Department of Health & Children
AN ROINN SLÁINTE AGUS LEANAÍ

Childhood Obesity Surveillance Initiative

Ireland

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Childhood Obesity Surveillance Initiative **Ireland**

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Foreword

I very much welcome the publication of this research, undertaken as part of the World Health Organization's European Childhood Obesity Surveillance Initiative. Childhood obesity is of particular concern. While reflective of what is happening across the wider population, it is particularly worrying as childhood obesity leads to a wide range of serious health and social problems and reduces the average age at which lifestyle related diseases become apparent. In order to effectively address the problem, it is first essential that its prevalence be ascertained.

The research, carried out by the National Nutrition Surveillance Centre in 2008, was commissioned by the Department of Health and Children and the Health Service Executive and revealed high levels of overweight and obesity in primary school children. It found that 23% of 7 year olds are either overweight or obese. It also found differing rates among girls and boys, with 27% of girls overweight or obese, compared with 18% of boys.

Lifestyles and health are intrinsically linked. Healthy lifestyles are established at an early age and healthy habits formed in childhood can be of benefit in later life. There is now good evidence to show that healthy lifestyles start prior to conception, with factors such as maternal diet and lifestyle, or indeed the choice to breastfeed having a bearing on one's health. The importance of the early life period on future health has been clearly demonstrated. Establishing healthy eating patterns is one of the best ways of enabling children to attain their optimum growth and health potential. Healthy eating also allows children to take full advantage of the opportunity to learn and play during the school day.

Just like a balance sheet with its debits and credits, physical activity has to be factored into the energy equation. In June 2009 I launched National Guidelines on Physical Activity. These were developed by a steering group lead by this Department and the Health Service Executive. The Guidelines emphasise the importance of physical activity to overall health and well-being and give clear information on the recommended levels of physical activity for different sectors of the population. The guidelines recommend that all children and young people should be active, at a moderate to vigorous level, for at least 60 minutes every day.

We need to take a more holistic approach to promoting, maintaining and improving health. While health professionals have a key role to play, the involvement of many sectors outside the traditional health sector are required in order to establish environments that encourage and facilitate healthy lifestyle choices.

Small changes in lifestyle behaviours can positively influence levels of overweight and obesity. With proper information, encouragement and support, people can control many of the factors that influence their own and their children's lifestyle and learn to take greater personal responsibility for their family's health and well-being. I am confident that by working together we can make a difference.

Áine Brady

Áine Brady, TD
Minister for Older People and Health Promotion.

Contents

Executive Summary

'The childhood obesity surveillance initiative will be an ongoing, systematic process of collection, analysis, interpretation and dissemination of descriptive information for monitoring obesity in the WHO European Region and for use in programme planning and evaluation' [1].

The initiative in Ireland aims to measure trends in overweight and obesity in children aged 7.0-7.9 years in order to have a correct understanding of the progress of the epidemic but also allowing inter-country comparisons within the WHO European Region. The implementation of a simple, effective and sustainable surveillance initiative will be important to tackle and monitor the obesity epidemic in children, reduce the incidence of childhood obesity, identify groups at risk and evaluate the impact of obesity preventive interventions. The core objective was to measure in primary school children aged 7.0-7.9 years: Weight, height and waist circumference and to examine prevalence of normal weight, overweight, obesity and mean BMI.

The measurements were carried out over as short a period as possible and were not collected during the first two weeks of a new school term or immediately after a major holiday. In this case, measurements commenced two weeks after the Easter break on the 10th April 2008 and continued until the 26th June 2008 (11 week period). Each consenting child had height, weight and waist circumference measured. Height was recorded to the last 0.1cm, weight recorded to the last 0.1kg and waist circumference to the last mm. Training in standardised measurement techniques and standard equipment was provided to 30 nutritionists who carried out the fieldwork.

BMI scores were compared with the International Obesity Taskforce (IOTF) cut off points. Other information on the school was also collected.

Key Findings

■■ Two thousand four hundred and twenty (7 years old) children had their height, weight and waist circumference measurements recorded (1152 boys and 1268 girls). In total 595 children were measured in 60 small schools and 1825 children were measured in 103 large schools. Seventy two percent of available children on the day of study consented to take part.

■■ There was no significant difference between all boys and girls for weight or waist measurements . However, there was a significant difference between girls and boys for height and BMI.

■■ There was no significant difference between children in the large versus small schools for any of the measurements including height, weight, waist circumference or BMI. There was also no difference observed between boys from the small schools versus large schools or between girls from small schools versus large schools for any of the measurements.

■■ HSE regions were divided into West, South, Dublin North-East and Dublin Mid-Leinster. There was no significant difference between heights, weights or BMI for all children between regions although there was a significant difference between waist circumference measurements.

■■ Twenty three disadvantaged schools participated in the study. There was no significant difference between height, weight, waist circumference or BMI for the children from these schools compared with other schools.

■■ This report demonstrates high levels of overweight and obesity in 7 year old children. When categorised by the IOTF standards, 73% of girls and 82% of boys were of normal BMI while 19% of girls and 13% of boys were overweight and 8% of girls and 5% of boys were obese. These gender differences were not significant for obese children but were significantly different for overweight.

In 2002, the North South Survey established baseline data on the prevalence of overweight and obesity among 4 to 16 year olds.
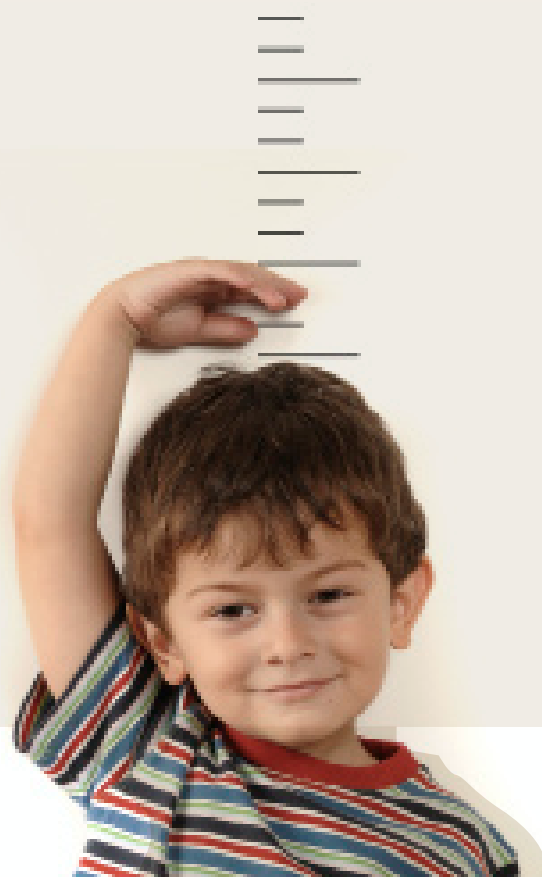
Introduction

BACKGROUND

Obesity in children is an important health problem, accelerating throughout the world and with particularly alarming trends in Europe [2, 3]. It causes a wide range of serious health and social consequences and increases the likelihood of adult morbidity such as dyslipidaemia, hyperinsulinimia, hypertension and early atherosclerosis as well as mortality in adulthood [4, 5]. The health consequences of overweight for children during childhood are less clear, but a systematic review shows that childhood obesity is strongly associated with risk factors for cardiovascular disease (CVD) and diabetes, orthopaedic problems and mental disorders [6]. Moreover, childhood obesity is linked to underachievement in school and to lower self-esteem [7]. Over 60% of children who are overweight before puberty will be overweight in early adulthood, reducing the average age at which non-communicable diseases become apparent and greatly increasing the burden on health services, which have to provide treatment during much of their adult life. The World Health Organization estimates that worldwide about 22 million children under 5 years of age are overweight [2].

In 2002, the North South Survey established baseline data on the prevalence of overweight and obesity among 4 to 16 year olds. The prevalence of overweight and obesity in boys was 23% and in girls it was 28% [8]. The National Children's Food Survey conducted between 2003 and 2004 reported that the prevalence of obesity in boys ranged from 4.1 to 11.2% and in girls from 9.3 to 16.3% depending on which method was used. This represents a two to fourfold increase in obesity in children aged 8-12 years since 1990, again depending on the definition of obesity used [9]. The National Taskforce on Obesity, 2005 (NTFO) [10], reported that over 300,000 children are estimated to be overweight and obese and this is projected to increase annually by 10,000.

The system aims to measure trends in overweight and obesity in children aged 7.0 – 7.9 years

This growing problem of obesity in children is not unique to Ireland and the World Health Organization (WHO) has recently issued recommendations and guidelines for regular collection of data on weight, height, waist and hip circumference in children worldwide [1]. Preventing the rise in levels of overweight and obesity is a challenge to government. In 2005, The Department of Health and Children published the report of the National Taskforce on Obesity [10]. As part of its plan for tackling obesity it recommended that;

'A national database of growth measurements (height, weight, waist circumference, BMI) for children and adults should be developed by the Population Health Directorate in order to monitor prevalence trends of growth, overweight and obesity. The database can be created by developing the surveillance systems to collect the required data, for example the national health and lifestyle surveys, established longitudinal research projects and the school health surveillance system.' (recommendation 3, 5).

As a result, the Department of Health and Children and the Health Service Executive commissioned the National Nutrition Surveillance Centre, UCD School of Public Health and Population Science to carry out this work in the Republic of Ireland.

MEASURING CHILDHOOD OBESITY

The body mass index, or BMI is considered to be the best available population marker for monitoring trends in obesity. It is calculated from the formula, weight in Kg/height in m^2. Hall [11] has described it simply as an index of weight adjusted for height. Although it has many weaknesses as a measure of fatness of an individual, it is the only convenient measure for monitoring whole population fatness. It is widely used in adult populations and cut off points of $25Kg/m^2$ and $30Kg/m^2$ are recognised worldwide as definitions of adult overweight and obesity.

Defining overweight and obesity in children requires different methodology: Children's body fat content changes as they grow and is different for boys and girls. These differences mean that a single categorisation cannot be used to define childhood overweight and obesity; each sex and age group needs its own categorisation. Growth reference percentile charts and cut off points at agreed percentiles (for defining overweight and obesity) have been developed for this purpose. Different countries however, use different growth reference charts and different percentile cut off points for overweight and obesity. This leads to difficulties in comparing data across countries. In an approach developed to counteract this lack of consistency, Cole et al in 2000 [12] developed a new definition of childhood overweight and obesity based on pooled international data for BMI and cut off points corresponding to the adult overweight and obesity cut off points of 25 and 30 kg/ m^2 at age 18 years. This work was done following a recommendation of an expert committee of the International Obesity Taskforce. These charts and the associated cut offs are now recommended for use in international comparisons of prevalence of overweight and obesity in childhood populations and are known as the IOTF cut off points. New growth charts are also being developed for Ireland. The cut off points proposed for overweight and obesity are the 91st and 98th percentiles, which correspond to the UK growth charts and are in close proximity to the IOTF cut off points. These charts will be used for clinical purposes and assessment of individual children.

AIMS AND OBJECTIVES

The childhood obesity surveillance initiative will be an ongoing, systematic process of collection, analysis interpretation and dissemination of descriptive information for monitoring obesity, identified as a serious public health problem [2] in the WHO European Region and for use in programme planning and evaluation [1].

The initiative aims to measure trends in overweight and obesity in children aged 7.0 – 7.9 years in order to have a correct understanding of the progress of the epidemic, while also allowing inter-country comparisons within the WHO European Region. The implementation of a simple, effective and sustainable surveillance initiative will be important to tackle and monitor the obesity epidemic in children, identify groups at risk and evaluate the impact of obesity preventive interventions.

In this context, it is important to highlight that surveillance is not equivalent to screening. Screening means applying a test to a defined group of persons in order to identify at an early stage, a risk factor or a combination of risk factors of a disease- the people who are found are then treated.

At baseline, the core objective will be to measure in primary school children aged 7.0-7.9 years:

- **Weight, height, body mass index (BMI) and waist circumference**

- **Prevalence of underweight, normal weight, overweight, obesity and mean BMI**

In the Republic of Ireland, the objective was to achieve a nationally representative sample of 7 year old children

Study Design and Methods

The WHO European Childhood Obesity Surveillance Initiative (COSI) is a collaborative study with Principal Investigators from all countries co-operating in relation to survey content, methodology and timing using a European protocol. The Irish surveillance system is based on COSI protocol and the Irish representative is Ursula O'Dwyer, advisor to the Department of Health and Children. Strict adherence to the protocol was required for inclusion in the European database and this was achieved with the current study.

Rudolf et al (2006) suggested to use the standard deviation scores (SDS) of the mean BMI for demonstrating whether or not a halt in the rise in obesity has been achieved [13]. The determined sample size of ≈2300 children per age group is based on an 80% power to detect a minimum difference of 0.10 SDS mean BMI per year at a 2-sided 5% significance level.

A disadvantage of cluster sampling is that the overall estimate is less precise than that based on a simple random sampling of the same total size of the whole population. To achieve the same precision as a simple random sample requires a larger total sample size to take into account this design effect [14, 15]. Referring to the calculation above and taking a design effect of 1.2 based on analyses done by HBSC [16], one will need to have a final effective sample size of ≈2800 children (≈1400 boys and ≈1400 girls).

It was also important to consider the expected consent rates in determining the necessary over-sample. For example, an estimated proportion of 0.9 of subjects giving consent would require the enrolment of ≈3100 children initially to achieve the minimum target sample size of ≈2800 children; whereas an estimated response rate of 80% would require the enrolment of ≈3500 initially.

Assuming an average of ≈25 pupils per class, ≈124/140 classes would be required to achieve the final recommended sample size of ≈2800 pupils per targeted age group. Extra classes would be required if there are fewer than 25 pupils or when there are lower attendance rates than expected.

In the Republic of Ireland, the objective was to achieve a nationally representative sample of 7 year old children based on the following procedure. For the purposes of sampling school size was defined by the number of 7 year olds in First Class (in third year after enrolment) as provided by the Department of Education. As per protocol a nationally representative sample of schools was chosen on a probability proportional to size basis. In larger schools the average class size of 7 year olds was estimated to be around 20. If there were multiple classes in a school only one such class was sampled. In smaller schools selected for study with only one class, all the available 7 year olds were examined. However, 85% of the total of 2,830 schools in the country have class sizes with 20 or less 7 year olds in each, 50% have class sizes of less than 8 and 20% of schools have 3 or fewer such pupils in a class. This proliferation of small schools in Ireland therefore resulted in an unavoidable undersampling of pupils in small schools when using a 'proportional to size' cluster sample. Because sampling small schools will result in a low yield of pupils per school, for logistical reasons, the number of small schools in the sample was reduced.

Therefore, for efficiency reasons and because of the large number of small schools in Ireland, the sampling scheme, while sampling from schools of all sizes, undersampled pupils in small schools.

It was estimated that the final sampling scheme would provide 3,100 pupils in 180 schools. This allows for a 10% refusal rate within a school resulting in the required sample size of 2,800 pupils.

The dataset contained a sample of 498 schools and the schools were ordered by size. This was divided into 10 groups depending on class size (See table 1). From this, 11 schools were to be randomly selected from each of the first 5 groups of smaller sized schools (55 schools) and 25 schools were to be randomly selected from each of the final 5 groups of larger sized schools (125 schools). Therefore, the expected outcome was a selection of:

55 small schools (11 x 5) with an average of 10 students per class i.e. 550 pupils

125 large schools (25 x 5) with an average of 20 students i.e. 2500 pupils.

TABLE 1 **BREAKDOWN OF SCHOOLS**

GROUP	NUMBER OF SCHOOLS (TOTAL = 498)
1 Small Schools	47
2 Small Schools	61
3 Small Schools	54
4 Small Schools	62
5 Small Schools	54
6 Large Schools	52
7 Large Schools	54
8 Large Schools	40
9 Large Schools	27
10 Large Schools	47

Thirty nutritionists were recruited to carry out the fieldwork.

A cross-sectional design was applied.

SUBJECTS

The age group of 7.0 - 7.9 years was chosen because it precedes puberty and eliminates possible differences between different European countries that could be attributed to variations in the age of puberty [17]. Also, at this age the identification of obesity is of value to predict the condition in adulthood [18]. In addition, other studies in Ireland monitor 5 (Lifeways Study), 6 (Mayo Growth Surveillance Project) and 9 year olds (National Longitudinal Study of Children) so at a national level there is information across these age ranges.

Methods

ETHICAL CONSIDERATIONS

Ethical approval was obtained from the Research Ethics Committee, Human Research Sub Committee, University College, Dublin.

Prior to data collection, letter and consent forms were sent to all schools in which the objectives of the surveillance system explained. Only schools who returned a signed consent form were contacted to participate in the study.

All parents were sent a letter explaining the surveillance system and the anthropometric measurements. An informed consent form was also given to parents. Parents were fully informed about all study procedures and their informed consent obtained on a voluntary basis prior to the child's enrolment to the study. To ensure confidentiality for all collected and archived data, identification numbers were assigned to each child and each register only mentions these numbers. Only the research team has access to the full list of ID numbers and corresponding names of the children sampled. Original forms are stored in safe cabinets at the NNSC and these will be destroyed after 7 years.

All information and consent forms to parents/guardians were approved by the Irish National Adult Literacy Agency (NALA). They were also available in Irish and Polish and this translation was conducted by a professional translator.

FEEDBACK TO PARENTS AND CHILDREN

Although their child's height, weight and waist circumference measurements were not routinely given to parents, they were given if requested. Children were never told their measurements on the day and were also never told the measurements of other children.

TRAINING AND STANDARDISATION

Thirty nutritionists were recruited to carry out the fieldwork. All researchers attended a training session in anthropometric measurements and data collection following a standardised protocol drawn up by WHO. The initial training included a review of the background and objectives of the surveillance system, standardised use of the forms, taking measurements of subjects as described in the protocol, support of children with anxieties, calibration of measurement instruments, recording measurement values immediately after reading them and writing legibly to reduce mistakes during data transfer.

ANTHROPOMETRIC MEASUREMENTS

Measurements were carried out over as short as period as possible and data were not collected during the first two weeks of a new school term or immediately after a major holiday. In this case, measurements commenced two weeks after the Easter break on the 10th April 2008 and continued until the 26th June 2008 (11 week period).

Anthropometric measurements were done following standardised procedures [18-22]: weight, height and waist circumference. All equipment was calibrated prior to the start of the data collection and SECA 872 weighing scales and the SECA 214 portable stadiometers were used throughout.

Children can be very sensitive about their own size and those of children around them [23]. Measuring height, weight and waist circumference could accentuate these sensitivities and increase the risk of stigmatisation and bullying. To minimise any potential for harm, all measurements were therefore done in a private room or behind screens to ensure confidentiality and privacy. Children were asked to wear normal, light, indoor clothing without shoes. Hair ornaments were removed and ponytails undone and all children were asked to empty their pockets.

Weight was measured in kilograms, to the nearest 100 gram unit (0.1 kg) using SECA 872 weighing scales. The stadiometers were mounted at a right angle between a level floor and against a straight vertical surface (wall or pillar). Children's height was measured in centimetres and the reading taken to the last completed 1 millimetre (mm). A non-elastic metal tape with blank lead-in was used for the measurement of waist circumference and measured in centimetres (cm) and recorded to the nearest mm.

OTHER DATA

Individual information on date of birth, date and time of measurement, gender, clothes worn when measured as well as data on school year, school name and school address were also collected through the core data collection form. Furthermore, permission was asked of the child before the measurements and recorded.

An additional form was also completed by the teacher or principal. The mandatory school return form reported on the location of the school, the number of children registered and measured (examined) per sampled class, the number having refused to be measured and those absent on the measuring day. Further, a few school (environmental) characteristics were included, such as the frequency of physical education lessons, availability of school playgrounds, the possibility of obtaining certain foods and beverages on the school premises and currently ongoing school initiatives organized to promote a healthy life style (healthy eating, physical activity).

DATA ENTRY

All of the above data were recorded on prepared data sheets. The original data sheets were then sent to the NNSC. In addition, the nutritionists also recorded the coded data into standardised spreadsheets which were emailed back to the NNSC.

DATA ANALYSIS

Data was anonymised at the point of data entry and analysed at both the country level, locally by the NNSC and at the European level (common analysis) by WHO.

Results

RECRUITMENT OF SCHOOLS

In the first instance, letters were sent on the 10th March 2008 to 200 schools inviting them to participate in the study. This was broken down into 13 schools in each of the first five groups (small schools) and 27 schools in the larger schools (groups 6-10). The second batch of letters was sent on the 21st April 2008. This was broken down into 10 invitations to each of the five groups of small schools and 20 to the larger schools with the exception of group 8 where only 13 letters were sent as there was a total of 40 schools in this group. No letters were sent to group 9 as they had all been approached in the first round (see table 2). Finally, any outstanding schools were invited to participate in the study on the 6th May 2008. Due to the short time frame all 498 were invited to participate in the study in order to ensure that the target numbers for each group was reached. However, once the target numbers for each group was achieved, letters were sent to any remaining schools informing them that they would no longer be required to participate in the study. In order to maximise response rates from the larger schools, postal reminders were sent to schools followed by telephone calls from research staff at UCD.

When positive responses were received from school principals, he or she was telephoned to arrange a date for the measurements to take place. Once this had been confirmed, information sheets and consent forms in Irish, English or Polish for parents were posted to schools. These were distributed to the pupils by the teacher and collected by the nutritionists on the day of the anthropometric measurements. Children were not measured if the consent letter was not signed or if the parent stated that they did not wish their child to participate.

TABLE 2 **RECRUITMENT PROCESS**

GROUP	TOTAL NUMBER OF SCHOOLS	LETTERS SENT ROUND 1 10/03/08	LETTERS SENT ROUND 2 21/04/08	LETTERS SENT ROUND 3 06/05/08
1	47	13	10	24
2	61	13	10	38
3	54	13	10	31
4	62	13	10	39
5	54	13	10	31
6	52	27	20	5
7	54	27	20	7
8	40	27	13	0
9	27	27	0	0
10	47	27	20	0

TABLE 3 **RESPONSE RATE**

SCHOOL TYPE	RESPONSE RATE (%)
Small Schools	91/278 (33%)
Large Schools	105/220 (48%)

Due to time constraints, all schools were invited to participate in the study. Although 91 (33%) of small schools responded, once we measured children in 60 small schools we informed the remaining schools that they would be no longer required to participate in the study. The response rate was much higher from the larger schools (105) as a larger number was required (estimated 125 schools) and these schools were actively pursued through follow up letters and phone calls in order to maximise the response rate from this group. Children from 103 of these schools were measured within the time allowed.

The following table shows the response rate when broken down into urban and rural schools.

TABLE 4 **RESPONSE RATE OF URBAN VERSUS RURAL SCHOOLS**

	URBAN SCHOOLS	RURAL SCHOOLS
Large Schools	26/66 (39%)	79/154 (51%)
Small Schools	6/30 (20%)	85/248 (34%)

DISADVANTAGED SCHOOLS

The School Support Programme under the DEIS (Delivering Equality of Opportunity in Schools) action plan for educational inclusion has identified 631 disadvantaged schools. Disadvantaged schools have been identified as those schools that are at a social or economic disadvantage which prevents students from deriving appropriate benefit from education in schools. These have been divided into 3 categories:

- Primary Urban Band 1 (194 schools)

- Primary Urban Band 2 (137 schools)

- Primary Rural (300 schools)

Of the 498 schools randomly selected for this study, seventy five (15%) were on this list.

As outlined by the WHO protocol only the data on the seven year olds were analysed

TABLE 5 **BREAKDOWN OF DISADVANTAGED SCHOOLS**

	PRIMARY URBAN BAND 1	*PRIMARY URBAN BAND 2*	*PRIMARY RURAL*	*TOTAL*
Small schools	15	7	20	42
Large Schools	15	18	0	33
Total	30	25	20	75

TABLE 6 **PARTICIPATION OF DISADVANTAGED SCHOOLS**

	TOTAL DISADVANTAGED SCHOOLS (N=75)
Small Schools	**42**
Consent	*13 (31%)*
No response	*26 (62%)*
Refusal	*3 (7%)*
Large Schools	**33**
Consent	*10 (30%)*
No Response	*16 (48%)*
Refusal	*7 (21%)*

PARENTAL CONSENT

In total 154 schools out of 163 returned a school form, which included data on total class numbers, children who had not consented and those who were absent. Seventy two percent of children had consent forms and these were the children who were measured. Twenty seven percent of children did not have consent forms and 6% of children were absent of the day of the measurement.

PROFILE OF PARTICIPANTS

Two thousand six hundred and thirty two children from First Class had their height, weight and waist circumference measurements recorded (1263 boys and 1369 girls). Of these, 2420 were seven year olds (1152 boys and 1268 girls). As outlined by the WHO protocol only the data on the seven year olds were analysed. Table 7 shows a breakdown of all participants and further information on the children who were not seven years old is shown in appendix 1.

TABLE 7 **AGE AND GENDER OF ALL CHILDREN IN THE STUDY**

Age	Boys		Girls		Totals	
	N	%	N	%	N	%
5	1	←0.00	0	0	1	0
6	21	2	30	2	51	2
7	1152	91	1268	93	2420	92
8	88	8	71	5	159	6
9	1	←0.00	0	0	1	0
Totals	1263	48	1369	52	2632	100

Overall 47.6% of participants were boys and 52.4% were girls.

TABLE 8 **RESULTS FOR 7 YEAR OLDS**

Boys	N= 1152	47.6%
Girls	N= 1268	52.4%
Total	N=2420	100%

Tables 9 and 10 show the descriptive statistics for boys and girls measurements including:

TABLE 9 **HEIGHT, WEIGHT, WAIST CIRCUMFERENCE AND BMI FOR 7 YEAR OLD BOYS**

	Mean	SE Mean	St Dev	Minimum	Maximum
Weight (kg)N=1152	27.01	0.14	4.81	17.50	54.40
Height (cm) N=1151	126.44	0.16	5.46	109.90	150.60
Waist (cm) N=1150	58.35	0.17	5.78	46.00	87.20
BMI N=1151	16.80	0.06	2.14	12.09	27.79

TABLE 10 **HEIGHT, WEIGHT, WAIST CIRCUMFERENCE AND BMI FOR 7 YEARS OLD GIRLS**

	Mean	Mean SE	St Dev	Minimum	Maximum
Weight (kg) N=1268	26.77	0.15	5.29	17.30	58.10
Height (cm) N=1268	124.90	0.16	5.59	106.50	144.10
Waist (cm) N=1267	58.42	0.19	6.69	45.90	91.90
BMI N=1268	17.06	0.07	2.46	10.31	31.79

There was no significant difference between all boys and girls for weight or waist measurements (p=0.245 and 0.780, respectively). However, there was a significant difference between height (p=0.000) and therefore also between BMI (p=0.005) for boys and girls (figures 1 and 2).

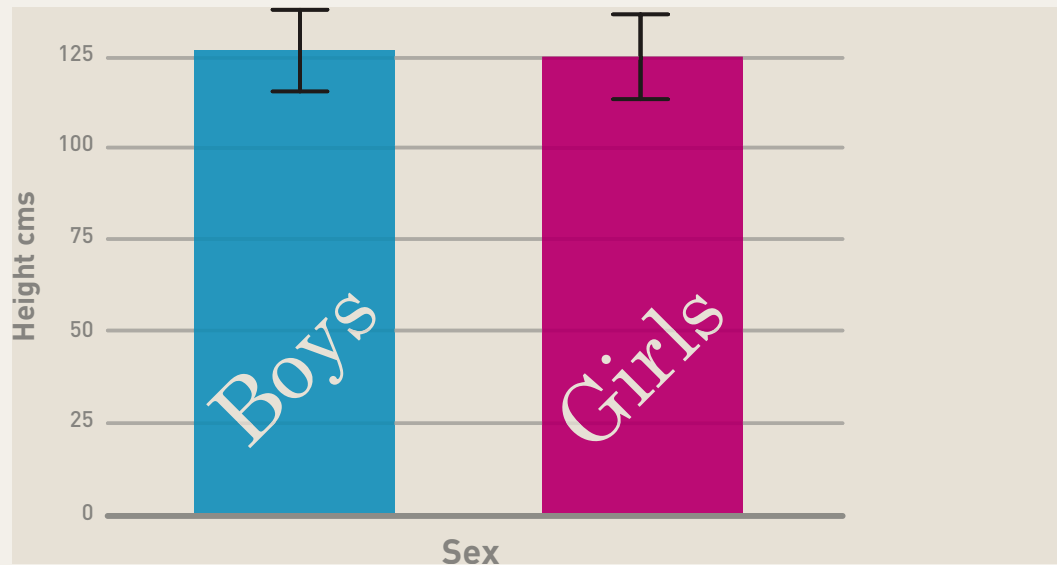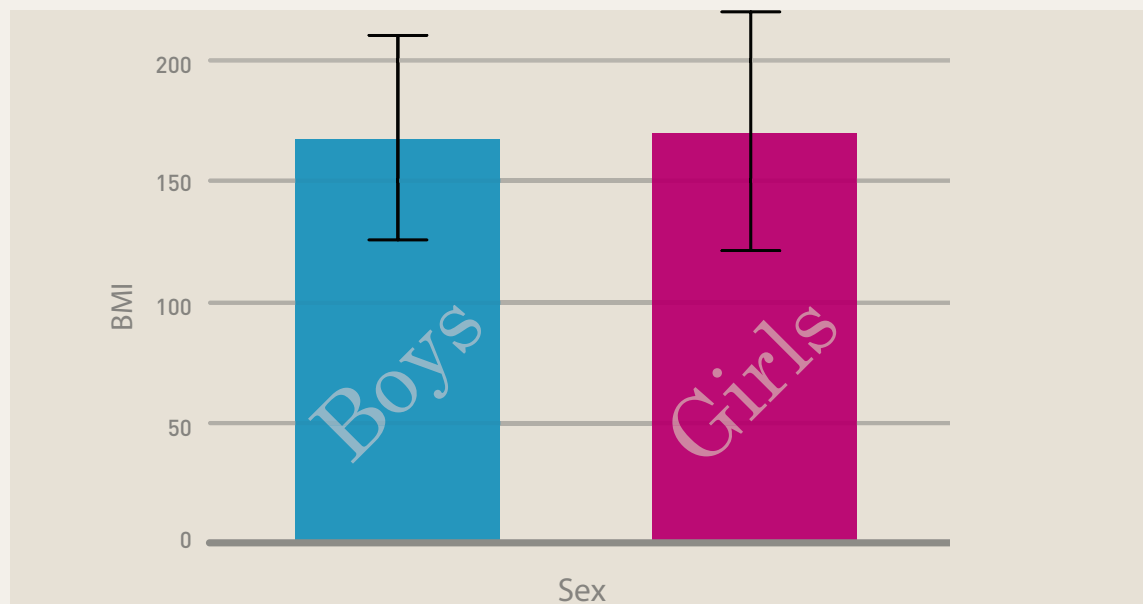*FIGURE 1* **HEIGHT OF BOYS V GIRLS   P = 0.000**

FIGURE 2 **BMI OF BOYS V GIRLS   P= 0.005**

BODY MASS INDEX OF 7 YEAR OLD CHILDREN CATEGORISED BY THE IOTF STANDARDS

BMI was calculated for all children. The figure below (figure 3) shows BMI categorised by the International Obesity Taskforce Standards and presented as percentages. When categorised by the IOTF standards, 73% of girls and 82% of boys were of normal BMI while 19% of girls and 13% of boys were overweight and 8% of girls and 5% of boys were obese. These gender differences were not significant for obese children (p=0.076) but were significantly different for overweight (p=0.007).

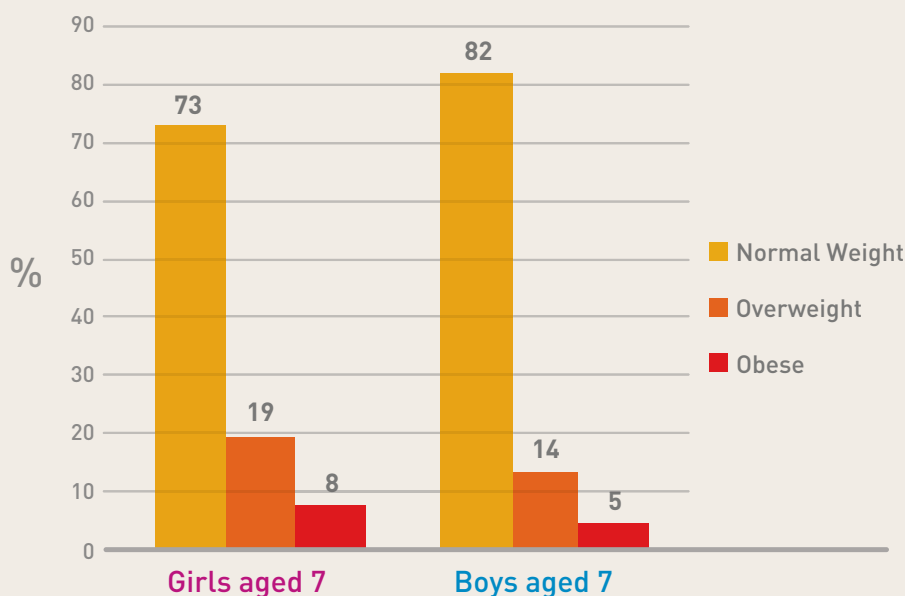*FIGURE 3*   **BODY MASS INDEX OF 7 YEAR OLD CHILDREN CATEGORISED BY THE IOTF STANDARDS**

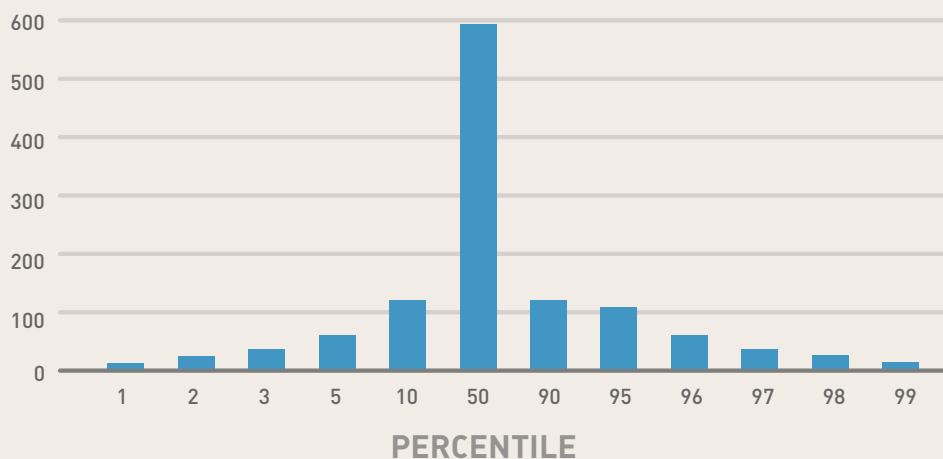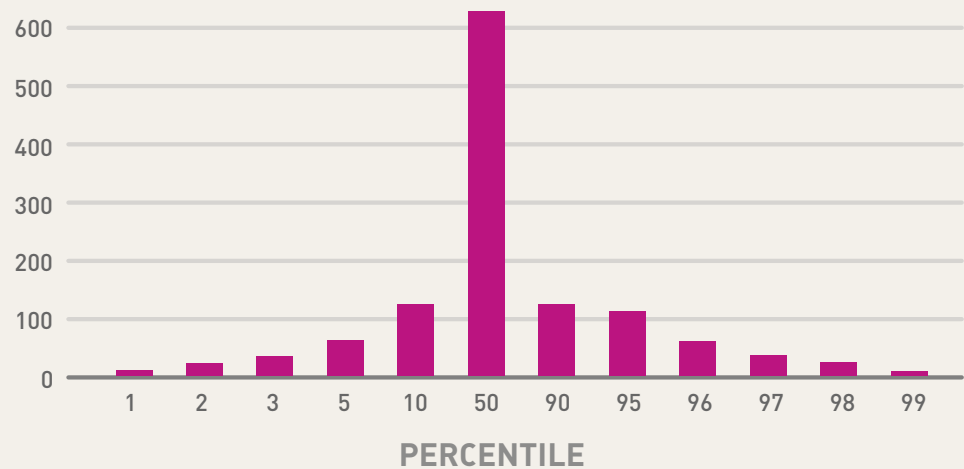
FIGURE 4 **BMI PERCENTILES BOYS**

FIGURE 5 **BMI PERCENTILES GIRLS**

New growth charts are being developed for Ireland. The cut off points proposed for overweight and obesity are the 91st and 98th percentiles, which correspond to the UK growth charts and are in close proximity to the IOTF cut off points. For boys the 91st and 98th percentiles are a BMI of 19.54 and 23.57. Nine percent of boys were in the 91st percentile and 2% were in the 98th percentile. For girls the 91st and 98th percentiles are BMI of 21.6 and 23.93. Nine percent of girls were in the 91st percentile and 2% were in the 98th percentile (figures 4 and 5).

LARGE SCHOOLS VERSUS SMALL SCHOOLS

In total 595 children were measured in 60 small schools and 1825 children were measured in 103 large schools.

	LARGE SCHOOLS	*SMALL SCHOOLS*
Girls	**947/1825 (52%)**	**321/595 (54%)**
Boys	**878/1825 (48%)**	**274/595 (46%)**

There was no significant difference between all children in the large versus small schools for any of the measurements including height, weight, waist circumference or BMI (Table 11).

TABLE 11 **COMPARISON OF BODY MEASUREMENTS IN LARGE SCHOOLS VERSUS SMALL SCHOOLS**

SCHOOL TYPE	*N*	*WEIGHT (KG)*	*HEIGHT (CM)*	*WAIST (CM)*	*BMI*
Large	**1825**	**26.83 (SD 5.12)**	**125.61 (SD5.63)**	**58.34 (SD6.33)**	**16.90 (SD2.32)**
Small	**595**	**27.05 (SD4.91)**	**125.61 (SD5.45)**	**58.55 (SD6.11)**	**17.06 (SD2.29)**
P value		**0.337**	**0.974**	**0.463**	**0.130**

There was also no significant difference between boys from the small schools versus large schools for any of the parameters measured (Height, p=0.164; weight, p=0.513; waist circumference, p=0.694 and BMI, p=0.966). Similarly there were no significant difference between girls from small schools versus large schools for height (p=0.230), weight (p=0.466), waist circumference (p=0.538) or BMI (p=0.066).

HSE REGIONS

HSE regions were divided into South, West, Dublin North-East and Dublin Mid-Leinster. There was no significant difference between heights, weights or BMI for all children between regions although there was a significant difference (p=0.001) between waist circumference measurements.

TABLE 12 **RESULTS BY HSE REGION FOR ALL CHILDREN**

HSE Region	Weight (kg) Mean (sd) Range n	Height (cm) Mean (sd) Range n	Waist Circumference (cm) Mean (sd) Range n	BMI Mean (sd) Range n
South	27.11 (4.86) 17.5-54.5 510	126.06 (5.39) 108-143 509	58.37 (6.00) 46.0-85.0 508	16.96 (2.22) 12.78-28.62 509
Dublin North-East	26.83 (5.25) 17.9-58.1 560	125.29 (5.63) 112.0-142.0 560	58.81 (6.54) 46.0-92.0 559	16.97 (2.37) 12.40-29.22 560
Dublin Mid-Leinster	26.92 (5.23) 18.10-55.90 805	125.55 (5.64) 107.0-151.0 805	58.72 (6.55) 46.0-90.0 805	16.97 (2.44) 12.11-31.60 805
West	26.67 (4.83) 17.3-49.3 545	125.67 (5.63) 112.0-143.0 545	57.48 (5.74) 47.0-82.0 545	16.79 (2.11) 12.75-26.65 545
P value	P= 0.566	P=0.151	P=0.001	P=0.457

TABLE 13 **RESULTS BY HSE REGION FOR BOYS**

HSE Region	Weight (kg) Mean (sd) Range n	Height (cm) Mean (sd) Range n	Waist Circumference (cm) Mean (sd) Range n	BMI Mean (sd) Range n
South	27.40 (4.99) 18.7-48.7 250	126.43 (5.32) 111.0-143.0 249	58.38 (6.20) 47.0-85.0 249	17.04 (2.29) 13.33-27.51 249
Dublin North-East	27.21 (5.51) 17.9-48.0 251	125.69 (5.71) 112.0-141.0 251	59.13 (6.74) 47.0-83.0 251	17.08 (2.45) 13.29-29.95 251
Dublin Mid-Leinster	27.11 (5.2) 18.10-54.4 393	125.78 (5.79) 107.0-151.0 393	58.83 (6.56) 46.0-90.0 393	17.03 (2.43) 13.32-28.29 393
West	26.67 (4.76) 17.60-49.3 258	125.68 6.00) 113.0-143.0 258	57.36 (5.42) 47.00-82.00 258	16.79 (2.04) 12.86-26.65 258

TABLE 14 **RESULTS BY HSE REGION FOR GIRLS**

HSE Region	Weight (kg) Mean (sd) Range n	Height (cm) Mean (sd) Range n	Waist Circumference (cm) Mean (sd) Range n	BMI Mean (sd) Range n
South	26.83 (4.72) 17.5-54.5 260	125.71 (5.45) 108.0-139.0 259	58.37 (5.82) 46. 0-85.0 259	16.88 (2.15) 12.78-28.62 259
Dublin North-East	26.53 (5.00) 18.4-58.1 309	124.96 (5.55) 112.0-142.0 309	58.55 (6.37) 46.0-92.0 308	16.88 (2.30) 12.40-29.22 309
Dublin Mid-Leinster	26.73 (5.25) 18.10-55.90 412	125.33 (5.5) 108.0-144.0 412	58.62 (6.55) 46.0-90.0 412	16.91 (2.46) 12.11-31.60 412
West	26.68 (4.91) 17.30-48.50 287	125.65 (5.32) 112.0-140.0 287	57.58 (6.01) 49.0-82.0 287	16.79 (2.18) 12.75-26.61 287

DISADVANTAGED SCHOOLS

Twenty three disadvantaged schools participated in the study. There was no significant difference between height, weight, waist circumference or BMI for the children from these schools compared with other schools.

TABLE 15 **RESULTS BY DISADVANTAGED SCHOOLS**

School Type	Children (n)	Weight (kg) sd Range	Height (cm) sd Range	Waist (cm) sd Range	BMI sd Range
Primary Urban Band 1	87	26.76 (4.82) **19.0–45.2**	124.39 (5.23) **111.9–138.0**	58.38 (6.36) **46.0–81.4**	17.21 (2.37) **13.64–26.02**
Primary Urban Band 2	88	26.78 (4.64) **18.1–39.3**	125.84 (5.88) **112.6–140.3**	58.2 (5.63) **47.3–73.0**	16.81(2.01) **13.83–23.04**
Primary Rural	24	25.78 (4.01) **18.1–34.3**	124.3 (5.04) **116.4–134.7**	58.04 (5.51) **48.9–69.5**	16.60 (1.71) **13.36–20.56**
Other schools		26.91 (5.11) **17.3–58.1** *n=2221*	125.70 (5.68) **106.5–167.1** *n=2220*	58.40 (6.31) **45.9–91.9** *n=2218*	16.93 (2.32) **10.31–31.79** *n=2220*
P value		0.736	0.115	0.984	0.566

TABLE 16 **RESULTS BY DISADVANTAGED SCHOOLS FOR GIRLS**

School Type	Girls (n)	Weight (kg) sd Range	Height (cm) sd Range	Waist (cm) sd Range	BMI sd Range
Primary Urban Band 1	45	27.34 (5.62) 20.0-45.2	123.93 (5.50) 111.9-138.0	59.48 (7.58) 50.3-81.4	17.69 (2.67) 13.64-26.02
Primary Urban Band 2	30	27.76 (5.95) 18.4-39.3	124.73 (5.96) 112.6-134	59.99 (7.22) 47.6-73.0	17.65 (2.53) 14.24-23.04
Primary Rural	14	24.73 (4.62) 18.1-34.3	122.42 (5.41) 116.4-134.7	57.66 (6.16) 48.9-67.2	16.39 (1.99) 13.36-20.56
Other schools		26.75 (5.27) 17.3-58.1 n=1179	124.97 (5.71) 106.5-167.1 n=1179	58.35 (6.65) 45.9-91.9 n=1178	17.03 (2.45) 10.31-31.79 n=1179

TABLE 17 **RESULTS BY DISADVANTAGED SCHOOLS FOR BOYS**

School Type	Boys (n)	Weight (kg) sd Range	Height (cm) sd Range	Waist (cm) sd Range	BMI sd Range
Primary Urban Band 1	42	26.13 (3.74) 19.0-36.5	124.89 (4.94) 113.5-137.7	57.21 (4.51) 46.0-75.5	16.71 (1.90) 13.95-23.74
Primary Urban Band 2	58	26.27 (3.75) 18.1-37.5	126.42 (5.81) 114.4-140.3	57.27 (4.38) 47.3-71.5	16.38 (1.54) 13.83-21.17
Primary Rural	10	27.24 (2.51) 21.6-30.4	126.9 (3.07) 121.6-131.0	58.56 (4.72) 52.2-69.5	16.89 (1.27) 14.44-18.32
Other schools		27.08 (4.91) 17.5-54.4 n=1042	126.53 (5.52) 109.9-151.3 n=1041	58.45 (5.90) 46.1-87.2 n=1040	16.83 (2.17) 12.09-27.79 n=1041

Discussion

Despite a low response rate at the school level, this had no impact on the findings and the response rate at the class level was very good (72%). There appeared to be no difference between schools that were disadvantaged compared with other schools but the number of disadvantaged schools that participated in the study was low so power may have been an issue. WHO envisage that this initiative will be repeated at 2 year intervals. In 2010, the first progress report on counteracting obesity is due to be sent to the WHO Regional Committee in which the results of this surveillance initiative will be included.

Key Findings

Two thousand four hundred and twenty (7 years old) children had their height, weight and waist circumference measurements recorded (1152 boys and 1268 girls). In total 595 children were measured in 60 small schools and 1825 children were measured in 103 large schools.

There was no significant difference between all boys and girls for weight or waist measurements (p=0.245 and 0.780, respectively). However, there was a significant difference between girls and boys for height (p=0.000) and BMI (p=0.005).

There was no significant difference between all children in the large versus small schools for any of the measurements including height, weight, waist circumference or BMI. There was also no difference observed between boys from the small schools versus large schools or between girls from small schools versus large schools for any of the measurements.

HSE regions were divided into West, South, Dublin Mid-Leinster and Dublin North East. There was no significant difference between heights, weights or BMI for all children between regions although there was a significant difference (p=0.001) between waist circumference measurements.

References

1. WHO. European Childhood Obesity Surveillance Initiative. January, 2008. World Health Organization. Prepared by Trudy Wijnhoven and Francesco Branca

2. *The challenge of obesity in the WHO European Region and the strategies for response. Summary.* Copenhagen, World Health Organization, Regional Office for Europe, 2007

3. Lobstein T, Baur L, Uauy R; IASO International Obesity Taskforce. Obesity in children and young people: a crisis in public health. *Obesity Reviews*, 2004, 5 Suppl 1: 4-104

4. Krassas GE, Tzotzas T. Do obese children become obese adults: childhood predictors of adult disease. *Pediatric Endocrinology Reviews*, 2004, 1 Suppl 3: 455-459

5. Freedman DS et al. The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. Pediatrics, 1999, 103: 1175-1182

6. Dietz WH. Health consequences of obesity in youth: childhood predictors of adult disease. Pediatrics, 1998, 101: 518-525

7. Strauss RS. Childhood obesity and self esteem. Pediatrics. 2000:105(1)

8. H Whelton, J Harrington, E Crowley, V Kelleher, M Cronin and IJ Perry. Prevalence of overweight and obesity on the island of Ireland: results from the North South Survey of Children's Height, Weight and Body Mass Index, 2002. BMC Public Health, 2007, 7:187-196

9. JL O'Neill, SN McCarthy, SJ Burke, EM Hannon, M Kiely, A Flynn, MAT Flynn and MJ Gibney. Prevalence of overweight and obesity in Irish School children using four different definitions. *European Journal of Clinical Nutrition*, 2006, 1-9

10. Department of Health and Children (2005). Obesity –The Policy Challenges –The Report of the National Taskforce on Obesity. Department of Health and Children

11. Hall, DMB., *Uses and Abuses of the BMI,* Supplement to BACCH News-*Measuring Childhood Obesity* Autumn 2005.

12. Cole TJ et al. Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal*, 2000, 320: 1240-1245

13. Rudolf MCJ et al. The TRENDS project: development of a methodology to reliably monitor the obesity epidemic in childhood. *Archives of Disease in Childhood*, 2006, 91:309-311.

14. Kirkwood BR. *Essentials of medical statistics.* Oxford, Blackwell Science, 1988.

15. Killip S, Mayfoud Z, Pearce K. What is an intracluster correlation coefficient? Crucial concepts for primary care researchers. *Annals of Family Medicine*, 2004, 2:204-208.

16. Currie C et al., eds. *Health Behaviour in School-Aged Children: a WHO cross-national study. Research protocol for the 2001/2002 survey*. Edinburgh, The University of Edinburgh, 2002 (http://www.euro.who.int/Document/e82923.pdf

17. Lehingue Y. The European Childhood Obesity Group (ECOG) project: the European collaborative study on the prevalence of obesity in children. *American Journal of Clinical Nutrition*, 1999, 70 Suppl: 166-168

18. Janssen I et al. Utility of childhood BMI in the prediction of adulthood disease: comparison of national and international references. Obesity Research, 2005, 13: 1106-1115

19. *Physical Status: the use and interpretation of anthropometry. Report of a WHO Expert Committee*. Geneva, World Health Organization, 1995 (WHO Technical Report Series 854)

20. De Onis M et al. Measurement and standardisation protocols for anthropometry used in the construction of a new international growth reference. *Food and Nutrition Bulletin*, 2004, 25: S27-S36

21. *WHO Multicentre Growth Reference Study Protocol. Appendix B: Measurement and standardisation protocols*. Geneva, World Health Organization, 1999

22. *WHO child growth standards. Training course on child growth assessment: B, measuring a child's growth*. Geneva, World Health Organization, 2006

23. Lohman TG, Roche AF, Martorell R eds. *Anthropometric Standardisation*

24. McConnon A, Kelly C, McGloin A, Kelleher C. Investigation of the acceptability of anthropometric measurement to Irish children in the school setting: Children's perspective in Republic of Ireland. *Irish Journal of Medical Science* (in press)

Appendix 1

RESULTS FROM 6 AND 8 YEAR OLD CHILDREN

WEIGHT, HEIGHT, WAIST CIRCUMFERENCE AND BMI IN BOYS AGED 6 YEARS OLD

	Mean	Mean SE	St Dev	Minimum	Maximum
Weight (kg) N=21	25.21	0.87	3.98	19.70	33.20
Height (cm) N=21	123.07	1.21	5.56	111.3	131.20
Waist (cm) N=21	57.72	1.08	4.96	49.10	67.50
BMI N=21	16.55	0.349	1.60	14.41	20.10

WEIGHT, HEIGHT, WAIST CIRCUMFERENCE AND BMI IN GIRLS AGED 6 YEARS OLD

	Mean	Mean SE	St Dev	Minimum	Maximum
Weight (kg) N=30	27.09	1.03	5.65	21.40	49.10
Height (cm) N=30	123.52	0.80	4.40	116.30	132.40
Waist (cm) N=30	59.14	1.31	7.17	49.50	85.20
BMI N=30	17.66	0.52	2.84	13.92	28.57

WEIGHT, HEIGHT, WAIST CIRCUMFERENCE AND BMI IN BOYS AGED 8 YEARS OLD

	Mean	Mean SE	St Dev	Minimum	Maximum
Weight (kg) N=88	28.81	0.64	5.97	20.20	54.40
Height (cm) N=88	128.65	0.60	5.61	113.90	147.1
Waist (cm) N=87	59.90	0.73	6.80	47.40	86.70
BMI N=88	17.29	0.27	2.51	12.94	28.19

WEIGHT, HEIGHT, WAIST CIRCUMFERENCE AND BMI IN GIRLS AGED 8 YEARS OLD

	Mean	Mean SE	St Dev	Minimum	Maximum
Weight (kg) N=71	27.42	0.66	5.59	18.40	47.30
Height (cm) N=71	126.52	0.66	5.57	108.20	139.00
Waist (cm) N=71	59.18	0.85	7.18	48.00	86.20
BMI N=71	17.03	0.32	2.70	13.88	25.53