

Danish clinical guidelines for examination and treatment of overweight and obese children and adolescents in a pediatric setting

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This guideline by the Obesity Committee within The Danish Paediatric Society has also been approved by the Committees for Endocrinology, Gastroenterology, Cardiology, Neonatology and Nephro-urology within The Danish Paediatric Society, Danish Paediatricians Organization, The Danish Society for Diabetes in Childhood and The Danish Association for the Study of Obesity. The Danish College of General Practitioners supports the referral criteria for pediatric evaluation. November 28, 2014.

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BACKGROUND

Over the past two hundred years, life expectancy in the Western world has steadily increased. Recent projections from American data raise concerns in regards to obesity related complications (1). The projected impact of the obesity epidemic may lead to shorter life expectancies in the current generation of children compared to their parents. Therefore comprehensive action in relation to child obesity intervention is recommended (1).

Traditionally, examination and treatment of obesity has not been prioritized in pediatrics, despite overweight children being at an increased risk of becoming obese adults (2-4). More than one in three obese preschool children remain obese as adults (5). Among obese school children almost half remain overweight, a risk that increases with increasing age (6). The significance of childhood obesity is controversial, yet the incidence of adverse health effects may be underestimated (7) and the full consequences of the obesity epidemic remain to be realized (1, 8). Obese children are three times more likely to have hypertension than normal-weight children (9), and a large retrospective Danish study has shown a convincing association between elevated BMI in childhood (7-13 years) and cardiovascular disease in adulthood (10).

Overweight and obesity are major problems that pediatricians should acknowledge. This is emphasized by the Danish data of schoolchildren aged 6-16 years, showing that overweight and obesity from 1947 to 2003 have increased significantly, particular-

ly among the youngest boys (11). Furthermore, recent data shows an approximately 10% prevalence of overweight and obesity among preschool children (12). In the Funen birth cohort from 2001, the prevalence of obesity in children was 1.9% of the children aged 2.5-3.5 years; 2.5% of those aged 3.5-4.5 years; and 2.5% in the group aged 4.5-5.5 years (12). In Copenhagen in 2007, the prevalence of obesity in 5-8 year old girls and boys was 3.7% and 2.6% respectively, whilst in 14-16 year old girls and boys, it was 4.7% and 4.2% respectively (13). In the 2010 "Schoolchildren Study" comprising a random sample of schools in Denmark 2-3% of the children aged 11, 13 and 15 years were obese based on a BMI calculated from the children's self-reported height and weight (14).

It may seem discouraging, that a previous Cochrane review has shown no evidence of sustained efficacy with respect to any individual preventive treatment on obesity in children (15). However, based on the latest Cochrane review (16) and in particular recent studies of multidisciplinary intervention with prolonged follow-up in Germany (17, 18) and Denmark (19), there is reason to believe that, multidisciplinary treatment approaches aimed at weight limiting changes entrenched in the child's family, may cause long term weight loss in children and adolescents. "Julemærkehjemmene" in Denmark have developed strategies in helping children lose weight. The challenge, however, has been to maintain weight loss in the home environment (20), and this may be ensured by increased interdisciplinary cooperation.

STRATEGY

The Obesity Committee of The Danish Pediatric Society (DPS) recommend that obesity in children and adolescents be considered a chronic illness, despite BMI cut-off values not being based on studies assessing the long-term detrimental effects of different degrees of obesity.

We anticipate a paradigm shift where obesity is perceived as a chronic illness, alongside other chronic diseases in Denmark. This is in line with the recent statement from the American Medical Society (AMA), recognizing obesity as a disease (21).

We recommend a multidisciplinary service implemented as a "chronic care model" (standard outpatient services) based on the principle of "best clinical practice" (22), primarily inspired by the

recommendations of the American expert committee (23) and the daily practice of "The Children's Obesity Clinic" at the Copenhagen University Hospital Holbaek (19). Surveys concordantly indicate that a combination of diet, physical activity and behavior-focused interventions provides the best efficacy (22, 23). In addition, family-based interventions seem to be particularly effective both in the short and long term (16, 24, 25).

According to the Danish Health Care legislation the regions and municipalities are responsible for prevention and treatment regarding health services for children and adolescents. This is stipulated in Act No. 913 from 13/07/2010, which indicates that local authorities are obliged to establish general initiatives or provide individual-based support for obese children and adolescents.

In the pediatric wards, we recommend that teams *ideally* consisting of pediatricians, clinical dietitians, nurses, psychologists, social workers and physiotherapists are responsible for the treatment of obese children and adolescents. Furthermore, it is recommended that collaborations are established with general practitioners, pediatricians in private practice, sports instructors and organizations in the municipalities or other appropriate municipal services. A multi-disciplinary treatment approach involving various institutions would benefit both the individual child and family, and have positive socioeconomic implications. Municipalities and the primary health care sector should be encouraged to provide broad and differentiated health related initiatives tailored to identify and treat obese children and adolescents at a very early stage, thus reducing the number requiring highly specialized services.

DEFINITIONS

Body Mass Index (BMI) = weight (kg) / [height (m)]² is pivotal for assessing obesity. BMI is a simple and useful tool, and it can be complemented by information from a waist circumference measurement and best clinical judgment.

In accordance with the National Board of Health and The Danish College of General Practitioners (26) we define:

- Overweight as a BMI above the 90th percentile for age and sex.
- Obesity as a BMI above the 99th percentile for age and sex.

An alternative measure is the isoBMI where the definitions of overweight and obesity for children and adolescent's current BMI is "correlated" to the adult equivalent. According to this definition:

- Overweight is an isoBMI of 25 and above.
- Obesity is an isoBMI of 30 and above.

The Danish BMI curves indicating IsoBMI are available (27):

Girls: http://vækstkurver.dk/PDF/pige_BMI_0_20_aar.pdf

Boys: http://vækstkurver.dk/PDF/dreng_BMI_0_20_aar.pdf

The BMI z-score, which describe a patient's BMI in relation to the average BMI for a person of the same age and sex [z-score =

(current BMI - mean) / standard deviation] is often used internationally. However, the calculation of the BMI z-score requires digitalized direct access to a normal reference material which may prove to be difficult in a clinical everyday setting.

Children and adolescents should be referred for examination and treatment in a pediatric setting if they have a:

BMI corresponding to an isoBMI of at least 30 OR

BMI corresponding to an isoBMI of 25 to 30 AND one or more of the following features (leading to a suspicion of complex obesity):

- Suspicion of a specific medical reason for obesity.
- Dyscrine features.
- Declining rate of growth (height), a relatively short stature.
- Developmental delay.
- Persistent overeating / "binge-eating" and searching for food.
- Rapidly increasing BMI.
- Other complications / associated conditions e.g. hypertension, dyslipidemia, elevated liver enzymes, insulin resistance, pre-diabetes, type 2 diabetes, polycystic ovary syndrome, or obstructive sleep apnea.
- Concurrent family history of two or more of the following diagnoses: type 2 diabetes, hypertension, hyperlipidemia, metabolic syndrome, cardiovascular disease, or obesity

HISTORY (28):

Obtaining a thorough medical history is fundamental, as it provides the basis for any supplementary investigations and aids in the planning of further treatment. We recommend using the structured "overweight-sheet/overvægtsskema" from the Obesity Committee of DPS (*Appendix1 – in Danish*) to ensure collection of all relevant information. We also recommend interviewing the patient regarding different aspects of life as assessed by the visual analogue scale (VAS) sheet from the Obesity Committee of DPS (*Appendix2 and 3 – in Danish*):

- Pregnancy, birth information, breastfeeding, and previous growth.
- Predisposition to obesity, hypertension, dyslipidemia, type 2 diabetes, or other cardiovascular diseases.
- Ethnicity / consanguinity with potentially increased risk of complications.
- Headache ((pseudo)tumor cerebri, hypertension), daytime sleepiness, and snoring (sleep apnea).
- Abdominal pain (constipation, psychogenic, gallstones, and fatty liver).
- Pain in the hips / knees / ankles (epiphysiolysis).

- Girls after menarche: menstrual irregularities and / or hirsutism (polycystic ovary syndrome).
- History of diet and exercise is pivotal. We recommend a thorough approach as comprehensive as stated in the overweight-sheet (*Appendix 1 – in Danish*).
- Medications (including: glucocorticoids, psychotropic and thyroid medication).
- Intoxicating substances (tobacco increases insulin resistance and the risk of cardiovascular disease, alcohol may add to the total calorie intake).
- Social history: education, well-being, bullying, family structure and dynamics.
- Sleeping pattern: apnea, the duration of sleep.
- Psychosocial history: depression, low self-esteem, anxiety, and solitude.

PHYSICAL EXAMINATION INCLUDING PARACLINICAL RESULTS AND SPECIFIC PHENOTYPES (22, 23, 24, 28, 29):

Physical examination:

- Height and weight to calculate BMI (and BMI changes prospectively).
- Waist circumference (also for the assessment of treatment outcome). It should be measured midway between the lower part of the ribs and the upper part of the hipbone. Preferentially, the waist circumference is measured in the same way every time (30, 31).
- Previous growth data plotted on the height-weight curves <http://www.vækstkurver.dk/>. The expected target height according to the child's genetic potential is calculated:

Girls: the average of the parental height in cm subtracted 6.5 cm.

Boys: the average of the parental height in cm added 6.5 cm

- Is the patient growing according to the "target level"/genetic potential?
- Most children with "simple" obesity have a height above their target percentile and an advanced bone age.
- Low actual height for target height combined with overweight/obesity should warrant considering a more specific assessment: syndromic, chromosomal and endocrinological evaluation
- Pubertal evaluation a.m. Tanner, including assessment of potential virilization in girls.

- Measurement of blood pressure according to the Danish consensus report on hypertension in children (appropriate cuff size, sitting with support beneath the feet or lying preceded by a minimum of 5 minutes of rest, measuring the blood pressure at least

3 times, until there is a maximum of 5 mm Hg difference between the latest two measurements). If the first measurement shows an elevated blood pressure it is recommended to measure the blood pressure more times and use a mercury sphygmomanometer and/or ambulant blood pressure monitoring depending on individual assessment.

http://www.laeger.dk/portal/pls/portal/!PORTAL.wwpob_page.s how? docname=9796971.PDF

- Neurological examination with focus on pathology in/near hypothalamus
- Examination for acantosis nigricans especially in the neck, armpits and inguinal (often associated with hyperinsulinemia)
- Examination for striae

Paraclinical investigation:

1) Blood samples (fasting when possible):

- Thyroid function (TSH, fT4, fT3), HbA1c, blood glucose, insulin. Red/white blood cell count. Calcium metabolism markers (vitamin D, PTH, ionized calcium, phosphate, albumin). Lipids (total cholesterol and fractions, triglycerides). Liver function tests (Alanine transaminase, alkaline phosphatase, bilirubin, gamma-glutamyl transferase). Urate, creatinine, urea, Na and K.

- If a non-fasting patient has pathological values in lipid/glucose metabolism, repeat fasting samples are required

2) Medical imaging:

- DEXA scans (ideally), alternative bio-impedance to assess body fat.

Special findings/phenotypes warranting further investigation:

- Syndromic obesity: Karyotyping, genetic testing for Prader Willi Syndrome, etc. If monogenic obesity is suspected: adapted genetic evaluation regarding MC4R (melanocortin 4 receptor), leptin receptor and other potential "obesogenic" genetic variations.

- Arterial hypertension: The patient should be evaluated and treated as other hypertensive patients.

http://www.laeger.dk/portal/pls/portal/!PORTAL.wwpob_page.s how? docname=9796971.PDF

- Vitamin D deficiency: The patient should be evaluated and treated as other patients with vitamin D deficiency.

http://www.paediatri.dk/images/pdf_filer/dps_veil/013ge.pdf

- For patients with a pre-diabetic phenotype (HbA1c of 5.7 to 6.4% (39-47 mmol/mol) or repeated fasting blood glucose levels at 5.6 to 6.9 mmol/l or oral glucose tolerance test with glucose levels of 7.8 to 11.0 mmol/l after 2 hours): Refer to a department with a diabetes section for children and adolescents for further investigation, follow-up and decision making regarding potential treatment <http://www.dsbd.dk/instrukser/t2dm>

- Suspicion of precocious puberty: standard local guidelines

- Delayed pubertal development: standard local guidelines
- Hirsutism or irregular menstruation: 17-OH-progesterone, testosterone, estradiol, LH, FSH, ultrasound of the ovaries and uterus for potential polycystic ovary syndrome (32).
- If non-alcoholic hepatic steatosis (fatty liver) is suspected: Optimally MR spectroscopy, otherwise abdominal ultrasound of the liver (risk of inter-observer variation).
- Asthma or other respiratory symptoms: Spirometry or alternative pulmonary function test.
- Suspected sleep apnea: Evaluation by a skilled sleep laboratory.
- Pain or restriction of motion in the lower extremities: conventional x-ray of the knee and /or hip joint. Consider referral to a pediatric orthopedic surgeon.
- Rapidly developed/evolving obesity: consider measuring prolactin, ACTH, morning cortisol, and urinary cortisol (optimally x 3), and MRI of the brain.
- If the scores on life conditions on the VAS scale are low: consider contacting the school, a social worker, psychologist, etc.
- In case of explicit social problems /severe challenges regarding compliance: consider contacting social services.

TREATMENT (16, 22, 23, 24, 25, 33):

Successful treatment is fully dependent on the effort comprising the entire family. The overall message is that the family, as a whole should support initiatives and be involved in the treatment including adherence to the same dietary advice as the patient.

Obesity is rarely caused by an underlying endocrinological or other well-defined medical cause. The main principle of the treatment is therefore to reduce caloric intake (not necessarily smaller amounts of food, but more fiber containing and "greener" food) while increasing the physical activity (i.e. decreasing inactivity):

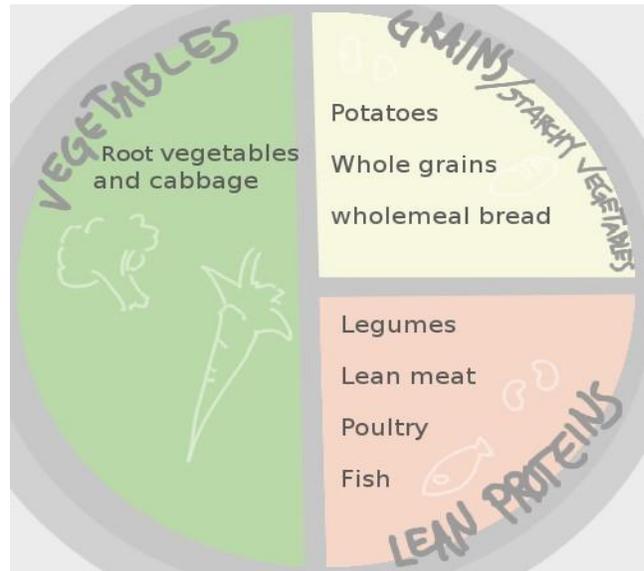
1 Diet (reducing caloric intake):

a) Advice regarding individual meals:

- 4-5 (6) meals a day, which should provide moderate satiety throughout the day.
- Breakfast should be consumed every morning. It may consist of whole grain products (bread) with low-fat cold cuts, oatmeal, whole grain cereals, eggs and low-fat milk.
- Lunch: Whole grain bread with low-fat cold cuts and vegetables.
- Between main meals: Whole grain products (bread, oatmeal, etc.), vegetables. Cold cuts preferably low-fat (optimally 6% fat: 6 gram fat/100 gram of product). The Danish "keyhole label" is for products with maximum 10% fat (10 gram fat/100 gram of product).

- Dinner: Meals should be served in restricted portions according to the T-model or "healthy plate model" as illustrated in Figure 1. The meal may be preceded by the intake of a large glass of water. Preferably only one serving. After consuming the first portion, the child should wait at least 20 minutes before a second serving is considered.

Figure 1: T-plate model (healthy plate model)



b) General advice with food intake:

- Bread and pasta should always be whole grain variants. White bread should be avoided.
- No butter or spread on the bread. It is recommended that butter is removed from the household.
- Lean cold cuts with max 6% fat.
- Fibers corresponding to the fiber 5+ gram rule (minimal intake of fibers in grams per day = age + 5) (33).
- Vegetables/salads may be consumed in large amounts (attention to abdominal pain due to large fiber load).
- Maximum two fruit servings a day for example one apple and one piece of watermelon.
- Intake of fluids should be covered by water and half a liter of skimmed milk a day. It is recommended that soft drinks are removed from the household. Replacement with "light products" is unsuitable as it maintains the desire and need for "sweetness".

c) Food intake miscellaneous:

- Fast-food maximum once a month.
- Candy and other sweets maximum once a week and in very limited quantities.
- Do not eat in front of TV/PC /PlayStation/etc.

2) Activity/Exercise (increasing energy consumption/reducing inactivity):

- Maximum two hours daily of screen time (TV, PC, mobile phone etc.), besides school work. This restriction is age dependent (younger children should be restricted to an even shorter screen time).
- Time monitoring, for example a mobile phone can advantageously be used as a tool to enable screen time compliance.
- If not related to school assignments, time in front of TV or PC should be omitted prior to 5 p.m.
- At least one hour of exercise every day (should generate significant rise in pulse /sweating. Every session should last at least 20 minutes).
- Team sports should be encouraged. Some sports traditionally are more accessible when it comes to the inclusion of obese children (e.g. American football, volleyball and handball).
- Daily transportation to/from school should be by foot/ bike, if this doesn't pose a traffic-related danger.
- Many families gain from using pedometers that may be acquired for reasonable sums in sports shops and pharmacies. Children should walk at least 10,000 steps per day depending on age.

3) Sleep:

- No screen time after bedtime (when the child goes to bed, it is recommended that the TV and the computer is turned off and the mobile phone is silenced).
- Age-appropriate bedtime and hours of sleeping (34, 35).

4) Tobacco and alcohol:

- A complete smoking cessation should be encouraged. Children, young people and parents smoking should be offered relevant counseling for tobacco cessation
- Children and young people under the age of 16 should not drink alcohol. Young people above the age of 16 are recommended to drink as little alcohol as possible and not to exceed 5 units on the same occasion. These are the recommendations by the Danish National Board of Health
<https://sundhedsstyrelsen.dk/en/health/alcohol>

5) Pharmacotherapy and surgery:

- Pharmacotherapy is rarely indicated. Effective products are scarce and there is currently no consensus for pharmaceutical treatment.
- There is generally no indication for obesity surgery in children.

SUMMARY:

Overweight children are at an increased risk of becoming obese adults, which may lead to shorter life expectancies in the current

generation of children as compared to their parents. Furthermore, being an overweight child has a negative psycho-social impact. We consider obesity in children and adolescents a chronic illness, which is in line with the American Medical Society. We summarize the evidence for the efficacy of a combination of diet, physical activity and behavior-focused interventions in a family-based setting. The present guidelines propose a multidisciplinary service implemented as a "chronic care model" based on "best clinical practice" inspired by an American expert committee and the daily practice of "The Children's Obesity Clinic" at Copenhagen University Hospital Holbaek.

Children and adolescents should be referred for examination and treatment in a pediatric setting when BMI corresponds to an isoBMI of minimum 30 or BMI corresponds to an isoBMI of 25 and complex obesity is suspected.

Obtaining a thorough medical history is pivotal. We propose a structured interview to ensure collection of all relevant information. We recommend physical examination focused on BMI, waist circumference, growth, pubertal stage, blood pressure, neurology and skin and provide comprehensive paraclinical investigations for obesity and obesity related conditions.

Treatment of obesity in children and adolescents is fully dependent on the combined effort of the entire family. This cannot be overemphasized! The main principle of the treatment is developing an individual detailed plan for every patient to reduce caloric intake whilst increasing physical activity, leaving no ambiguity with the recommendations.

REFERENCES:

1. Olshansky SJ, Passaro DJ, Hershov RC et al. A potential decline in life expectancy in the United States in the 21st century. *NEJM* 2005; 352: 1138-45.
2. Guo SS, Roche AF, Chumlea WC et al. The predictive value of childhood body mass index values for overweight at age 35 y. *Am J Clin Nutr* 1994; 59: 810-9.
3. Freedman DS, Khan LK, Serdula MK et al. The relation of childhood BMI to adult adiposity: the Bogalusa Heart Study. *Pediatrics* 2005; 115: 22-7
4. Steinberger J, Moran A, Hong CP et al. Adiposity in childhood predicts obesity and insulin resistance in young adulthood. *J Pediatr* 2001; 138: 469-73.
5. Singh AS, Mulder C, Twisk JW et al. Tracking of childhood overweight into adulthood: a systematic review of the literature. *Obes Rev* 2008; 9: 474-88.
6. Niclasen BV. Overvægt og fedme - Sociale følger, holdninger, selvværd og livskvalitet med fokus på børn og unge. *Ugeskr læger* 2005; 167: 1145-8.
7. Wabitsch M. Overweight and obesity in European children: definition and diagnostic procedures, risk factors and consequences for later health outcome. *Eur J Pediatr* 2000; 159: s8-s13
8. Franks PW, Hanson RL, Knowler WC et al. Childhood obesity, other cardiovascular risk factors, and premature death. *NEJM* 2010; 362: 485-93.

9. Sorof J, Daniels S. Obesity hypertension in children: a problem of epidemic proportions. *Hypertension* 2002; 40: 441–7.
10. Baker JL, Olsen LW, Sørensen TI. Childhood Body-Mass Index and the risk of coronary heart disease in adulthood. *NEJM* 2007; 357: 2329–37.
11. Pearson S, Olsen LW, Hansen B et al. Stigning i overvægt og fedme blandt københavnske skolebørn i perioden 1947–2003. *Ugeskr læger* 2005; 167: 158–62.
12. Larsen LM, Hertel NT, Mølgaard C et al. Prevalence of overweight and obesity in Danish preschool children over a 10-year period: a study of two birth cohorts in general practice. *Acta Paediatr* 2012; 101: 201–7.
13. Pearson S, Hansen B, Sørensen TIA et al. Overweight and obesity trends in Copenhagen schoolchildren from 2002 to 2007. *Acta Paediatr* 2010; 99: 1675–78.
14. Rasmussen M, Due P, red. Skolebørnsundersøgelsen 2010. København: Statens Institut for Folkesundhed 2011. <http://www.hbsc.dk/rapport.php?file=HBSC-Rapport-2010.pdf>
15. Summerbell CD, Waters E, Edmunds L et al. Interventions for treating obesity in children (Cochrane review). *The Cochrane Library*, 2005; Issue 2.
16. Oude Luttikhuis H, Baur L, Jansen H et al. Interventions for treating obesity in children (Cochrane review). *Cochrane Database Syst Rev* 2009; Issue 1.
17. Reinehr T, Temmesfeld M, Kersting M et al. Four-year follow-up of children and adolescents participating in an obesity intervention program. *Int J Obes* 2007; 31: 1074–7.
18. Reinehr T, Kleber M, Lass N et al. Body mass index patterns over 5 y in obese children motivated to participate in a 1-y lifestyle intervention: age as a predictor of long-term success. *Am J Clin Nutr* 2010; 91: 1165–71.
19. Holm JC, Gamborg M, Bille DS et al. Chronic care treatment of obese children and adolescents. *Int J Pediatr Obes* 2011; 6: 188–96.
20. Holm JC, Gamborg M, Ward LC et al. Tracking of leptin, soluble leptin receptor, and the free leptin index during weight loss and regain in children. *Obes Facts* 2011; 4: 461–8
21. American Medical Association House of Delegates. Recognition of obesity as a disease. 2013, 420 (A-13). <http://www.npr.org/documents/2013/jun/ama-resolution-obesity.pdf>
22. Flynn MA, McNeil DA, Maloff B et al: Reducing obesity and related chronic disease risk in children and youth: a synthesis of evidence with “best practice” recommendations”. *Obes Rev* 2006; 7: 7–66.
23. Barlow SE, Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report. *Pediatrics* 2007; 120: s164–s192.
24. Batch JA, Baur LA. Management and prevention of obesity and its complications in children and adolescents. *Med J Aust* 2005; 182: 130–5.
25. Han JC, Lawlor DA, Kimm SY. Childhood Obesity. *The Lancet* 2010; 375: 1737–48.
26. Opsporing og behandling af overvægt hos førskolebørn DSAM og Sundhedsstyrelsen, 2006. http://www.sst.dk/publ/Publ2006/CFF/Overvaegt/Overvaegtige_boern.pdf
27. Tinggaard J, Aksglaede L, Sørensen K et al. The 2014 Danish references from birth to 20 years for height, weight and body mass index. *Acta Paediatr* 2014;103: 214–24.
28. Krebs NF, Himes JH, Jacobson D et al. Assessment of child and adolescent overweight and obesity. *Pediatrics* 2007; 120: s193–s228.
29. Pearson S, Broøløs EJ, Herner EB et al. Screening Copenhagen school children at risk of type 2 diabetes mellitus using random capillary blood glucose. *Acta Paediatr* 2007; 96: 885–9.
30. Brannsether B, Roelants M, Bjerknes R et al. Waist circumference and waist-to-height ratio in Norwegian children 4–18 years of age: Reference values and cut-off levels. *Acta Paediatr* 2011; 100: 1576–82.
31. Fernandez JR, Redden DT, Pietrobelli A et al. Waist circumference percentiles in nationally representative samples of african-american, european-american, and mexican-american children and adolescents. *J Pediatr* 2004; 145: 439–44.
32. Vilmann LS, Thisted E, Baker JL et al. Development of obesity and polycystic ovary syndrome in adolescents. *Horm Res Paediatr* 2012; 78: 269–78.
33. Spear BA, Barlow SE, Ervin C et al. Recommendations for treatment of child and adolescent overweight and obesity. *Pediatrics* 2007; 120: s254–s288.
34. Iglowstein I, Jenni OG, Molinari L et al. Sleep duration from infancy to adolescence: reference values and generational trends. *Pediatrics* 2003; 111: 302–7.
35. Taveras EM, Rifas-Shiman SL, Oken E et al. Short sleep duration in infancy and risk of childhood overweight. *Arch Pediatr Adolesc Med* 2008; 162: 305–11.