5	112.8	116.1	117.7	119.4	122.6	125.1	125.9	127.6
6.0y	100.6	102.3	103.2	105.8	109.2	110.9	112.6	116.0	119.5	121.2	122.9	126.3	128.9	129.8	131.5
6.5y	103.1	104.9	105.8	108.5	112.1	113.9	115.6	119.2	122.8	124.6	126.4	130.0	132.6	133.6	135.3
7.0y	105.6	107.4	108.4	111.2	114.9	116.8	118.6	122.3	126.1	127.9	129.8	133.5	136.3	137.3	139.1
7.5y	107.9	109.9	110.8	113.7	117.6	119.5	121.5	125.3	129.2	131.2	133.1	137.0	139.9	140.8	142.8
8.0y	110.3	112.2	113.3	116.3	120.3	122.3	124.2	128.3	132.3	134.3	136.2	140.3	143.3	144.3	146.3
8.5y	112.5	114.6	115.6	118.7	122.9	124.9	127.0	131.1	135.2	137.3	139.3	143.5	146.6	147.6	149.7
9.0y	114.8	116.9	118.0	121.2	125.5	127.6	129.7	133.9	138.2	140.3	142.4	146.6	149.8	150.9	153.0
9.5y	117.2	119.4	120.5	123.7	128.1	130.3	132.4	136.8	141.1	143.3	145.4	149.8	153.1	154.2	156.3
10.0y	119.8	122.0	123.1	126.5	130.9	133.1	135.3	139.8	144.2	146.4	148.6	153.1	156.4	157.6	159.8
10.5y	122.6	124.8	126.0	129.3	133.9	136.1	138.4	142.9	147.5	149.7	151.9	156.5	159.9	161.0	163.3

Age	-3	-2.67	-2.5	-2	-1.33	-1	-0.67	0	0.67	1	1.33	2	2.5	2.67	3
11.0y	125.5	127.8	128.9	132.4	137.0	139.3	141.5	146.2	150.8	153.0	155.3	159.9	163.4	164.5	166.8
11.5y	128.5	130.8	132.0	135.5	140.1	142.4	144.7	149.4	154.0	156.3	158.6	163.3	166.7	167.9	170.2
12.0y	131.5	133.8	135.0	138.5	143.1	145.4	147.7	152.4	157.1	159.4	161.7	166.4	169.9	171.0	173.3
12.5y	134.2	136.5	137.7	141.2	145.9	148.2	150.5	155.2	159.8	162.1	164.4	169.1	172.6	173.8	176.1
13.0y	136.7	139.0	140.1	143.6	148.3	150.6	152.8	157.5	162.2	164.4	166.7	171.4	174.9	176.0	178.3
13.5y	138.7	141.0	142.1	145.6	150.2	152.5	154.8	159.4	164.0	166.3	168.6	173.2	176.7	177.9	180.1
14.0y	140.3	142.6	143.7	147.2	151.8	154.0	156.3	160.9	165.5	167.8	170.0	174.7	178.1	179.3	181.5
14.5y	141.5	143.8	145.0	148.4	153.0	155.2	157.5	162.1	166.6	168.9	171.1	175.7	179.1	180.3	182.6
15.0y	142.4	144.7	145.9	149.3	153.8	156.1	158.3	162.9	167.4	169.7	171.9	176.5	179.9	181.1	183.3
15.5y	143.1	145.3	146.5	149.9	154.4	156.7	158.9	163.4	168.0	170.2	172.5	177.0	180.4	181.6	183.8
16.0y	143.5	145.8	146.9	150.3	154.8	157.1	159.3	163.8	168.4	170.6	172.9	177.4	180.8	181.9	184.2
16.5y	143.9	146.1	147.2	150.6	155.2	157.4	159.6	164.2	168.7	170.9	173.1	177.7	181.1	182.2	184.4
17.0y	144.1	146.4	147.5	150.9	155.4	157.6	159.9	164.4	168.9	171.2	173.4	177.9	181.3	182.4	184.7
17.5y	144.4	146.6	147.7	151.1	155.6	157.8	160.1	164.6	169.1	171.3	173.6	178.1	181.5	182.6	184.8
18.0y	144.5	146.8	147.9	151.3	155.8	158.0	160.2	164.7	169.3	171.5	173.7	178.2	181.6	182.7	185.0

APPENDIX B.1 WEIGHT (KG) FOR AGE, BOYS 0-18 YEARS (LMS, PERCENTILES, Z-SCORE CURVES)

Age	L	M	S	P1	P3	P5	P10	P25	P50	P75	P90	P95	P97	P99
0w	0.8289	3.39	0.1617	2.2	2.4	2.5	2.7	3.0	3.4	3.8	4.1	4.3	4.5	4.7
1w	0.8101	3.59	0.1606	2.3	2.5	2.7	2.9	3.2	3.6	4.0	4.3	4.6	4.7	5.0
2w	0.7918	3.80	0.1597	2.5	2.7	2.8	3.0	3.4	3.8	4.2	4.6	4.8	5.0	5.3
3w	0.7739	4.00	0.1587	2.6	2.9	3.0	3.2	3.6	4.0	4.4	4.8	5.1	5.2	5.5
4w	0.7562	4.19	0.1578	2.7	3.0	3.1	3.4	3.8	4.2	4.6	5.1	5.3	5.5	5.8
5w	0.7391	4.38	0.1569	2.9	3.1	3.3	3.5	3.9	4.4	4.9	5.3	5.6	5.7	6.1
6w	0.7222	4.57	0.1560	3.0	3.3	3.4	3.7	4.1	4.6	5.1	5.5	5.8	6.0	6.3
7w	0.7057	4.76	0.1552	3.1	3.4	3.6	3.8	4.3	4.8	5.3	5.7	6.0	6.2	6.6
8w	0.6896	4.94	0.1544	3.3	3.6	3.7	4.0	4.4	4.9	5.5	6.0	6.2	6.4	6.8
9w	0.6738	5.12	0.1536	3.4	3.7	3.9	4.1	4.6	5.1	5.7	6.2	6.5	6.7	7.1
10w	0.6584	5.29	0.1529	3.5	3.9	4.0	4.3	4.8	5.3	5.8	6.4	6.7	6.9	7.3
12w	0.6284	5.63	0.1515	3.8	4.1	4.3	4.6	5.1	5.6	6.2	6.8	7.1	7.3	7.7
14w	0.5998	5.96	0.1502	4.0	4.4	4.6	4.9	5.4	6.0	6.6	7.2	7.5	7.7	8.2
16w	0.5724	6.27	0.1491	4.3	4.6	4.8	5.1	5.7	6.3	6.9	7.5	7.9	8.1	8.6
18w	0.5461	6.57	0.1480	4.5	4.9	5.1	5.4	5.9	6.6	7.2	7.9	8.3	8.5	9.0
20w	0.5211	6.86	0.1470	4.7	5.1	5.3	5.6	6.2	6.9	7.6	8.2	8.6	8.9	9.4
22w	0.4972	7.14	0.1460	4.9	5.3	5.5	5.9	6.5	7.1	7.9	8.5	9.0	9.2	9.8
24w	0.4743	7.40	0.1452	5.1	5.5	5.7	6.1	6.7	7.4	8.1	8.8	9.3	9.6	10.1
26w	0.4525	7.66	0.1444	5.3	5.7	6.0	6.3	6.9	7.7	8.4	9.2	9.6	9.9	10.5
28w	0.4317	7.90	0.1437	5.5	5.9	6.2	6.5	7.2	7.9	8.7	9.4	9.9	10.2	10.8
32w	0.3930	8.36	0.1424	5.9	6.3	6.5	6.9	7.6	8.4	9.2	10.0	10.5	10.8	11.4
36w	0.3580	8.78	0.1413	6.2	6.6	6.9	7.3	8.0	8.8	9.6	10.5	11.0	11.3	12.0
40w	0.3263	9.17	0.1405	6.5	7.0	7.2	7.6	8.3	9.2	10.1	10.9	11.5	11.8	12.5
44w	0.2978	9.52	0.1398	6.8	7.2	7.5	7.9	8.7	9.5	10.5	11.3	11.9	12.3	13.0
48w	0.2721	9.85	0.1392	7.0	7.5	7.8	8.2	9.0	9.9	10.8	11.7	12.3	12.7	13.4
52w	0.2489	10.15	0.1387	7.3	7.8	8.0	8.5	9.2	10.2	11.1	12.1	12.7	13.1	13.8
56w	0.2280	10.42	0.1383	7.5	8.0	8.3	8.7	9.5	10.4	11.4	12.4	13.0	13.4	14.2
60w	0.2091	10.67	0.1380	7.7	8.2	8.5	8.9	9.7	10.7	11.7	12.7	13.3	13.7	14.6
64w	0.1919	10.91	0.1378	7.8	8.4	8.7	9.1	9.9	10.9	12.0	13.0	13.6	14.1	14.9
1.5y	0.1418	11.61	0.1373	8.4	8.9	9.2	9.7	10.6	11.6	12.7	13.8	14.5	15.0	15.9
2.0y	0.0729	12.65	0.1371	9.2	9.8	10.1	10.6	11.5	12.7	13.9	15.1	15.8	16.3	17.3
2.5y	0.0141	13.61	0.1374	9.9	10.5	10.9	11.4	12.4	13.6	14.9	16.2	17.1	17.6	18.7
3.0y	-0.0450	14.66	0.1384	10.7	11.3	11.7	12.3	13.4	14.7	16.1	17.5	18.4	19.1	20.3
3.5y	-0.1044	15.79	0.1400	11.5	12.2	12.6	13.2	14.4	15.8	17.4	18.9	19.9	20.6	22.0
4.0y	-0.1609	16.95	0.1424	12.3	13.0	13.5	14.2	15.4	17.0	18.7	20.4	21.5	22.3	23.8
4.5y	-0.2127	18.10	0.1454	13.1	13.9	14.3	15.1	16.4	18.1	20.0	21.9	23.1	24.0	25.7
5.0y	-0.2595	19.22	0.1488	13.8	14.7	15.2	16.0	17.4	19.2	21.3	23.4	24.8	25.7	27.6
5.5y	-0.3024	20.35	0.1528	14.5	15.5	16.0	16.8	18.4	20.4	22.6	24.9	26.4	27.5	29.6
6.0y	-0.3423	21.53	0.1575	15.3	16.2	16.8	17.7	19.4	21.5	24.0	26.5	28.2	29.4	31.8
6.5y	-0.3797	22.83	0.1629	16.0	17.1	17.7	18.7	20.5	22.8	25.5	28.4	30.3	31.6	34.4
7.0y	-0.4134	24.27	0.1692	16.9	18.0	18.7	19.7	21.7	24.3	27.3	30.5	32.6	34.1	37.3
7.5y	-0.4413	25.82	0.1761	17.7	19.0	19.7	20.8	23.0	25.8	29.2	32.8	35.2	36.9	40.6
8.0y	-0.4616	27.43	0.1832	18.6	19.9	20.7	22.0	24.3	27.4	31.2	35.2	37.9	39.9	44.1
8.5y	-0.4735	29.04	0.1901	19.4	20.9	21.7	23.1	25.6	29.0	33.2	37.6	40.7	43.0	47.7
9.0y	-0.4775	30.61	0.1966	20.2	21.8	22.7	24.1	26.9	30.6	35.1	40.0	43.5	46.0	51.3
9.5y	-0.4743	32.17	0.2026	21.0	22.7	23.6	25.2	28.2	32.2	37.1	42.4	46.2	49.0	54.8
10.0y	-0.4639	33.77	0.2081	21.8	23.6	24.6	26.3	29.5	33.8	39.1	44.9	49.0	52.0	58.4

Age	L	M	S	P1	P3	P5	P10	P25	P50	P75	P90	P95	P97	P99
10.5y	-0.4457	35.45	0.2132	22.7	24.5	25.6	27.4	30.8	35.5	41.1	47.4	51.9	55.1	62.1
11.0y	-0.4186	37.29	0.2177	23.6	25.6	26.7	28.6	32.3	37.3	43.4	50.2	55.0	58.4	65.9
11.5y	-0.3810	39.31	0.2213	24.6	26.7	28.0	30.0	34.0	39.3	45.8	53.1	58.2	61.8	69.7
12.0y	-0.3318	41.54	0.2235	25.7	28.0	29.4	31.6	35.9	41.5	48.5	56.1	61.5	65.3	73.5
12.5y	-0.2706	44.01	0.2238	27.0	29.5	31.0	33.4	38.0	44.0	51.3	59.3	64.9	68.8	77.1
13.0y	-0.1985	46.71	0.2217	28.6	31.3	32.9	35.4	40.3	46.7	54.4	62.6	68.2	72.2	80.5
13.5y	-0.1182	49.62	0.2171	30.4	33.3	35.0	37.7	42.9	49.6	57.5	65.8	71.5	75.4	83.5
14.0y	-0.0338	52.72	0.2106	32.4	35.6	37.4	40.3	45.8	52.7	60.8	69.1	74.7	78.6	86.4
14.5y	0.0496	55.89	0.2031	34.7	38.0	39.9	43.0	48.7	55.9	64.1	72.4	77.8	81.6	89.2
15.0y	0.1277	58.96	0.1955	36.9	40.5	42.5	45.7	51.6	59.0	67.2	75.5	80.8	84.5	91.7
15.5y	0.1968	61.75	0.1888	39.0	42.7	44.8	48.2	54.3	61.8	70.0	78.2	83.5	87.0	94.1
16.0y	0.2553	64.12	0.1834	40.8	44.7	46.9	50.3	56.6	64.1	72.4	80.6	85.7	89.2	96.1
16.5y	0.3026	66.04	0.1793	42.3	46.3	48.5	52.1	58.4	66.0	74.4	82.5	87.6	91.0	97.8
17.0y	0.3393	67.52	0.1763	43.4	47.5	49.8	53.4	59.8	67.5	75.9	83.9	89.0	92.5	99.1
17.5y	0.3661	68.61	0.1743	44.2	48.4	50.7	54.4	60.8	68.6	77.0	85.0	90.1	93.5	100.1
18.0y	0.3839	69.33	0.1730	44.8	49.0	51.3	55.0	61.5	69.3	77.7	85.8	90.8	94.2	100.8

Age	-3	-2.67	-2.5	-2	-1.33	-1	-0.67	0	0.67	1	1.33	2	2.5	2.67	3
0w	1.8	2.0	2.1	2.3	2.7	2.9	3.0	3.4	3.8	3.9	4.1	4.5	4.8	4.9	5.1
1w	2.0	2.1	2.2	2.5	2.8	3.0	3.2	3.6	4.0	4.2	4.4	4.8	5.1	5.2	5.4
2w	2.1	2.3	2.4	2.6	3.0	3.2	3.4	3.8	4.2	4.4	4.6	5.1	5.4	5.5	5.7
3w	2.2	2.4	2.5	2.8	3.2	3.4	3.6	4.0	4.4	4.7	4.9	5.3	5.7	5.8	6.0
4w	2.3	2.5	2.6	2.9	3.3	3.5	3.8	4.2	4.6	4.9	5.1	5.6	5.9	6.0	6.3
5w	2.5	2.7	2.8	3.1	3.5	3.7	3.9	4.4	4.9	5.1	5.3	5.8	6.2	6.3	6.6
6w	2.6	2.8	2.9	3.2	3.7	3.9	4.1	4.6	5.1	5.3	5.5	6.1	6.4	6.6	6.8
7w	2.7	2.9	3.0	3.4	3.8	4.0	4.3	4.8	5.3	5.5	5.8	6.3	6.7	6.9	7.1
8w	2.8	3.0	3.2	3.5	4.0	4.2	4.4	4.9	5.5	5.7	6.0	6.5	7.0	7.1	7.4
9w	3.0	3.2	3.3	3.6	4.1	4.4	4.6	5.1	5.7	5.9	6.2	6.8	7.2	7.4	7.7
10w	3.1	3.3	3.4	3.8	4.3	4.5	4.8	5.3	5.8	6.1	6.4	7.0	7.4	7.6	7.9
12w	3.3	3.5	3.7	4.0	4.5	4.8	5.1	5.6	6.2	6.5	6.8	7.4	7.9	8.1	8.4
14w	3.5	3.8	3.9	4.3	4.8	5.1	5.4	6.0	6.6	6.9	7.2	7.9	8.4	8.5	8.9
16w	3.7	4.0	4.1	4.5	5.1	5.4	5.7	6.3	6.9	7.2	7.6	8.3	8.8	9.0	9.3
18w	4.0	4.2	4.4	4.8	5.3	5.6	5.9	6.6	7.2	7.6	7.9	8.6	9.2	9.4	9.8
20w	4.2	4.4	4.6	5.0	5.6	5.9	6.2	6.9	7.6	7.9	8.3	9.0	9.6	9.8	10.2
22w	4.4	4.6	4.8	5.2	5.8	6.1	6.5	7.1	7.9	8.2	8.6	9.4	10.0	10.2	10.6
24w	4.5	4.8	5.0	5.4	6.0	6.4	6.7	7.4	8.1	8.5	8.9	9.7	10.3	10.6	11.0
26w	4.7	5.0	5.2	5.6	6.3	6.6	6.9	7.7	8.4	8.8	9.2	10.1	10.7	10.9	11.4
28w	4.9	5.2	5.4	5.8	6.5	6.8	7.2	7.9	8.7	9.1	9.5	10.4	11.0	11.3	11.7
32w	5.2	5.5	5.7	6.2	6.9	7.2	7.6	8.4	9.2	9.6	10.0	11.0	11.7	11.9	12.4
36w	5.5	5.9	6.0	6.5	7.2	7.6	8.0	8.8	9.6	10.1	10.5	11.5	12.3	12.5	13.0
40w	5.8	6.2	6.3	6.8	7.6	7.9	8.3	9.2	10.1	10.5	11.0	12.0	12.8	13.1	13.6
44w	6.1	6.4	6.6	7.1	7.9	8.3	8.7	9.5	10.4	10.9	11.4	12.5	13.3	13.6	14.1
48w	6.3	6.7	6.8	7.4	8.2	8.6	9.0	9.9	10.8	11.3	11.8	12.9	13.7	14.0	14.6
52w	6.5	6.9	7.1	7.6	8.4	8.8	9.2	10.2	11.1	11.6	12.2	13.3	14.2	14.5	15.1
56w	6.7	7.1	7.3	7.8	8.6	9.1	9.5	10.4	11.4	11.9	12.5	13.6	14.5	14.9	15.5
60w	6.9	7.3	7.5	8.0	8.9	9.3	9.7	10.7	11.7	12.2	12.8	14.0	14.9	15.2	15.9
64w	7.1	7.5	7.6	8.2	9.1	9.5	9.9	10.9	12.0	12.5	13.1	14.3	15.2	15.6	16.2
1.5y	7.6	8.0	8.2	8.8	9.7	10.1	10.6	11.6	12.7	13.3	13.9	15.2	16.2	16.6	17.3
2.0y	8.3	8.7	8.9	9.6	10.5	11.0	11.5	12.7	13.9	14.5	15.2	16.6	17.7	18.2	19.0
2.5y	9.0	9.4	9.6	10.3	11.3	11.9	12.4	13.6	14.9	15.6	16.3	17.9	19.2	19.6	20.5
3.0y	9.7	10.2	10.4	11.1	12.2	12.8	13.4	14.7	16.1	16.8	17.6	19.4	20.8	21.3	22.3
3.5y	10.5	10.9	11.2	12.0	13.1	13.7	14.4	15.8	17.4	18.2	19.1	21.0	22.6	23.1	24.3
4.0y	11.2	11.7	12.0	12.8	14.1	14.7	15.4	17.0	18.7	19.6	20.5	22.7	24.5	25.1	26.4
4.5y	11.9	12.5	12.8	13.7	15.0	15.7	16.4	18.1	20.0	21.0	22.1	24.4	26.4	27.1	28.6
5.0y	12.6	13.2	13.5	14.4	15.9	16.6	17.4	19.2	21.3	22.4	23.6	26.2	28.4	29.2	30.9
5.5y	13.3	13.9	14.2	15.2	16.7	17.5	18.4	20.4	22.6	23.8	25.1	28.0	30.5	31.5	33.3
6.0y	13.9	14.5	14.9	16.0	17.6	18.5	19.4	21.5	24.0	25.3	26.8	30.0	32.9	33.9	36.0
6.5y	14.6	15.3	15.6	16.8	18.5	19.5	20.5	22.8	25.5	27.0	28.6	32.3	35.5	36.7	39.2
7.0y	15.3	16.0	16.4	17.7	19.6	20.6	21.7	24.3	27.3	28.9	30.7	34.9	38.6	40.0	42.9
7.5y	16.1	16.8	17.3	18.6	20.7	21.8	23.0	25.8	29.1	31.0	33.1	37.9	42.1	43.7	47.1
8.0y	16.8	17.7	18.1	19.6	21.8	23.0	24.3	27.4	31.1	33.2	35.5	41.0	45.9	47.8	51.7
8.5y	17.5	18.4	18.9	20.5	22.9	24.2	25.7	29.0	33.1	35.4	38.0	44.2	49.8	51.9	56.5
9.0y	18.2	19.2	19.7	21.4	23.9	25.4	26.9	30.6	35.1	37.6	40.5	47.3	53.6	56.0	61.2
9.5y	18.9	19.9	20.4	22.2	25.0	26.5	28.2	32.2	37.0	39.8	42.9	50.5	57.4	60.1	65.9
10.0y	19.5	20.6	21.2	23.1	26.0	27.7	29.5	33.8	39.0	42.0	45.4	53.6	61.3	64.2	70.6
10.5y	20.2	21.3	22.0	24.0	27.1	28.9	30.9	35.5	41.1	44.4	48.0	56.9	65.2	68.4	75.3

Age	-3	-2.67	-2.5	-2	-1.33	-1	-0.67	0	0.67	1	1.33	2	2.5	2.67	3
11.0y	20.9	22.2	22.8	25.0	28.4	30.3	32.4	37.3	43.4	46.9	50.8	60.3	69.2	72.6	80.0
11.5y	21.8	23.1	23.8	26.1	29.7	31.8	34.0	39.3	45.8	49.5	53.7	63.8	73.2	76.8	84.5
12.0y	22.7	24.1	24.9	27.4	31.3	33.5	35.9	41.5	48.4	52.4	56.8	67.4	77.1	80.8	88.7
12.5y	23.8	25.3	26.1	28.9	33.1	35.4	38.0	44.0	51.3	55.4	60.0	70.9	80.7	84.4	92.3
13.0y	25.0	26.7	27.6	30.5	35.1	37.6	40.4	46.7	54.3	58.6	63.3	74.3	84.0	87.7	95.3
13.5y	26.5	28.3	29.3	32.5	37.4	40.1	43.0	49.6	57.5	61.8	66.6	77.5	87.0	90.5	97.7
14.0y	28.2	30.2	31.3	34.7	39.9	42.7	45.8	52.7	60.7	65.1	69.9	80.6	89.7	93.0	99.9
14.5y	30.1	32.3	33.4	37.1	42.6	45.6	48.8	55.9	64.0	68.4	73.1	83.6	92.3	95.4	101.9
15.0y	32.1	34.4	35.6	39.5	45.3	48.4	51.7	59.0	67.1	71.5	76.2	86.4	94.7	97.7	103.8
15.5y	33.9	36.3	37.6	41.7	47.7	50.9	54.3	61.8	70.0	74.3	78.9	88.9	97.0	99.9	105.6
16.0y	35.4	38.0	39.4	43.6	49.9	53.1	56.6	64.1	72.4	76.7	81.2	91.0	98.9	101.7	107.3
16.5y	36.7	39.4	40.8	45.2	51.6	54.9	58.4	66.0	74.3	78.6	83.1	92.8	100.5	103.3	108.7
17.0y	37.7	40.4	41.9	46.4	52.9	56.3	59.9	67.5	75.8	80.1	84.6	94.2	101.8	104.5	109.8
17.5y	38.4	41.2	42.7	47.3	53.9	57.3	60.9	68.6	76.9	81.2	85.7	95.3	102.8	105.4	110.7
18.0y	38.9	41.7	43.2	47.8	54.5	58.0	61.6	69.3	77.7	82.0	86.4	96.0	103.5	106.1	111.3

APPENDIX B.2 WEIGHT (KG) FOR AGE, GIRLS 0-18 YEARS (LMS, PERCENTILES, Z-SCORE CURVES)

Age	L	M	S	P1	P3	P5	P10	P25	P50	P75	P90	P95	P97	P99
0w	1.4093	3.25	0.1566	2.0	2.2	2.4	2.6	2.9	3.3	3.6	3.9	4.1	4.2	4.4
1w	1.3819	3.44	0.1555	2.1	2.4	2.5	2.7	3.1	3.4	3.8	4.1	4.3	4.4	4.6
2w	1.3552	3.63	0.1544	2.2	2.5	2.7	2.9	3.3	3.6	4.0	4.3	4.5	4.6	4.9
3w	1.3289	3.81	0.1534	2.4	2.7	2.8	3.0	3.4	3.8	4.2	4.5	4.7	4.9	5.1
4w	1.3032	3.99	0.1523	2.5	2.8	3.0	3.2	3.6	4.0	4.4	4.8	5.0	5.1	5.3
5w	1.2781	4.16	0.1514	2.6	2.9	3.1	3.3	3.7	4.2	4.6	5.0	5.2	5.3	5.6
6w	1.2535	4.34	0.1504	2.7	3.1	3.2	3.5	3.9	4.3	4.8	5.2	5.4	5.5	5.8
7w	1.2294	4.51	0.1495	2.9	3.2	3.4	3.6	4.1	4.5	5.0	5.4	5.6	5.7	6.0
8w	1.2059	4.67	0.1487	3.0	3.3	3.5	3.8	4.2	4.7	5.1	5.5	5.8	5.9	6.2
9w	1.1828	4.84	0.1478	3.1	3.5	3.6	3.9	4.4	4.8	5.3	5.7	6.0	6.2	6.5
10w	1.1603	5.00	0.1470	3.2	3.6	3.8	4.0	4.5	5.0	5.5	5.9	6.2	6.4	6.7
12w	1.1166	5.30	0.1455	3.5	3.8	4.0	4.3	4.8	5.3	5.8	6.3	6.6	6.7	7.1
14w	1.0749	5.60	0.1441	3.7	4.1	4.3	4.6	5.1	5.6	6.1	6.6	6.9	7.1	7.5
16w	0.1035	5.88	0.1428	3.9	4.3	4.5	4.8	5.3	5.9	6.5	7.0	7.3	7.5	7.8
18w	0.9967	6.16	0.1416	4.1	4.5	4.7	5.0	5.6	6.2	6.8	7.3	7.6	7.8	8.2
20w	0.9602	6.42	0.1405	4.3	4.7	4.9	5.3	5.8	6.4	7.0	7.6	7.9	8.1	8.5
22w	0.9253	6.67	0.1394	4.5	4.9	5.2	5.5	6.0	6.7	7.3	7.9	8.2	8.4	8.9
24w	0.8919	6.91	0.1385	4.7	5.1	5.4	5.7	6.3	6.9	7.6	8.2	8.5	8.7	9.2
26w	0.8601	7.14	0.1376	4.9	5.3	5.6	5.9	6.5	7.1	7.8	8.4	8.8	9.0	9.5
28w	0.8297	7.36	0.1368	5.1	5.5	5.7	6.1	6.7	7.4	8.0	8.7	9.1	9.3	9.8
32w	0.7730	7.78	0.1354	5.4	5.9	6.1	6.5	7.1	7.8	8.5	9.2	9.6	9.8	10.3
36w	0.7215	8.16	0.1342	5.7	6.2	6.4	6.8	7.4	8.2	8.9	9.6	10.0	10.3	10.8
40w	0.6748	8.52	0.1332	6.0	6.5	6.7	7.1	7.8	8.5	9.3	10.0	10.5	10.7	11.3
44w	0.6324	8.85	0.1324	6.3	6.8	7.0	7.4	8.1	8.9	9.7	10.4	10.9	11.2	11.7
48w	0.5941	9.16	0.1317	6.5	7.0	7.3	7.7	8.4	9.2	10.0	10.8	11.2	11.5	12.1
52w	0.5592	9.45	0.1312	6.8	7.3	7.5	7.9	8.6	9.5	10.3	11.1	11.6	11.9	12.5
56w	0.5275	9.71	0.1308	7.0	7.5	7.7	8.2	8.9	9.7	10.6	11.4	11.9	12.2	12.9
60w	0.4985	9.96	0.1304	7.2	7.7	7.9	8.4	9.1	10.0	10.9	11.7	12.2	12.6	13.2
64w	0.4721	10.20	0.1302	7.4	7.9	8.1	8.6	9.3	10.2	11.1	12.0	12.5	12.9	13.5
1.5y	0.3931	10.93	0.1296	7.9	8.5	8.8	9.2	10.0	10.9	11.9	12.8	13.4	13.8	14.5
2.0y	0.2826	12.06	0.1297	8.8	9.4	9.7	10.2	11.0	12.1	13.2	14.2	14.8	15.3	16.1
2.5y	0.1904	13.11	0.1307	9.6	10.2	10.5	11.1	12.0	13.1	14.3	15.5	16.2	16.7	17.6
3.0y	0.1035	14.19	0.1326	10.4	11.0	11.4	12.0	13.0	14.2	15.5	16.8	17.6	18.2	19.2
3.5y	0.0205	15.30	0.1354	11.2	11.9	12.2	12.9	14.0	15.3	16.8	18.2	19.1	19.7	20.9
4.0y	-0.0568	16.43	0.1392	11.9	12.7	13.1	13.8	15.0	16.4	18.1	19.7	20.7	21.4	22.8
4.5y	-0.1270	17.56	0.1438	12.7	13.5	13.9	14.6	16.0	17.6	19.4	21.2	22.3	23.1	24.7
5.0y	-0.1898	18.70	0.1493	13.4	14.2	14.7	15.5	16.9	18.7	20.7	22.7	24.1	25.0	26.8
5.5y	-0.2460	19.87	0.1556	14.1	15.0	15.5	16.4	17.9	19.9	22.1	24.4	25.9	26.9	29.0
6.0y	-0.2957	21.12	0.1626	14.8	15.8	16.3	17.3	19.0	21.1	23.6	26.2	27.9	29.1	31.5
6.5y	-0.3381	22.44	0.1701	15.5	16.6	17.2	18.2	20.1	22.4	25.2	28.1	30.1	31.5	34.3
7.0y	-0.3722	23.83	0.1778	16.2	17.4	18.1	19.2	21.2	23.8	26.9	30.2	32.5	34.1	37.3
7.5y	-0.3974	25.29	0.1854	17.0	18.3	19.0	20.2	22.4	25.3	28.8	32.5	35.0	36.8	40.6
8.0y	-0.4134	26.81	0.1924	17.8	19.1	19.9	21.2	23.6	26.8	30.6	34.8	37.6	39.7	44.0
8.5y	-0.4203	28.39	0.1986	18.6	20.1	20.9	22.3	24.9	28.4	32.6	37.2	40.3	42.6	47.5
9.0y	-0.4183	30.04	0.2040	19.5	21.1	22.0	23.4	26.3	30.0	34.6	39.6	43.1	45.6	51.0
9.5y	-0.4074	31.78	0.2086	20.4	22.1	23.1	24.7	27.7	31.8	36.7	42.2	46.0	48.7	54.6
10.0y	-0.3881	33.65	0.2124	21.4	23.2	24.3	26.0	29.3	33.7	39.0	44.9	49.0	51.9	58.2

Age	L	M	S	P1	P3	P5	P10	P25	P50	P75	P90	P95	P97	P99
10.5y	-0.3615	35.67	0.2152	22.5	24.5	25.6	27.4	31.0	35.7	41.4	47.7	52.1	55.3	62.0
11.0y	-0.3296	37.85	0.2170	23.7	25.8	27.0	29.0	32.8	37.9	44.0	50.7	55.3	58.7	65.8
11.5y	-0.2959	40.18	0.2172	25.1	27.3	28.6	30.8	34.8	40.2	46.7	53.7	58.6	62.1	69.5
12.0y	-0.2644	42.64	0.2148	26.7	29.1	30.4	32.7	37.0	42.6	49.4	56.8	61.8	65.4	72.9
12.5y	-0.2391	45.13	0.2094	28.5	31.0	32.4	34.8	39.3	45.1	52.1	59.6	64.7	68.3	75.8
13.0y	-0.2223	47.52	0.2015	30.4	33.0	34.5	37.0	41.6	47.5	54.6	62.0	67.1	70.6	78.0
13.5y	-0.2148	49.71	0.1924	32.4	35.1	36.6	39.1	43.7	49.7	56.7	64.0	69.0	72.4	79.6
14.0y	-0.2153	51.64	0.1834	34.3	37.0	38.6	41.1	45.7	51.6	58.5	65.7	70.5	73.9	80.8
14.5y	-0.2217	53.26	0.1756	36.0	38.7	40.3	42.8	47.4	53.3	60.1	67.1	71.8	75.1	81.7
15.0y	-0.2312	54.59	0.1693	37.5	40.2	41.7	44.2	48.8	54.6	61.3	68.2	72.8	76.0	82.5
15.5y	-0.2417	55.64	0.1644	38.6	41.3	42.8	45.3	49.9	55.6	62.3	69.1	73.6	76.7	83.1
16.0y	-0.2513	56.44	0.1609	39.5	42.2	43.7	46.2	50.7	56.4	63.0	69.8	74.2	77.3	83.6
16.5y	-0.2590	57.00	0.1584	40.1	42.8	44.3	46.8	51.3	57.0	63.5	70.2	74.7	77.7	84.0
17.0y	-0.2642	57.35	0.1569	40.5	43.2	44.7	47.2	51.7	57.4	63.9	70.5	74.9	78.0	84.2
17.5y	-0.2665	57.49	0.1563	40.6	43.3	44.8	47.3	51.8	57.5	64.0	70.6	75.0	78.1	84.3
18.0y	-0.2656	57.44	0.1565	40.6	43.3	44.8	47.2	51.8	57.4	63.9	70.6	75.0	78.1	84.2

Age	-3	-2.67	-2.5	-2	-1.33	-1	-0.67	0	0.67	1	1.33	2	2.5	2.67	3
0w	1.5	1.7	1.8	2.2	2.5	2.7	2.9	3.3	3.6	3.7	3.9	4.2	4.4	4.5	4.7
1w	1.6	1.9	2.0	2.3	2.7	2.9	3.1	3.4	3.8	4.0	4.1	4.5	4.7	4.8	4.9
2w	1.8	2.0	2.1	2.4	2.9	3.1	3.3	3.6	4.0	4.2	4.4	4.7	5.0	5.0	5.2
3w	1.9	2.1	2.2	2.6	3.0	3.2	3.4	3.8	4.2	4.4	4.6	4.9	5.2	5.3	5.5
4w	2.0	2.2	2.4	2.7	3.2	3.4	3.6	4.0	4.4	4.6	4.8	5.2	5.4	5.5	5.7
5w	2.1	2.4	2.5	2.8	3.3	3.5	3.7	4.2	4.6	4.8	5.0	5.4	5.7	5.8	6.0
6w	2.2	2.5	2.6	3.0	3.5	3.7	3.9	4.3	4.8	5.0	5.2	5.6	5.9	6.0	6.2
7w	2.4	2.6	2.7	3.1	3.6	3.8	4.1	4.5	5.0	5.2	5.4	5.8	6.1	6.2	6.5
8w	2.5	2.7	2.9	3.2	3.7	4.0	4.2	4.7	5.1	5.4	5.6	6.0	6.4	6.5	6.7
9w	2.6	2.8	3.0	3.4	3.9	4.1	4.4	4.8	5.3	5.6	5.8	6.2	6.6	6.7	6.9
10w	2.7	3.0	3.1	3.5	4.0	4.3	4.5	5.0	5.5	5.7	6.0	6.4	6.8	6.9	7.1
12w	2.9	3.2	3.3	3.7	4.3	4.5	4.8	5.3	5.8	6.1	6.3	6.8	7.2	7.3	7.6
14w	3.1	3.4	3.6	4.0	4.5	4.8	5.1	5.6	6.1	6.4	6.7	7.2	7.6	7.7	8.0
16w	3.3	3.6	3.8	4.2	4.8	5.0	5.3	5.9	6.4	6.7	7.0	7.6	8.0	8.1	8.4
18w	3.6	3.8	4.0	4.4	5.0	5.3	5.6	6.2	6.7	7.0	7.3	7.9	8.3	8.5	8.8
20w	3.7	4.0	4.2	4.6	5.2	5.5	5.8	6.4	7.0	7.3	7.6	8.2	8.7	8.8	9.2
22w	3.9	4.2	4.4	4.8	5.4	5.8	6.1	6.7	7.3	7.6	7.9	8.6	9.0	9.2	9.5
24w	4.1	4.4	4.6	5.0	5.7	6.0	6.3	6.9	7.6	7.9	8.2	8.9	9.3	9.5	9.8
26w	4.3	4.6	4.8	5.2	5.9	6.2	6.5	7.1	7.8	8.1	8.5	9.1	9.7	9.8	10.2
28w	4.5	4.8	4.9	5.4	6.0	6.4	6.7	7.4	8.0	8.4	8.7	9.4	10.0	10.1	10.5
32w	4.8	5.1	5.3	5.7	6.4	6.7	7.1	7.8	8.5	8.9	9.2	10.0	10.5	10.7	11.1
36w	5.1	5.4	5.6	6.1	6.7	7.1	7.4	8.2	8.9	9.3	9.7	10.4	11.0	11.2	11.6
40w	5.4	5.7	5.8	6.4	7.1	7.4	7.8	8.5	9.3	9.7	10.1	10.9	11.5	11.7	12.1
44w	5.6	5.9	6.1	6.6	7.3	7.7	8.1	8.9	9.7	10.1	10.5	11.3	12.0	12.2	12.6
48w	5.8	6.2	6.4	6.9	7.6	8.0	8.4	9.2	10.0	10.4	10.8	11.7	12.4	12.6	13.1
52w	6.1	6.4	6.6	7.1	7.9	8.3	8.6	9.5	10.3	10.7	11.2	12.1	12.8	13.0	13.5
56w	6.3	6.6	6.8	7.3	8.1	8.5	8.9	9.7	10.6	11.0	11.5	12.4	13.1	13.4	13.9
60w	6.5	6.8	7.0	7.5	8.3	8.7	9.1	10.0	10.9	11.3	11.8	12.7	13.5	13.7	14.2
64w	6.6	7.0	7.2	7.7	8.5	8.9	9.3	10.2	11.1	11.6	12.1	13.0	13.8	14.1	14.6
1.5y	7.2	7.5	7.7	8.3	9.1	9.6	10.0	10.9	11.9	12.4	12.9	14.0	14.8	15.1	15.7
2.0y	8.0	8.4	8.6	9.2	10.1	10.6	11.0	12.1	13.1	13.7	14.3	15.5	16.5	16.8	17.5
2.5y	8.7	9.1	9.4	10.0	11.0	11.5	12.0	13.1	14.3	14.9	15.6	16.9	18.0	18.4	19.1
3.0y	9.5	9.9	10.1	10.9	11.9	12.4	13.0	14.2	15.5	16.2	16.9	18.4	19.7	20.1	21.0
3.5y	10.2	10.6	10.9	11.7	12.8	13.4	14.0	15.3	16.8	17.5	18.3	20.0	21.4	21.9	22.9
4.0y	10.9	11.4	11.6	12.5	13.7	14.3	15.0	16.4	18.0	18.9	19.8	21.8	23.4	23.9	25.1
4.5y	11.5	12.1	12.4	13.2	14.5	15.2	16.0	17.6	19.4	20.3	21.3	23.5	25.4	26.0	27.4
5.0y	12.2	12.7	13.0	14.0	15.4	16.1	16.9	18.7	20.7	21.8	22.9	25.4	27.5	28.3	29.9
5.5y	12.8	13.4	13.7	14.7	16.2	17.1	17.9	19.9	22.1	23.3	24.6	27.5	29.9	30.8	32.6
6.0y	13.4	14.0	14.4	15.5	17.1	18.0	19.0	21.1	23.6	25.0	26.4	29.7	32.6	33.6	35.8
6.5y	14.0	14.7	15.1	16.3	18.1	19.0	20.1	22.4	25.2	26.7	28.4	32.2	35.5	36.7	39.3
7.0y	14.7	15.4	15.8	17.1	19.0	20.1	21.2	23.8	26.9	28.6	30.5	34.9	38.7	40.2	43.2
7.5y	15.3	16.1	16.5	17.9	20.0	21.2	22.4	25.3	28.7	30.7	32.8	37.8	42.2	43.9	47.4
8.0y	16.0	16.8	17.3	18.8	21.0	22.3	23.7	26.8	30.6	32.8	35.1	40.8	45.8	47.8	51.8
8.5y	16.7	17.6	18.1	19.7	22.1	23.5	24.9	28.4	32.6	34.9	37.6	43.8	49.6	51.7	56.4
9.0y	17.4	18.4	18.9	20.6	23.2	24.7	26.3	30.0	34.6	37.2	40.1	47.0	53.3	55.7	60.9
9.5y	18.2	19.2	19.8	21.6	24.4	26.0	27.7	31.8	36.7	39.5	42.7	50.2	57.1	59.8	65.4
10.0y	19.0	20.2	20.8	22.7	25.7	27.4	29.3	33.7	39.0	42.0	45.4	53.5	61.0	63.8	70.0
10.5y	20.0	21.2	21.8	23.9	27.2	29.0	31.0	35.7	41.4	44.6	48.3	57.0	64.9	67.9	74.4

Age	-3	-2.67	-2.5	-2	-1.33	-1	-0.67	0	0.67	1	1.33	2	2.5	2.67	3
11.0y	21.0	22.3	23.0	25.2	28.7	30.7	32.8	37.9	43.9	47.4	51.3	60.5	68.8	72.0	78.8
11.5y	22.1	23.5	24.3	26.7	30.5	32.6	34.8	40.2	46.6	50.3	54.3	64.0	72.6	75.9	82.9
12.0y	23.5	25.0	25.8	28.4	32.4	34.6	37.0	42.6	49.4	53.2	57.4	67.3	76.1	79.4	86.4
12.5y	25.1	26.7	27.6	30.3	34.5	36.8	39.3	45.1	52.1	56.0	60.2	70.2	79.0	82.3	89.2
13.0y	27.0	28.6	29.5	32.3	36.6	39.0	41.6	47.5	54.5	58.4	62.7	72.5	81.1	84.3	91.0
13.5y	28.9	30.5	31.5	34.4	38.8	41.2	43.8	49.7	56.7	60.5	64.7	74.3	82.6	85.7	92.1
14.0y	30.7	32.4	33.4	36.3	40.7	43.1	45.7	51.6	58.5	62.3	66.3	75.7	83.7	86.6	92.8
14.5y	32.4	34.1	35.0	38.0	42.4	44.8	47.4	53.3	60.0	63.7	67.7	76.8	84.5	87.4	93.3
15.0y	33.8	35.5	36.5	39.4	43.8	46.2	48.8	54.6	61.2	64.9	68.8	77.7	85.2	88.0	93.7
15.5y	34.9	36.7	37.6	40.6	45.0	47.4	49.9	55.6	62.2	65.8	69.7	78.4	85.8	88.5	94.1
16.0y	35.8	37.5	38.5	41.4	45.8	48.2	50.8	56.4	63.0	66.5	70.3	78.9	86.2	88.9	94.4
16.5y	36.4	38.2	39.1	42.0	46.4	48.8	51.3	57.0	63.5	67.0	70.8	79.3	86.6	89.2	94.7
17.0y	36.8	38.6	39.5	42.4	46.8	49.2	51.7	57.4	63.8	67.3	71.1	79.6	86.8	89.4	94.8
17.5y	37.0	38.7	39.6	42.6	47.0	49.3	51.9	57.5	63.9	67.4	71.2	79.7	86.9	89.5	94.9
18.0y	36.9	38.7	39.6	42.5	46.9	49.3	51.8	57.4	63.9	67.4	71.2	79.7	86.8	89.5	94.9

APPENDIX C.1 BMI (KG/M^2) FOR AGE, BOYS 0-18 YEARS (LMS, PERCENTILES, Z-SCORE CURVES)

Age	L	M	S	P1	P3	P5	P10	P25	P50	P75	P90	P95	P97	P99
0w	-0.0953	12.91	0.0980	10.3	10.8	11.0	11.4	12.1	12.9	13.8	14.6	15.2	15.5	16.3
1w	0.0732	13.60	0.0974	10.8	11.3	11.6	12.0	12.7	13.6	14.5	15.4	15.9	16.3	17.0
2w	0.1298	13.94	0.0972	11.1	11.6	11.9	12.3	13.1	13.9	14.9	15.8	16.3	16.7	17.4
3w	0.1682	14.22	0.0971	11.3	11.8	12.1	12.5	13.3	14.2	15.2	16.1	16.6	17.0	17.7
4w	0.1970	14.47	0.0969	11.5	12.0	12.3	12.8	13.5	14.5	15.4	16.4	16.9	17.3	18.0
5w	0.2197	14.69	0.0968	11.7	12.2	12.5	13.0	13.8	14.7	15.7	16.6	17.2	17.6	18.3
6w	0.2381	14.89	0.0967	11.8	12.4	12.7	13.1	13.9	14.9	15.9	16.8	17.4	17.8	18.5
7w	0.2532	15.07	0.0966	12.0	12.5	12.8	13.3	14.1	15.1	16.1	17.0	17.6	18.0	18.8
8w	0.2656	15.24	0.0966	12.1	12.7	13.0	13.4	14.3	15.2	16.3	17.2	17.8	18.2	19.0
9w	0.2760	15.41	0.0965	12.2	12.8	13.1	13.6	14.4	15.4	16.4	17.4	18.0	18.4	19.2
10w	0.2844	15.56	0.0964	12.3	12.9	13.2	13.7	14.6	15.6	16.6	17.6	18.2	18.6	19.3
12w	0.2971	15.83	0.0962	12.6	13.1	13.5	14.0	14.8	15.8	16.9	17.9	18.5	18.9	19.7
14w	0.3048	16.07	0.0961	12.8	13.3	13.7	14.2	15.1	16.1	17.1	18.1	18.8	19.2	19.9
16w	0.3087	16.28	0.0959	12.9	13.5	13.8	14.4	15.3	16.3	17.4	18.4	19.0	19.4	20.2
18w	0.3094	16.47	0.0957	13.1	13.7	14.0	14.5	15.4	16.5	17.6	18.6	19.2	19.6	20.4
20w	0.3073	16.63	0.0955	13.2	13.8	14.2	14.7	15.6	16.6	17.7	18.8	19.4	19.8	20.6
22w	0.3029	16.77	0.0953	13.3	13.9	14.3	14.8	15.7	16.8	17.9	18.9	19.5	20.0	20.8
24w	0.2963	16.90	0.0951	13.4	14.1	14.4	14.9	15.8	16.9	18.0	19.0	19.7	20.1	20.9
26w	0.2879	17.00	0.0949	13.5	14.2	14.5	15.0	15.9	17.0	18.1	19.2	19.8	20.2	21.1
28w	0.2777	17.09	0.0947	13.6	14.2	14.6	15.1	16.0	17.1	18.2	19.3	19.9	20.3	21.2
32w	0.2527	17.23	0.0942	13.8	14.4	14.7	15.2	16.2	17.2	18.4	19.4	20.1	20.5	21.3
36w	0.2224	17.32	0.0938	13.8	14.5	14.8	15.3	16.3	17.3	18.4	19.5	20.2	20.6	21.4
40w	0.1874	17.38	0.0933	13.9	14.5	14.9	15.4	16.3	17.4	18.5	19.6	20.2	20.7	21.5
44w	0.1483	17.40	0.0929	14.0	14.6	14.9	15.4	16.3	17.4	18.5	19.6	20.2	20.7	21.5
48w	0.1059	17.40	0.0924	14.0	14.6	14.9	15.4	16.3	17.4	18.5	19.6	20.2	20.7	21.5
52w	0.0604	17.38	0.0920	14.0	14.6	14.9	15.4	16.3	17.4	18.5	19.5	20.2	20.6	21.5
56w	0.0123	17.34	0.0916	14.0	14.6	14.9	15.4	16.3	17.3	18.4	19.5	20.2	20.6	21.5
60w	-0.0382	17.29	0.0912	14.0	14.6	14.9	15.4	16.3	17.3	18.4	19.4	20.1	20.5	21.4
64w	-0.0907	17.24	0.0908	14.0	14.6	14.9	15.4	16.2	17.2	18.3	19.4	20.0	20.5	21.3
1.5y	-0.2884	17.01	0.0896	13.9	14.4	14.7	15.2	16.0	17.0	18.1	19.1	19.8	20.2	21.1
2.0y	-0.6656	16.58	0.0881	13.7	14.2	14.4	14.9	15.6	16.6	17.6	18.6	19.3	19.8	20.7
2.5y	-1.0246	16.25	0.0876	13.5	14.0	14.2	14.6	15.3	16.2	17.3	18.3	19.0	19.5	20.4
3.0y	-1.3391	16.00	0.0881	13.3	13.8	14.0	14.4	15.1	16.0	17.0	18.1	18.8	19.3	20.3
3.5y	-1.5968	15.82	0.0895	13.2	13.6	13.9	14.2	14.9	15.8	16.9	18.0	18.7	19.2	20.4
4.0y	-1.7948	15.68	0.0917	13.1	13.5	13.7	14.1	14.8	15.7	16.7	17.9	18.7	19.3	20.5
4.5y	-1.9371	15.58	0.0945	13.0	13.4	13.6	14.0	14.7	15.6	16.7	17.9	18.7	19.4	20.7
5.0y	-2.0301	15.53	0.0980	12.9	13.3	13.5	13.9	14.6	15.5	16.7	18.0	18.9	19.6	21.1
5.5y	-2.0831	15.52	0.1019	12.8	13.2	13.4	13.8	14.6	15.5	16.7	18.1	19.1	19.8	21.5
6.0y	-2.1043	15.57	0.1062	12.8	13.2	13.4	13.8	14.6	15.6	16.8	18.3	19.4	20.2	22.1
6.5y	-2.1007	15.66	0.1108	12.7	13.2	13.4	13.8	14.6	15.7	17.0	18.5	19.7	20.6	22.7
7.0y	-0.2078	15.80	0.1156	12.8	13.2	13.5	13.9	14.7	15.8	17.2	18.9	20.1	21.1	23.4
7.5y	-2.0399	15.97	0.1206	12.8	13.3	13.5	14.0	14.8	16.0	17.5	19.2	20.6	21.7	24.2
8.0y	-1.9892	16.17	0.1255	12.8	13.3	13.6	14.1	15.0	16.2	17.7	19.6	21.1	22.2	25.0
8.5y	-1.9281	16.38	0.1304	12.9	13.4	13.7	14.2	15.1	16.4	18.0	20.0	21.6	22.8	25.8
9.0y	-1.8581	16.60	0.1350	13.0	13.5	13.8	14.3	15.3	16.6	18.3	20.5	22.1	23.4	26.6
9.5y	-1.7803	16.83	0.1393	13.0	13.6	13.9	14.4	15.4	16.8	18.7	20.9	22.6	23.9	27.3
10.0y	-1.6956	17.09	0.1431	13.1	13.7	14.0	14.6	15.6	17.1	19.0	21.3	23.1	24.5	27.9

Age	L	M	S	P1	P3	P5	P10	P25	P50	P75	P90	P95	P97	P99
10.5y	-1.6049	17.35	0.1465	13.2	13.8	14.2	14.7	15.8	17.4	19.3	21.7	23.5	25.0	28.4
11.0y	-1.5086	17.64	0.1494	13.3	14.0	14.3	14.9	16.1	17.6	19.7	22.1	24.0	25.4	28.9
11.5y	-1.4075	17.93	0.1517	13.5	14.1	14.5	15.1	16.3	17.9	20.0	22.5	24.4	25.8	29.2
12.0y	-1.3021	18.25	0.1535	13.6	14.3	14.7	15.3	16.6	18.2	20.4	22.9	24.8	26.2	29.5
12.5y	-1.1928	18.57	0.1549	13.8	14.5	14.9	15.5	16.8	18.6	20.8	23.3	25.2	26.6	29.7
13.0y	-1.0802	18.90	0.1557	13.9	14.7	15.1	15.8	17.1	18.9	21.1	23.7	25.5	26.9	29.9
13.5y	-0.9646	19.23	0.1562	14.1	14.8	15.3	16.0	17.4	19.2	21.5	24.0	25.8	27.2	30.1
14.0y	-0.8464	19.57	0.1563	14.3	15.1	15.5	16.3	17.7	19.6	21.9	24.4	26.2	27.4	30.2
14.5y	-0.7260	19.89	0.1561	14.4	15.2	15.7	16.5	18.0	19.9	22.2	24.7	26.4	27.7	30.3
15.0y	-0.6039	20.21	0.1557	14.6	15.4	15.9	16.7	18.3	20.2	22.5	25.0	26.7	27.9	30.4
15.5y	-0.4803	20.52	0.1550	14.7	15.6	16.1	17.0	18.5	20.5	22.8	25.3	26.9	28.1	30.5
16.0y	-0.3554	20.82	0.1541	14.9	15.8	16.3	17.2	18.8	20.8	23.1	25.6	27.2	28.3	30.5
16.5y	-0.2295	21.10	0.1530	15.0	16.0	16.5	17.4	19.1	21.1	23.4	25.8	27.3	28.4	30.6
17.0y	-0.1026	21.37	0.1517	15.1	16.1	16.7	17.6	19.3	21.4	23.7	26.0	27.5	28.5	30.6
17.5y	0.0252	21.61	0.1503	15.2	16.3	16.9	17.8	19.5	21.6	23.9	26.2	27.6	28.6	30.6
18.0y	0.1539	21.85	0.1488	15.3	16.4	17.0	18.0	19.7	21.9	24.1	26.4	27.8	28.7	30.6

Age	-3	-2.67	-2.5	-2	-1.33	-1	-0.67	0	0.67	1	1.33	2	2.5	2.67	3
0w	9.7	10.0	10.1	10.6	11.3	11.7	12.1	12.9	13.8	14.2	14.7	15.7	16.5	16.8	17.4
1w	10.1	10.5	10.6	11.2	11.9	12.3	12.7	13.6	14.5	15.0	15.5	16.5	17.3	17.6	18.2
2w	10.4	10.7	10.9	11.4	12.2	12.6	13.1	13.9	14.9	15.4	15.8	16.9	17.7	18.0	18.6
3w	10.6	10.9	11.1	11.7	12.5	12.9	13.3	14.2	15.2	15.7	16.2	17.2	18.0	18.3	18.9
4w	10.7	11.1	11.3	11.9	12.7	13.1	13.6	14.5	15.4	15.9	16.4	17.5	18.3	18.6	19.2
5w	10.9	11.3	11.5	12.1	12.9	13.3	13.8	14.7	15.7	16.2	16.7	17.8	18.6	18.9	19.5
6w	11.0	11.4	11.6	12.2	13.1	13.5	13.9	14.9	15.9	16.4	16.9	18.0	18.8	19.1	19.7
7w	11.2	11.5	11.7	12.4	13.2	13.7	14.1	15.1	16.1	16.6	17.1	18.2	19.1	19.3	19.9
8w	11.3	11.7	11.9	12.5	13.4	13.8	14.3	15.2	16.2	16.8	17.3	18.4	19.3	19.6	20.1
9w	11.4	11.8	12.0	12.6	13.5	14.0	14.4	15.4	16.4	16.9	17.5	18.6	19.5	19.8	20.4
10w	11.5	11.9	12.1	12.8	13.7	14.1	14.6	15.6	16.6	17.1	17.6	18.8	19.6	19.9	20.5
12w	11.7	12.1	12.3	13.0	13.9	14.4	14.8	15.8	16.9	17.4	17.9	19.1	20.0	20.3	20.9
14w	11.9	12.3	12.5	13.2	14.1	14.6	15.1	16.1	17.1	17.7	18.2	19.4	20.3	20.6	21.2
16w	12.0	12.5	12.7	13.4	14.3	14.8	15.3	16.3	17.3	17.9	18.4	19.6	20.5	20.8	21.4
18w	12.2	12.6	12.8	13.5	14.5	14.9	15.4	16.5	17.5	18.1	18.7	19.8	20.7	21.1	21.7
20w	12.3	12.8	13.0	13.7	14.6	15.1	15.6	16.6	17.7	18.3	18.8	20.0	20.9	21.3	21.9
22w	12.4	12.9	13.1	13.8	14.7	15.2	15.7	16.8	17.9	18.4	19.0	20.2	21.1	21.4	22.1
24w	12.5	13.0	13.2	13.9	14.9	15.3	15.8	16.9	18.0	18.6	19.1	20.3	21.3	21.6	22.2
26w	12.6	13.1	13.3	14.0	14.9	15.4	15.9	17.0	18.1	18.7	19.2	20.4	21.4	21.7	22.3
28w	12.7	13.2	13.4	14.1	15.0	15.5	16.0	17.1	18.2	18.8	19.3	20.6	21.5	21.8	22.5
32w	12.9	13.3	13.5	14.2	15.2	15.7	16.2	17.2	18.3	18.9	19.5	20.7	21.7	22.0	22.6
36w	13.0	13.4	13.6	14.3	15.3	15.8	16.3	17.3	18.4	19.0	19.6	20.8	21.8	22.1	22.8
40w	13.0	13.5	13.7	14.4	15.3	15.8	16.3	17.4	18.5	19.1	19.6	20.9	21.8	22.2	22.8
44w	13.1	13.5	13.7	14.4	15.4	15.8	16.3	17.4	18.5	19.1	19.7	20.9	21.9	22.2	22.9
48w	13.1	13.6	13.8	14.4	15.4	15.9	16.4	17.4	18.5	19.1	19.7	20.9	21.9	22.2	22.9
52w	13.2	13.6	13.8	14.4	15.4	15.8	16.3	17.4	18.5	19.1	19.6	20.9	21.8	22.2	22.9
56w	13.2	13.6	13.8	14.4	15.3	15.8	16.3	17.3	18.4	19.0	19.6	20.8	21.8	22.1	22.8
60w	13.2	13.6	13.8	14.4	15.3	15.8	16.3	17.3	18.4	18.9	19.5	20.8	21.7	22.1	22.8
64w	13.2	13.6	13.8	14.4	15.3	15.7	16.2	17.2	18.3	18.9	19.5	20.7	21.7	22.0	22.7
1.5y	13.1	13.5	13.7	14.3	15.1	15.6	16.0	17.0	18.1	18.6	19.2	20.4	21.4	21.8	22.5
2.0y	13.0	13.3	13.5	14.0	14.8	15.2	15.6	16.6	17.6	18.2	18.7	20.0	21.0	21.4	22.2
2.5y	12.9	13.2	13.3	13.8	14.6	14.9	15.3	16.2	17.3	17.8	18.4	19.7	20.8	21.2	22.1
3.0y	12.8	13.0	13.2	13.7	14.3	14.7	15.1	16.0	17.0	17.6	18.2	19.6	20.8	21.2	22.2
3.5y	12.7	12.9	13.1	13.5	14.2	14.6	14.9	15.8	16.8	17.4	18.1	19.5	20.9	21.4	22.5
4.0y	12.5	12.8	12.9	13.4	14.0	14.4	14.8	15.7	16.7	17.3	18.0	19.6	21.1	21.6	22.9
4.5y	12.4	12.7	12.8	13.3	13.9	14.3	14.7	15.6	16.7	17.3	18.0	19.7	21.4	22.0	23.5
5.0y	12.3	12.6	12.7	13.2	13.8	14.2	14.6	15.5	16.7	17.3	18.1	19.9	21.8	22.5	24.3
5.5y	12.3	12.5	12.7	13.1	13.8	14.2	14.6	15.5	16.7	17.4	18.2	20.2	22.3	23.2	25.2
6.0y	12.2	12.5	12.6	13.1	13.8	14.1	14.6	15.6	16.8	17.6	18.4	20.6	23.0	24.0	26.4
6.5y	12.2	12.4	12.6	13.1	13.8	14.2	14.6	15.7	17.0	17.8	18.7	21.1	23.7	24.9	27.7
7.0y	12.2	12.4	12.6	13.1	13.8	14.2	14.7	15.8	17.2	18.0	19.0	21.7	24.6	25.9	29.2
7.5y	12.2	12.5	12.6	13.1	13.9	14.3	14.8	16.0	17.4	18.3	19.4	22.3	25.5	27.0	30.8
8.0y	12.2	12.5	12.7	13.2	14.0	14.5	15.0	16.2	17.7	18.7	19.8	22.9	26.5	28.1	32.4
8.5y	12.2	12.6	12.7	13.3	14.1	14.6	15.1	16.4	18.0	19.0	20.2	23.5	27.4	29.2	33.9
9.0y	12.3	12.6	12.8	13.3	14.2	14.7	15.3	16.6	18.3	19.4	20.7	24.1	28.2	30.1	35.2
9.5y	12.3	12.7	12.8	13.4	14.3	14.9	15.4	16.8	18.6	19.8	21.1	24.7	29.0	30.9	36.2
10.0y	12.4	12.7	12.9	13.5	14.5	15.0	15.6	17.1	19.0	20.1	21.5	25.3	29.6	31.6	36.8
10.5y	12.4	12.8	13.0	13.6	14.6	15.2	15.8	17.4	19.3	20.5	21.9	25.8	30.1	32.1	37.2

Age	-3	-2.67	-2.5	-2	-1.33	-1	-0.67	0	0.67	1	1.33	2	2.5	2.67	3
11.0y	12.5	12.9	13.1	13.8	14.8	15.4	16.1	17.6	19.7	20.9	22.3	26.2	30.6	32.5	37.2
11.5y	12.6	13.0	13.2	13.9	15.0	15.6	16.3	17.9	20.0	21.3	22.7	26.6	30.8	32.7	37.1
12.0y	12.7	13.1	13.4	14.1	15.2	15.9	16.6	18.2	20.4	21.7	23.1	27.0	31.1	32.8	36.9
12.5y	12.8	13.3	13.5	14.3	15.4	16.1	16.8	18.6	20.7	22.0	23.5	27.3	31.2	32.8	36.5
13.0y	12.9	13.4	13.7	14.4	15.7	16.4	17.1	18.9	21.1	22.4	23.9	27.6	31.3	32.8	36.2
13.5y	13.1	13.5	13.8	14.6	15.9	16.6	17.4	19.2	21.5	22.8	24.2	27.9	31.4	32.8	35.9
14.0y	13.2	13.7	14.0	14.8	16.2	16.9	17.7	19.6	21.8	23.1	24.6	28.1	31.5	32.7	35.6
14.5y	13.3	13.8	14.1	15.0	16.4	17.2	18.0	19.9	22.2	23.5	24.9	28.3	31.5	32.7	35.3
15.0y	13.4	13.9	14.2	15.2	16.6	17.4	18.3	20.2	22.5	23.8	25.2	28.5	31.5	32.6	35.0
15.5y	13.5	14.1	14.4	15.4	16.9	17.7	18.5	20.5	22.8	24.1	25.5	28.7	31.5	32.5	34.7
16.0y	13.6	14.2	14.5	15.5	17.1	17.9	18.8	20.8	23.1	24.4	25.8	28.9	31.5	32.5	34.5
16.5y	13.6	14.3	14.6	15.7	17.3	18.2	19.1	21.1	23.4	24.7	26.0	29.0	31.5	32.4	34.3
17.0y	13.7	14.4	14.7	15.8	17.5	18.4	19.3	21.4	23.7	24.9	26.2	29.1	31.5	32.3	34.1
17.5y	13.7	14.4	14.8	16.0	17.7	18.6	19.5	21.6	23.9	25.1	26.4	29.2	31.4	32.2	33.8
18.0y	13.8	14.5	14.9	16.1	17.9	18.8	19.8	21.9	24.1	25.3	26.6	29.2	31.4	32.1	33.6

APPENDIX C.2 BMI (KG/M^2) FOR AGE, GIRLS 0-18 YEARS (LMS, PERCENTILES, Z-SCORE CURVES)

Age	L	M	S	P1	P3	P5	P10	P25	P50	P75	P90	P95	P97	P99
0w	0.6181	12.68	0.0950	10.0	10.5	10.8	11.2	11.9	12.7	13.5	14.3	14.7	15.0	15.6
1w	0.7596	13.14	0.0962	10.3	10.8	11.1	11.5	12.3	13.1	14.0	14.8	15.3	15.6	16.2
2w	0.7967	13.40	0.0965	10.5	11.0	11.3	11.8	12.5	13.4	14.3	15.1	15.6	15.9	16.5
3w	0.8169	13.63	0.0967	10.6	11.2	11.5	12.0	12.7	13.6	14.5	15.3	15.8	16.1	16.8
4w	0.8281	13.84	0.0967	10.8	11.4	11.7	12.1	12.9	13.8	14.7	15.6	16.1	16.4	17.0
5w	0.8337	14.04	0.0968	10.9	11.5	11.8	12.3	13.1	14.0	15.0	15.8	16.3	16.6	17.3
6w	0.8353	14.22	0.0967	11.1	11.7	12.0	12.5	13.3	14.2	15.2	16.0	16.5	16.8	17.5
7w	0.8339	14.39	0.0967	11.2	11.8	12.1	12.6	13.5	14.4	15.3	16.2	16.7	17.0	17.7
8w	0.8301	14.55	0.0966	11.3	11.9	12.3	12.8	13.6	14.6	15.5	16.4	16.9	17.2	17.9
9w	0.8244	14.70	0.0965	11.5	12.1	12.4	12.9	13.7	14.7	15.7	16.5	17.1	17.4	18.1
10w	0.8170	14.85	0.0964	11.6	12.2	12.5	13.0	13.9	14.8	15.8	16.7	17.2	17.6	18.2
12w	0.7984	15.12	0.0962	11.8	12.4	12.8	13.3	14.1	15.1	16.1	17.0	17.5	17.9	18.6
14w	0.7757	15.36	0.0959	12.0	12.6	13.0	13.5	14.4	15.4	16.4	17.3	17.8	18.2	18.9
16w	0.7498	15.58	0.0956	12.2	12.8	13.2	13.7	14.6	15.6	16.6	17.5	18.1	18.4	19.1
18w	0.7214	15.78	0.0953	12.4	13.0	13.4	13.9	14.8	15.8	16.8	17.7	18.3	18.7	19.4
20w	0.6909	15.95	0.0950	12.6	13.2	13.5	14.0	14.9	15.9	17.0	17.9	18.5	18.9	19.6
22w	0.6588	16.11	0.0946	12.7	13.3	13.7	14.2	15.1	16.1	17.1	18.1	18.7	19.1	19.8
24w	0.6252	16.24	0.0943	12.8	13.5	13.8	14.3	15.2	16.2	17.3	18.2	18.8	19.2	19.9
26w	0.5906	16.36	0.0939	12.9	13.6	13.9	14.4	15.3	16.4	17.4	18.4	19.0	19.4	20.1
28w	0.5550	16.47	0.0936	13.1	13.7	14.0	14.5	15.4	16.5	17.5	18.5	19.1	19.5	20.2
32w	0.4819	16.64	0.0929	13.2	13.9	14.2	14.7	15.6	16.6	17.7	18.7	19.3	19.7	20.4
36w	0.4068	16.76	0.0922	13.4	14.0	14.3	14.8	15.7	16.8	17.8	18.8	19.4	19.8	20.6
40w	0.3306	16.85	0.0916	13.5	14.1	14.4	14.9	15.8	16.9	17.9	18.9	19.5	19.9	20.7
44w	0.2540	16.91	0.0910	13.6	14.2	14.5	15.0	15.9	16.9	18.0	19.0	19.6	20.0	20.8
48w	0.1778	16.94	0.0905	13.7	14.3	14.6	15.1	15.9	16.9	18.0	19.0	19.6	20.0	20.8
52w	0.1021	16.95	0.0900	13.7	14.3	14.6	15.1	15.9	16.9	18.0	19.0	19.6	20.0	20.9
56w	0.0277	16.94	0.0896	13.7	14.3	14.6	15.1	15.9	16.9	18.0	19.0	19.6	20.0	20.9
60w	-0.0455	16.92	0.0892	13.8	14.3	14.6	15.1	15.9	16.9	18.0	19.0	19.6	20.0	20.8
64w	-0.1170	16.89	0.0888	13.8	14.3	14.6	15.1	15.9	16.9	17.9	18.9	19.6	20.0	20.8
1.5y	-0.3556	16.73	0.0878	13.7	14.2	14.5	15.0	15.8	16.7	17.8	18.8	19.4	19.8	20.7
2.0y	-0.7142	16.36	0.0873	13.5	14.0	14.3	14.7	15.4	16.4	17.4	18.4	19.0	19.5	20.4
2.5y	-0.9718	16.04	0.0881	13.3	13.8	14.0	14.4	15.1	16.0	17.1	18.1	18.8	19.2	20.2
3.0y	-1.1453	15.79	0.0898	13.1	13.5	13.8	14.2	14.9	15.8	16.8	17.9	18.6	19.1	20.0
3.5y	-1.2558	15.61	0.0923	12.9	13.3	13.6	14.0	14.7	15.6	16.7	17.7	18.5	19.0	20.1
4.0y	-1.3222	15.49	0.0956	12.7	13.2	13.4	13.8	14.6	15.5	16.6	17.7	18.5	19.0	20.2
4.5y	-1.3582	15.42	0.0993	12.6	13.1	13.3	13.7	14.5	15.4	16.5	17.7	18.5	19.1	20.3
5.0y	-1.3735	15.39	0.1035	12.5	13.0	13.2	13.6	14.4	15.4	16.6	17.8	18.7	19.3	20.6
5.5y	-1.3745	15.41	0.1080	12.4	12.9	13.1	13.6	14.4	15.4	16.6	18.0	18.9	19.6	21.0
6.0y	-1.3652	15.48	0.1127	12.4	12.8	13.1	13.6	14.4	15.5	16.8	18.2	19.2	19.9	21.4
6.5y	-1.3479	15.60	0.1175	12.4	12.9	13.1	13.6	14.5	15.6	17.0	18.5	19.5	20.3	21.9
7.0y	-1.3244	15.75	0.1221	12.4	12.9	13.2	13.7	14.6	15.8	17.2	18.8	19.9	20.7	22.5
7.5y	-1.2964	15.94	0.1266	12.4	13.0	13.3	13.8	14.7	15.9	17.4	19.1	20.3	21.2	23.1
8.0y	-1.2652	16.15	0.1307	12.5	13.0	13.4	13.9	14.9	16.1	17.7	19.5	20.8	21.7	23.7
8.5y	-1.2324	16.38	0.1345	12.6	13.1	13.5	14.0	15.0	16.4	18.0	19.9	21.2	22.2	24.3
9.0y	-1.1995	16.64	0.1378	12.7	13.3	13.6	14.2	15.2	16.6	18.4	20.3	21.7	22.7	24.9
9.5y	-1.1677	16.91	0.1406	12.8	13.4	13.8	14.4	15.5	16.9	18.7	20.7	22.1	23.2	25.5
10.0y	-1.1381	17.20	0.1428	13.0	13.6	14.0	14.6	15.7	17.2	19.0	21.1	22.6	23.7	26.1

Age	L	M	S	P1	P3	P5	P10	P25	P50	P75	P90	P95	P97	P99
10.5y	-1.1116	17.50	0.1446	13.2	13.8	14.2	14.8	16.0	17.5	19.4	21.5	23.1	24.2	26.7
11.0y	-1.0889	17.82	0.1458	13.4	14.0	14.4	15.0	16.2	17.8	19.8	22.0	23.5	24.7	27.2
11.5y	-1.0706	18.14	0.1464	13.6	14.2	14.6	15.3	16.5	18.1	20.1	22.4	24.0	25.1	27.7
12.0y	-1.0573	18.47	0.1466	13.8	14.5	14.9	15.6	16.8	18.5	20.5	22.8	24.4	25.6	28.2
12.5y	-1.0493	18.79	0.1464	14.0	14.8	15.2	15.8	17.1	18.8	20.9	23.2	24.8	26.0	28.6
13.0y	-0.1047	19.11	0.1458	14.3	15.0	15.4	16.1	17.4	19.1	21.2	23.5	25.2	26.4	29.1
13.5y	-1.0506	19.42	0.1448	14.6	15.3	15.7	16.4	17.7	19.4	21.5	23.9	25.5	26.8	29.4
14.0y	-1.0603	19.70	0.1436	14.8	15.5	16.0	16.7	18.0	19.7	21.8	24.2	25.9	27.1	29.8
14.5y	-1.0762	19.97	0.1421	15.1	15.8	16.2	16.9	18.2	20.0	22.1	24.5	26.1	27.4	30.0
15.0y	-1.0984	20.21	0.1404	15.3	16.0	16.4	17.1	18.5	20.2	22.3	24.7	26.4	27.6	30.3
15.5y	-1.1269	20.43	0.1386	15.5	16.3	16.7	17.4	18.7	20.4	22.6	24.9	26.6	27.8	30.5
16.0y	-1.1616	20.63	0.1367	15.7	16.5	16.9	17.6	18.9	20.6	22.7	25.1	26.8	28.0	30.7
16.5y	-1.2025	20.79	0.1347	15.9	16.7	17.1	17.8	19.1	20.8	22.9	25.2	26.9	28.1	30.8
17.0y	-1.2494	20.93	0.1327	16.1	16.8	17.3	17.9	19.2	20.9	23.0	25.3	27.0	28.2	30.9
17.5y	-1.3021	21.05	0.1305	16.3	17.0	17.4	18.1	19.4	21.1	23.1	25.4	27.1	28.3	31.0
18.0y	-1.3603	21.14	0.1284	16.5	17.2	17.6	18.2	19.5	21.1	23.2	25.5	27.1	28.3	31.0

Age	-3	-2.67	-2.5	-2	-1.33	-1	-0.67	0	0.67	1	1.33	2	2.5	2.67	3
0w	9.3	9.6	9.8	10.4	11.1	11.5	11.9	12.7	13.5	13.9	14.3	15.2	15.8	16.0	16.5
1w	9.5	9.9	10.1	10.7	11.5	11.9	12.3	13.1	14.0	14.4	14.8	15.7	16.4	16.6	17.1
2w	9.6	10.0	10.2	10.9	11.7	12.1	12.5	13.4	14.3	14.7	15.1	16.0	16.7	16.9	17.4
3w	9.8	10.2	10.4	11.0	11.9	12.3	12.8	13.6	14.5	15.0	15.4	16.3	17.0	17.2	17.7
4w	9.9	10.3	10.6	11.2	12.1	12.5	12.9	13.8	14.7	15.2	15.6	16.6	17.3	17.5	18.0
5w	10.1	10.5	10.7	11.4	12.3	12.7	13.1	14.0	15.0	15.4	15.9	16.8	17.5	17.7	18.2
6w	10.2	10.6	10.9	11.5	12.4	12.9	13.3	14.2	15.1	15.6	16.1	17.0	17.7	18.0	18.4
7w	10.3	10.8	11.0	11.7	12.6	13.0	13.5	14.4	15.3	15.8	16.3	17.2	17.9	18.2	18.7
8w	10.4	10.9	11.1	11.8	12.7	13.2	13.6	14.6	15.5	16.0	16.4	17.4	18.1	18.4	18.9
9w	10.6	11.0	11.2	11.9	12.8	13.3	13.8	14.7	15.7	16.1	16.6	17.6	18.3	18.6	19.1
10w	10.7	11.1	11.4	12.0	13.0	13.4	13.9	14.8	15.8	16.3	16.8	17.8	18.5	18.8	19.3
12w	10.9	11.3	11.6	12.3	13.2	13.7	14.2	15.1	16.1	16.6	17.1	18.1	18.8	19.1	19.6
14w	11.1	11.5	11.8	12.5	13.4	13.9	14.4	15.4	16.4	16.8	17.3	18.4	19.1	19.4	19.9
16w	11.3	11.7	12.0	12.7	13.6	14.1	14.6	15.6	16.6	17.1	17.6	18.6	19.4	19.7	20.2
18w	11.5	11.9	12.2	12.9	13.8	14.3	14.8	15.8	16.8	17.3	17.8	18.9	19.7	19.9	20.5
20w	11.6	12.1	12.3	13.0	14.0	14.5	14.9	15.9	17.0	17.5	18.0	19.1	19.9	20.1	20.7
22w	11.8	12.2	12.5	13.2	14.1	14.6	15.1	16.1	17.1	17.7	18.2	19.3	20.1	20.4	20.9
24w	11.9	12.3	12.6	13.3	14.3	14.7	15.2	16.2	17.3	17.8	18.3	19.4	20.2	20.5	21.1
26w	12.0	12.5	12.7	13.4	14.4	14.9	15.3	16.4	17.4	17.9	18.5	19.6	20.4	20.7	21.2
28w	12.1	12.6	12.8	13.5	14.5	15.0	15.5	16.5	17.5	18.0	18.6	19.7	20.5	20.8	21.4
32w	12.3	12.8	13.0	13.7	14.7	15.1	15.6	16.6	17.7	18.2	18.8	19.9	20.7	21.0	21.6
36w	12.5	12.9	13.2	13.8	14.8	15.3	15.7	16.8	17.8	18.3	18.9	20.0	20.9	21.2	21.8
40w	12.6	13.1	13.3	13.9	14.9	15.4	15.8	16.9	17.9	18.4	19.0	20.1	21.0	21.3	21.9
44w	12.7	13.2	13.4	14.0	15.0	15.4	15.9	16.9	18.0	18.5	19.1	20.2	21.1	21.4	22.0
48w	12.8	13.2	13.4	14.1	15.0	15.5	15.9	16.9	18.0	18.5	19.1	20.2	21.1	21.5	22.1
52w	12.9	13.3	13.5	14.1	15.0	15.5	16.0	16.9	18.0	18.5	19.1	20.3	21.2	21.5	22.1
56w	12.9	13.3	13.5	14.2	15.0	15.5	16.0	16.9	18.0	18.5	19.1	20.3	21.2	21.5	22.1
60w	13.0	13.4	13.6	14.2	15.0	15.5	15.9	16.9	18.0	18.5	19.1	20.2	21.2	21.5	22.1
64w	13.0	13.4	13.6	14.2	15.0	15.5	15.9	16.9	17.9	18.5	19.0	20.2	21.1	21.5	22.1
1.5y	13.0	13.4	13.5	14.1	14.9	15.3	15.8	16.7	17.8	18.3	18.9	20.1	21.0	21.4	22.1
2.0y	12.9	13.2	13.4	13.9	14.6	15.0	15.4	16.4	17.4	17.9	18.5	19.7	20.7	21.1	21.9
2.5y	12.7	13.0	13.1	13.6	14.4	14.7	15.1	16.0	17.0	17.6	18.2	19.5	20.5	20.9	21.8
3.0y	12.5	12.8	12.9	13.4	14.1	14.5	14.9	15.8	16.8	17.4	18.0	19.3	20.5	20.9	21.8
3.5y	12.3	12.6	12.7	13.2	13.9	14.3	14.7	15.6	16.6	17.2	17.8	19.3	20.5	21.0	21.9
4.0y	12.1	12.4	12.6	13.1	13.8	14.2	14.6	15.5	16.6	17.2	17.8	19.3	20.6	21.1	22.2
4.5y	12.0	12.3	12.4	12.9	13.7	14.0	14.5	15.4	16.5	17.2	17.8	19.4	20.9	21.4	22.6
5.0y	11.9	12.2	12.3	12.8	13.6	14.0	14.4	15.4	16.6	17.2	17.9	19.6	21.2	21.8	23.1
5.5y	11.8	12.1	12.2	12.8	13.5	13.9	14.4	15.4	16.6	17.3	18.1	19.9	21.6	22.3	23.7
6.0y	11.7	12.0	12.2	12.7	13.5	13.9	14.4	15.5	16.8	17.5	18.3	20.3	22.1	22.8	24.4
6.5y	11.7	12.0	12.2	12.7	13.5	14.0	14.5	15.6	17.0	17.7	18.6	20.7	22.7	23.5	25.2
7.0y	11.7	12.0	12.2	12.7	13.6	14.1	14.6	15.8	17.2	18.0	18.9	21.2	23.3	24.1	26.0
7.5y	11.7	12.0	12.2	12.8	13.7	14.2	14.7	15.9	17.4	18.3	19.3	21.7	24.0	24.9	26.9
8.0y	11.7	12.1	12.3	12.9	13.8	14.3	14.9	16.1	17.7	18.6	19.7	22.2	24.6	25.6	27.8
8.5y	11.8	12.2	12.4	13.0	13.9	14.5	15.0	16.4	18.0	19.0	20.0	22.7	25.3	26.3	28.6
9.0y	11.9	12.3	12.5	13.1	14.1	14.6	15.2	16.6	18.4	19.3	20.5	23.2	25.9	27.0	29.4
9.5y	12.0	12.4	12.6	13.3	14.3	14.8	15.5	16.9	18.7	19.7	20.9	23.8	26.6	27.7	30.2
10.0y	12.1	12.5	12.7	13.4	14.5	15.1	15.7	17.2	19.0	20.1	21.3	24.3	27.2	28.4	31.0
10.5y	12.3	12.7	12.9	13.6	14.7	15.3	16.0	17.5	19.4	20.5	21.7	24.8	27.8	29.0	31.6

Age	-3	-2.67	-2.5	-2	-1.33	-1	-0.67	0	0.67	1	1.33	2	2.5	2.67	3
11.0y	12.5	12.9	13.1	13.8	14.9	15.6	16.2	17.8	19.8	20.9	22.2	25.3	28.3	29.6	32.3
11.5y	12.7	13.1	13.3	14.1	15.2	15.8	16.5	18.1	20.1	21.3	22.6	25.8	28.9	30.1	32.8
12.0y	12.9	13.3	13.5	14.3	15.5	16.1	16.8	18.5	20.5	21.7	23.0	26.2	29.4	30.6	33.4
12.5y	13.1	13.5	13.8	14.6	15.7	16.4	17.1	18.8	20.8	22.0	23.4	26.7	29.8	31.1	33.9
13.0y	13.3	13.8	14.0	14.8	16.0	16.7	17.4	19.1	21.2	22.4	23.7	27.1	30.2	31.5	34.3
13.5y	13.6	14.0	14.3	15.1	16.3	17.0	17.7	19.4	21.5	22.7	24.1	27.4	30.6	31.9	34.7
14.0y	13.8	14.3	14.5	15.3	16.6	17.2	18.0	19.7	21.8	23.0	24.4	27.7	30.9	32.2	35.0
14.5y	14.1	14.5	14.8	15.6	16.8	17.5	18.2	20.0	22.1	23.3	24.7	28.0	31.2	32.5	35.3
15.0y	14.3	14.8	15.0	15.8	17.1	17.7	18.5	20.2	22.3	23.5	24.9	28.3	31.5	32.8	35.6
15.5y	14.5	15.0	15.2	16.1	17.3	18.0	18.7	20.4	22.5	23.8	25.1	28.5	31.7	33.0	35.8
16.0y	14.8	15.2	15.5	16.3	17.5	18.2	18.9	20.6	22.7	23.9	25.3	28.7	31.9	33.2	36.0
16.5y	15.0	15.4	15.7	16.5	17.7	18.4	19.1	20.8	22.9	24.1	25.4	28.8	32.0	33.3	36.2
17.0y	15.2	15.6	15.9	16.6	17.8	18.5	19.2	20.9	23.0	24.2	25.5	28.9	32.1	33.4	36.3
17.5y	15.3	15.8	16.0	16.8	18.0	18.7	19.4	21.1	23.1	24.3	25.6	29.0	32.2	33.5	36.4
18.0y	15.5	16.0	16.2	17.0	18.1	18.8	19.5	21.1	23.2	24.3	25.7	29.0	32.2	33.5	36.5

APPENDIX D.1 QUALITY ASSESSMENT OF HEIGHT, WEIGHT AND BMI DATA

Source	Code	Year of measurement	Sample size	Study design	Sampling method	Representative	Used as country representative	Measurement quality
11	BE	2002-2004	15,989	cross sectional	cluster sampling, stratified	country	yes	ME
12	BG	unknown	unknown	unknown	unknown	unknown	yes	unknown
13	CY	1999-2000	2,472	cross sectional	cluster sampling, stratified	country	yes	ME
14	CZ	2001-2002	59,000	cross sectional	cluster sampling	country	yes	ME
15	DE	2003-2006	17,641	cross sectional	multistage sampling	country	yes	ME
16	DE	1985-1999	34,422	cross sectional	mixed	17 areas throughout the country	yes	ME
17	DE	2003-2006	17,641	cross sectional	multistage sampling	country	yes	ME
18	DK	1995-2003	4,105	longitudinal	simple random sampling	country	yes	ME, recorded by parents
19	EE	1998	unknown	cross sectional	unknown	unknown	yes	ME
20	ES	1999-2008 (born 1999-2002)	32,064	cross sectional	unknown	4 regions	yes	ME
21	FI	2003-2009 (born 1983-2008)	73,659	mixed	all recorded auxology data in measurement period	Espoo (large city)	yes	ME
22	FR	1984-2003 (born 1984-1985)	278 (78 at age 18y)	longitudinal	convenience sampling at two health centers	Paris (large city)	yes	ME, except age 12 and 18y: self-reported
23	GR	Unknown	unknown	unknown	unknown	unknown	yes	unknown
24	HU	1979-2000 (born 1979-1982)	5,685 (1,039 at age 18y)	longitudinal	multistage sampling with group selection	country	yes	ME
25	IT	1996-2004	69,917	cross sectional	mutlistage sampling, stratified	country	yes	ME
26	LT	2000-2002	31,429	cross sectional	unknown	5 biggest cities and surrounding settlements	yes	ME
27	NL	2008-2009	10,129	cross sectional	multistage sampling, stratified	Country	yes	ME
28	PL	2007-2009	17,573	cross sectional	multistage sampling, stratified	country	yes	ME
29	SE	1973-1992 (born 1973-1975)	3,650	retrospective cohort study (longitudinal)	all children in final grade in 1992 in Göteborg	Göteborg (large city)	yes	ME

Source	Code	Year of measurement	Sample size	Study design	Sampling method	Representative	Used as country representative	Measurement quality
30	SE	1973-1992 (born 1973-1975)	3,650	retrospective cohort study (longitudinal)	all children in final grade in 1992 in Göteborg	Göteborg (large city)	yes	ME
31	SK	2001	36,203	cross sectional	multistage sampling	country	yes	ME
32	UK	1972-1990	37,700	mixed (17 studies, both cros sectional and longitudinal)	mixed	country	yes	ME (?)

APPENDIX D.2 QUALITY ASSESSMENT OF MENARCHE DATA

Source	Code	Year of measurement	Sample size	Study design	Sampling method	Representative	Used as country representative	Measurement quality	Estimate
11	BE	2002-2004	4,471	cross sectional	cluster sampling, stratified	Flemish part of country	yes	status quo	median
27	NL	1996-1997	3,028	cross sectional	multistage sampling, stratified	country	yes	status quo	median
33	BG	1994-2000	93	longitudinal	cluster sampling	Sofia	unknown	unknown	mean
34	CZ	2001	59,000 (boys and girls aged 0-19 y)	cross sectional	unknown	country	country	unknown	mean
35	DE	2003-2006	3,776	cross sectional	multistage sampling	country	yes	status quo method	median
36	DK	1991-2008	2,095	mixed (cross sectional and longitudinal)	cluster sampling	Copenhagen area	yes	status quo method	median
37	EE	2004-2005	580	cross sectional	convenience sampling	Tartu	unknown	status quo method	mean
38	ES	1980-2000 (born 1980-1982)	120	longitudinal	unknown	unknown	yes	unknown	mean
38	FI	unknown (published in 1993)	unknown	unknown	unknown	unknown	unknown	unknown	mean
39	FR	1994	2,834	cross sectional	post stratification sampling	18 Departments of France	yes	recall method	median
40	GR	2006	750	cross sectional	convenience sampling	6 senior high schools in Greater Athens area	unknown	self reported	mean
41	HU	between 1980-1992	unknown	cross sectional	unknown	Kaposvár, Fejér,	unknown	status quo	median

42	IE	2006	4,720	cross sectional	random sampling	Country	yes	recall method	mean
43	IT	between 2000-2008	3,783	cross sectional	multistage sampling, stratified	13 cities Northern Italy	no	self reported	median
44	LT	between 2000-2005	1,231	cross sectional	multi stage sampling	2 regions in country	yes	status quo	mean
45	PL	2000	2,426	cross sectional	cluster sampling, stratified	Eastern regions of Poland	no	status quo	mean
46	PT	1995-2001	3,366	cross sectional	simple random sampling	University of Coimbra	no	recall method	mean
47	SE	1990	unknown	unknown	unknown	unknown	unknown	unknown	median
48	UK	1991-2005 (born 1991-1992)	4,462	longitudinal	prospective cohort of 14,000 pregnant women	Southern England, but representative for Great Britain	yes	status quo	median

APPENDIX D.3 QUALITY ASSESSMENT OF DATA ON TANNER STAGES IN BOYS

Source	Code	Year of measurement	Sample size	Study design	Sampling method	Representative	Used as country representative	Measurement quality	Estimate
11	BE	2002-2004	4,219	cross sectional	cluster sampling, stratified	Flemish part of country	yes	ME	median
27	NL	1996-1997	2,524	cross sectional	multi stage sampling, stratified	country	yes	ME	median
35	DE	2003-2006	3,932	cross sectional	multistage sampling	country	yes	self-assessed based on drawings of Tanner's stages	median
38	ES	1980-2000 (born 1980-1982)	127	longitudinal, from birth to adult height	unknown	unknown	yes	ME	mean
59	IT	1991-1994	535	cross sectional	cluster sampling	Province of L'Aquila	yes	ME	median
45	PL	2000	3,602	cross sectional	cluster sampling. Stratified	Eastern regions of Poland		ME	mean
60	UK	1991-2005 (born 1991-1992)	4165	longitudinal	prospective cohort of 14,000 pregnant women	Southern England, but representative for Great Britain	Southern England, but representative for Great Britain	self-assessed based on drawings of Tanner's stages	median
49	DK	2006-2008	704	mixed (cross sectional and longitudinal)	cluster sampling	Copenhagen	unknown	ME	mean
50	HU	1991	unknown	unknown	unknown	Székesfehérvár	unknown	unknown	median

APPENDIX D.4 QUALITY ASSESSMENT OF DATA ON TESTICULAR VOLUME

Source	Code	Year of measurement	Sample size	Study design	Sampling method	Representative	Used as country representative	Measurement quality	Estimate
11	BE	2002-2004	4,219	cross sectional	cluster sampling, stratified	Flemish part of country	yes	ME	Prader Orchido-meter (ml)
49	DK	2006-2008	704	mixed (cross sectional and longitudinal)	cluster sampling	Copenhagen	unknown	ME	Prader Orchido-meter (ml)
51	NL	1996 - 1997	2,524	cross sectional	multistage sampling	country	yes	ME	Prader Orchido-meter (ml)

APPENDIX D.5 QUALITY ASSESSMENT OF DATA ON TANNER STAGES IN GIRLS

Source	Code	Year of measurement	Sample size	Study design	Sampling method	Representative	Used as country representative	Measurement quality	Estimate
11	BE	2002-2004	4,219	cross sectional	cluster sampling, stratified	Flemish part of country	yes	ME	median
35	DE	2003-2006	3,739	cross sectional	multistage sampling	country	yes	self assessed based on drawings of Tanner's stages	median
36	DK	1991-2008	2,095	mixed (cross sectional and longitudinal)	cluster sampling	Copenhagen area	yes	ME	mean
38	ES	1980-2000 (born 1980-1982)	120	unknown	unknown	unknown	yes	ME	mean
40	GR	2006	750	cross sectional	convenience sampling	6 senior high schools in Greater Athens area	unknown	self reported	mean
44	LT	unknown (between 2000-2005)	1,231	cross sectional	multistage sampling	2 regions	yes	ME	mean
45	PL	2000	3,722	cross sectional	cluster sampling, stratified	Eastern regions of Poland		ME	mean
48	UK	1991-2005 (born 1991-1992)	4,462	Longitudinal	prospective cohort of 14,000 pregnant women	Southern England, but representative for Great Britain	yes	self assessed based on drawings and descriptions of Tanner's stages	median
50	HU	1991	unknown	Unknown	unknown	Székesfehérvár	unknown	unknown	median
51	NL	1996-1997	2,266	cross sectional	multistage sampling, stratified	country	yes	ME	median
55	IT	1991-1994	399	cross sectional	unknown	Province of L'Aquila	no	ME	median

ME = medical examination

Glossary / Abbreviations

B1-B5	Tanner breast development stages (girls)
BMI	Body mass index (kg/m^2)
DRV	Dietary Reference Value
EFSA	European Food Safety Authority
EU	European Union
G1-G5	Tanner genital stages (boys)
GAMLSS	Generalized additive model for location, shape and skewness
L	Lambda in LMS model, skewness parameter
LMS	Model by Cole and Green (1992) that accounts for skewness
M	Median (=P50)
ME	Medical examination
NDA	EFSA Panel on Dietetic Products, Nutrition and Allergies
PH1-PH5	Tanner pubic hair stages (boys and girls)
P1-P99	Percentiles 1-99
SCF	Scientific Committee on Food
S	Sigma in LMS model, coefficient of variation
SD	Standard deviation
T1-T25	Testicular volume (1-25 ml)
TNO	Netherlands Organisation for Applied Scientific Research TNO
w	week