

OVERWEIGHT AND OBESITY IN EUROPEAN CHILDREN AND ADOLESCENTS

Causes and consequences – prevention
and treatment



REPORT

Prepared by the ILSI Europe
Overweight and Obesity in Children Task Force

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Report on Overweight and Obesity in European Children and Adolescents: Causes and consequences – prevention and treatment

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THE ILSI EUROPE OVERWEIGHT AND OBESITY IN CHILDREN TASK FORCE

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CONTENTS

INTRODUCTION AND BACKGROUND	4
SUMMARIES OF THE EXPERT GROUP REVIEW PAPERS AND PANEL DISCUSSIONS	5
1 Overweight and obesity in European children and adolescents – risks to health	5
2 Epidemiology of childhood overweight and obesity in Europe	7
3 Aetiology of childhood overweight and obesity in Europe	10
4 Intervention – primary and secondary prevention of overweight and obesity in European children and adolescents	14
EXECUTIVE SUMMARY OF REVIEW PAPERS	17
REFERENCES	21
ANNEX	21
WORKSHOP PARTICIPANTS	22

INTRODUCTION AND BACKGROUND

Obesity is one of the most common health problems in affluent societies. It is associated with increased risks of morbidity, and of mortality from non-communicable diseases such as diabetes, hypertension, and cardiovascular disorders. The economic impact of obesity, its treatment and the treatment of its co-morbidities is considerable, straining limited resources throughout Europe. There is also increasing evidence that childhood obesity, particularly in adolescence, is a strong predictor for adult obesity, especially among the off-spring of obese parents, and hence must be considered as an important public health issue. Finally, the long-term success rates of different treatment approaches are extremely low and therefore it is essential to focus on the prevention of obesity, starting in childhood and adolescence. In order to understand how such a preventative strategy may be developed, it is necessary to establish the prevalence of the problem among children and adolescents, to understand the determinants of childhood obesity and how they might be modified, and to identify at risk groups in the population.

An overview on childhood obesity and its causal and consequential relationships was published in 1998 from the proceedings of a workshop supported by ILSI [1]. However, this review concentrated mainly on the available data in the United States. Consequently the ILSI Europe Task Force on Overweight and Obesity in Children invited an expert group to review the existing literature in Europe, establishing the prevalence of overweight and obesity in children and adolescents, and its determinants, including heredity, early nutrition, cross-cultural food habits, physical activity patterns, and psychological and socio-economic factors. The expert group produced five draft review papers, collating the results from a wide range of studies and, where possible, comparing the situations in Europe and in the United States, and between individual countries in Europe. The papers addressed five key areas: health risks, epidemiology, aetiology, physical activity, and intervention/prevention.

The contents of these papers were presented and discussed and their conclusions reviewed in a mini-workshop held by ILSI Europe in Brussels (1 December 1998). The final full-length versions of the papers have been published in a peer-reviewed journal [2]. During the workshop a number of key themes were highlighted and formed the basis for a panel discussion: Health Risks, Epidemiology, Aetiology and Intervention. Using these four themes as a basis, the following sections summarise the key points from the papers and the discussions and conclusions from the mini-workshop.

SUMMARIES OF THE EXPERT GROUP REVIEW PAPERS AND PANEL DISCUSSIONS

1. *Overweight and obesity in European children and adolescents – risks to health*

Obesity can be defined as the pathological accumulation of excess body fat. In obese children, accumulation of body fat mainly occurs at subcutaneous sites, whereas in adolescents, as in adults, fat is also deposited intra-abdominally, a pattern associated with increased risk of metabolic disturbances.

The adverse effects and health risks of obesity in European children appear to be similar to those reported for American children and adolescents. In the short-term, these include both physical and psycho-social problems. Data from longitudinal studies suggest that in the longer term, childhood obesity, after three years of age, is associated with an increased risk of adult obesity and an increased morbidity and mortality in adult life, with persistence of metabolic abnormalities (see below) and an increased risk of cardiovascular disease and certain cancers. However, the European data in this area are sparse and limited; there is a need for new studies to assess the current situation in Europe.

The early medical consequences of childhood obesity include endocrine and metabolic disturbances. In some obese boys endocrine changes cause breast enlargement and delayed genital development. In girls hirsutism and acne may occur.

Cardiovascular risk factors associated with increased adult morbidity and mortality have been shown to occur in obese children and adolescents. Hyperinsulinaemia and impaired glucose tolerance, which may be early signs of non-insulin dependent diabetes (NIDDM)*, are associated with childhood obesity. Interestingly, there is evidence of increasing prevalence of NIDDM already in adolescence, paralleling the increase in number of obese adolescents, observed during the past few years. Abnormalities in blood lipids and raised blood pressure, also cardiovascular risk factors in adults, have been found in obese children. The metabolic changes seen in obese children and adolescents can be described as the *pre-metabolic syndrome*. They may be associated causatively with the observed endocrine disturbances in obesity (e.g. growth hormone deficiency, hyperleptinaemia).

There is evidence that the pattern of body fat distribution may be important in childhood. In adolescent girls abdominal fat deposition is associated with an adverse metabolic risk factor profile, in the same way as it is in adulthood. These relationships are less evident in younger girls and obese boys, due to the rapidly changing distribution of body fat during puberty. Data suggest that weight reduction can significantly decrease or even normalise levels of these metabolic risk factors, especially when abdominal fat is lost.

Other physical consequences of childhood obesity include orthopaedic problems and associated impairment in physical mobility and activity; abnormalities in the immune response, with increased susceptibility to infection, notably of the upper airways; alterations to the skin, associated with infection and reduced wound healing; and night-time respiratory problems and sleep apnoea, associated with deficits in neurocognitive ability.

* A new terminology is Type 2 diabetes.

Changes in physical appearance, as described above, and their psycho-social consequences are of equal, or for the children themselves, of greater importance than the medical consequences. Discrimination leading to social isolation may occur. Low self-esteem and abnormal behavioural patterns are common.

The long-term health risks of childhood obesity are still unclear and the relationships with age of onset of obesity, degree of adiposity, parental obesity, timing of puberty, and socio-economic factors have been actively debated. Many of the data available on tracking childhood obesity into adulthood derive from cohort studies in either the United States, Sweden or the UK, conducted 20 or more years ago, when the prevalence of obesity was lower, and generally methodological differences in the available studies have hampered the assessment of relationships between obesity in childhood and adulthood.

Notwithstanding the inconsistencies, there are some apparent trends. All studies show that obese children are more likely than normal weight children to become obese adults. Paradoxically, today, the majority of obese adults were not obese as children, but this picture may change in the near future. Childhood obesity in the second decade of life is an increasingly strong predictor of adult obesity. If one or both parents are obese, the likelihood of persistence of obesity in adulthood is greater.

Conclusions and research needs

Although data indicate a variety of health risks associated with obesity in European children, the exact prevalence of these co-morbidities is uncertain. No information is available on the influence of the degree and of the duration of obesity in European children and adolescents on health in adulthood.

Cross-sectional studies in defined populations are needed to provide current prevalence data, but longitudinal studies are essential to track the early complications in obese children and to establish relationships with obesity and health risks in adult life.

2. *Epidemiology of childhood overweight and obesity in Europe*

Definitions of obesity

The estimation of the prevalence and secular trends in childhood obesity, both within and between different countries in Europe, is severely restricted by the wide range of different definitions and cut-off points for overweight and obesity in different populations of children. A major problem is in the assessment of body composition, which unlike in adults, is complicated by the natural age-related physiological variations in body composition during childhood. Anthropometric measures of height, weight and calculation of the Body Mass Index (BMI), defined as weight (kg)/[height (m)]², and measurement of skinfold thickness at specific sites, have been used to measure fatness and to define and track obesity in both adults and children. However, their measurement in different studies is subject to variation in both sensitivity and specificity, making it difficult to make comparisons between these studies.

The identification of suitable cut-off points for defining overweight and obesity is critical. In children, the 90th and 97th centiles, respectively, have been used. However, it is important to establish cut-off points that correspond with health risks, in the same way as the 25 and 30 kg/m² cut-offs used in the adult BMI charts, which are crudely based on known risk ratios.

In recognition of the need for an international consensus on the definition of childhood overweight and obesity, the Childhood Obesity Working Group of the International Obesity Task Force (IOTF) has developed cut-off criteria with relative (age-specific) BMI charts [3] (Annex). The reference population was obtained by averaging from a heterogeneous group of surveys with differing rates of obesity prevalence. Data obtained on body mass index from six nationally representative cross-sectional surveys on growth (Brazil, Great Britain, Hong Kong, the Netherlands, Singapore and the United States) were used to develop centile charts for children. In order to link these with the definition for adult overweight and obesity, the curves for each population were drawn so that at age 18 years they passed through the cut-off points for BMI 25 and BMI 30 kg/m². The resulting curves were averaged to provide age- and sex-specific cut-off points from 2-18 years. The IOTF authors point out that although these cut-off points are less arbitrary and more internationally acceptable than others that have been used, this approach provides only a statistical definition which may still have its drawbacks.

In this context, it is also important to recognise that the degree of fatness can change at a constant BMI. Therefore, it is possible that while weight remains unchanged, children could be becoming fatter, reflecting the loss of muscle mass due to decreasing physical activity. Consequently, additional standardised measures of body fatness, based on skinfold thickness, may be needed in the assessment of childhood obesity, in order to follow long-term trends in adiposity.

Prevalence

Cross sectional studies can be useful in providing a 'snapshot' view of the prevalence of obesity at a given time. There have been numerous studies of this type throughout Europe, but the ranges in the prevalence estimates derived from them are considerable. The ranges should be viewed with caution, given that the population samples in some studies are small or may be confined to sub-groups of the population, that in some cases the randomness of the groups is uncertain, and that the indices used for assessment of body fat are variable.

Nevertheless, the data show complex patterns varying with time, age, gender and geographical region. Overall, obesity prevalence rates in young children (under 5 years) are relatively low (reported ranges 1%-4%), compared to older children (7-11 years; reported ranges 2%-23%) and adolescents (12-18 years; reported ranges 2%-29%). Gender differences are inconsistent. Some studies, for example from Italy, Austria and Finland, indicate a higher prevalence among boys, whilst others, from Britain and Spain, suggest that the prevalence is higher among girls.

The most obvious trend in these data is the geographical variation in the prevalence of childhood obesity, with the highest rates observed in Eastern European countries, especially Hungary, and in Southern Italy, Spain, and Greece. In contrast, Northern European countries have lower rates which are generally comparable across countries. Within countries, for example Italy, there are marked variations in regional prevalence, with lower rates in the North. The explanation for these geographical variations is unclear, but it would seem that environmental influences are strong and operate in complex ways both within and between countries.

Secular trends in prevalence

In the US, available data indicate that the prevalence of obesity in children and adolescents has increased, and also that the number of very obese children is growing. Therefore the fattest children are becoming fatter, with an increasing likelihood of the problem tracking into adult life.

Secular changes in the growth and maturation of European children and adolescents are variable: in some populations the trend towards early maturity and greater adult size is continuing, whereas in others it has stopped. Overall, throughout Europe, children are becoming taller at given ages. This is largely, but not wholly, explained by earlier maturation. Studies from some countries, such as France, the UK, and in Eastern Europe, also suggest that weight for height has increased with the increased stature – indicative of a tendency to greater fatness. However, in other countries, for example Belgium, increases in weight remain in line with height.

In order to monitor the trends in prevalence of obesity in European children, longitudinal studies of adequate size and duration, which reflect the ethnic and socio-economic composition of the population, are required. Unfortunately these only exist for a few European countries. The most robust are the British birth cohort studies: the National Survey of Health and Development, the National Child Development Study, and the National Study of Health and Growth, established in 1946, 1958, and 1972 respectively. Although these studies used different criteria for assessment of fatness, taken together, the data suggest that the prevalence of obesity in British children is increasing in line with the increased prevalence in British adults, and that the prevalence is greater among girls.

In contrast, data from a Finnish study has shown trends in the opposite direction, although this may reflect methodological differences. Data from the Amsterdam Growth and Health study and from an Italian study show trends in the same directions as in Britain. The diversity of social, cultural, economic and demographic conditions in Europe make it impossible to extrapolate these existing longitudinal data generally to Europe.

Conclusions and research needs

Overall there is considerable evidence that the prevalence of overweight and obesity is increasing within European countries, but there are marked regional variations in prevalence. Secular trends suggest that the increase appears to have been particularly marked during the 1980s in different countries and that in Europe, as in the US, the number of extremely obese children and adolescents is increasing. However, methodological and statistical limitations make comparisons of prevalence or rates of change between countries difficult.

The use of current data on height and weight as reference standards may obscure the increases in overweight and obesity in recent years. Further studies to compare trends in childhood obesity, using appropriate reference data sets such as the IOTF definitions and cut-off points, are still required.

It is unclear whether increased adiposity in childhood is a simple consequence of an overall increase in fatness in Europe, or whether there are sub-groups of children in European populations who, because of certain environmental conditions, may be especially susceptible at particular ages to the risks of obesity. Further research is required to assess this.

3. *Aetiology of childhood overweight and obesity in Europe*

Obesity is a multifactorial disorder, but there is general agreement that it is the result of variable interactions between genetic and environmental factors.

Genetic risks

Parental obesity is a key risk factor for childhood obesity and data from twin, adoption, and family studies suggest that genetic factors may account for 25%-40% of inter-individual differences in fatness. A variety of single gene defects leading to obesity has been identified in animals, and some of these have been shown to exist in humans as well. Leptin is the product of the *ob* gene and its deficiency has been shown to be involved in a few, very rare cases of extreme childhood obesity. Other rare single gene defects detected in humans include mutations in the leptin gene, in the leptin receptor gene, in the prohormone convertase I gene, in the pro-opiomelanocortin gene, and in the melanocortin-4-receptor gene. However, in general, genes that are involved in weight gain are not believed to directly cause obesity, but are believed to increase susceptibility to fat deposition in individuals exposed to specific environmental factors.

Environmental risks

An understanding of the variety of environmental factors influencing the development of obesity is hampered by the many methodological problems of measuring exposure to these factors over prolonged periods of time. There is some evidence that events very early in life, including exposure to high levels of glucose and insulin during foetal life, may influence subsequent obesity. It is recognised that infant feeding practices and development of food habits in the context of family lifestyle may also influence body weight, but it is difficult to untangle these factors from the influence of parental adiposity. Familial similarities in food composition and in levels of physical activity may partially explain familial patterns of fatness.

Dietary intake

The opportunities for eating and the pressures on children to eat are greater than ever before. Anecdotally it is said that the passive overconsumption of food which is palatable and readily available may contribute to increasing fatness in European children. There is a plethora of data relating to energy intake in European children, but a review of this data reveals no definite conclusions concerning the contribution of food intake *per se* to the increasing prevalence of obesity.

The collection of data on food habits and dietary intake in children is fraught with methodological difficulties. It is likely that the available data, which show a wide range in reported energy intake within specific age and gender groups, do not reflect habitual intake. It has been assumed that studies which have observed a decline in energy intake in industrialised countries reflect a response to a secular trend towards lower levels of activity. However, validation studies using the reliable doubly labelled water technique (DLW)* suggest that the energy intake data are prone to

*DLW measures total energy expenditure of non-restricted subjects over long periods. Subjects drink a dose of water containing the stable (non-radioactive) isotopes of ^2H (deuterium) and ^{18}O , which mix with normal hydrogen and oxygen in body water. As energy is expended hydrogen and oxygen are lost from the body; oxygen is lost more quickly as it is present in carbon dioxide and water. The rate of decline of both isotopes in urine over the course of the study is used to calculate carbon dioxide production and energy expenditure.

bias and are not necessarily indicative of a true decline in total energy expenditure. There is also evidence that both obese children and adolescents, in common with obese adults, underestimate self-reported food intakes.

The macronutrient composition of the diet has also been the subject of recent investigation in relation to obesity. Studies suggest that in adults increasing fatness is positively associated with the percentage of dietary energy derived from fat and negatively associated with the percentage of energy from carbohydrate. In children there is limited evidence of a similar relationship with dietary fat. Higher fat intakes are also associated with greater energy density, but the relationship between dietary energy density and childhood obesity requires further investigation. Some studies have also suggested that in toddlers and young children, high protein intakes may predispose to the development of later obesity, but this finding requires verification. More prospective studies are needed to determine the contribution of individual dietary components and dietary patterns to childhood obesity.

Eating frequency has been examined as another possible aetiological factor in obesity. Although studies have failed to show differences between total energy expenditure in 'nibbling' and 'gorging' individuals, future studies should take account of this factor, to better understand how it may relate to or influence food composition and intake.

Energy expenditure and physical activity

In adults it has been suggested that obesity may be better correlated with indicators of physical activity than with energy intakes. Sedentary behaviour among children, notably television viewing, has been identified as a significant predictor of weight gain later in life, but the evidence is equivocal, methodologically diverse and often cross-sectional; large longitudinal studies which accurately measure physical activity are not available.

The methodology for objectively measuring activity levels in children in such large studies is currently lacking. The assessment of physical activity and energy expenditure in children is particularly difficult, as many methods may induce behavioural changes in a child's spontaneous and natural activity patterns. The most common methods are diaries, activity recalls, observation, motion sensors, indirect calorimetry, heart rate monitoring, and the doubly labelled water technique. All have their advantages and disadvantages, but none are ideal.

Given the imperfections in existing data based on these techniques, certain trends in children's activity patterns are evident. Most studies using self-report methods, heart rate monitoring, or doubly labelled water indicate relatively high levels of physical activity in children and three national surveys on large representative samples report that 60%-70% of all children were involved in sufficient physical activity according to various definitions. Boys are generally more active than girls, and physical activity in boys and in girls declines with age, after peaking at around 13 to 14 years of age. There do not appear to be differences between the physical activity levels of European and American children, but the variations in methodology and definitions used in different studies make this difficult to judge.

Indirect evidence of declining activity levels, based on diminishing dietary energy intake, is available for both European and American children, but the weaknesses of this evidence have already been discussed. Other evidence of sedentary behaviour is the increasing amount of leisure time spent watching television, videos, and playing computer games. It is estimated that 30% (7%-51%) of European children watch television for more than four hours a day. The decline in independent activity of children outside the home, notably the use of cars for driving children to school and elsewhere, would also support the apparent decrease in overall activity levels. However, good direct data to support this apparent secular trend in declining activity levels are lacking.

As regards the relationship between physical activity and fatness, data from cross-sectional studies are quite consistent in demonstrating a negative association between childhood obesity and physical activity. However, supporting data from prospective studies are currently unavailable.

At present there is no convincing evidence that lack of physical activity is the dominant factor in the aetiology of obesity in European children and adolescents. However, it is possible that low habitual levels of activity in children may predispose towards obesity in adult life, if not during childhood. There is evidence of tracking of physical activity from childhood into adult life and that children who engage in regular physical activity are most likely to become active adults. A lack of appropriate and sufficient exercise is an important risk factor for cardiovascular disease in adults. However as yet, there is no consensus on the intensity and type of physical activity that may benefit health and development during childhood.

Socio-economic influences

The relationship between social factors and childhood obesity is equivocal and poorly understood. Socio-economic factors have received most attention, but the data are inconclusive, with some studies in the US and Europe showing an inverse relationship between socio-economic status and obesity prevalence, and studies from the UK, Denmark, Sweden and Italy showing no relationship. These unclear relationships within Europe may reflect in part inter-country differences in classification of socio-economic background, in sampling and in analysis.

In Eastern Europe, changes in the former communist countries have brought about profound changes in the social and economic environment, which may influence growth status. Previously, the absence of social differences in the growth of children may have reflected a general equalisation in salaries and living conditions across social groups. However, the switch to a free-market economy may result in the emergence of socio-economic differentials in child growth. It is also possible that the secular trend towards harmonisation in social standards in Western European countries has blurred social class associations. Changing demographic and social characteristics in Europe, such as the increase in one-parent families, decrease in family size, and more dual income families, may influence the family in many ways including dietary and physical activity patterns. Clarification of the role of these factors is important in studies on childhood obesity and in the development of effective intervention and preventative strategies.

Conclusions and research needs

Obesity is the consequence of a long-term imbalance between energy intake and energy expenditure, but the mechanism of this imbalance is unclear. It may be unrealistic to quantify the precise contribution of diet and physical activity in the aetiology of obesity, given the small day-to-day energy imbalance which leads to weight gain in the long-term. It is also difficult to establish whether changes in diet and/or physical activity precede or follow changes in fatness.

Some of the available prospective studies indicate that various confounding variables, such as parental weight and initial weight of the subjects, explain a greater proportion of the variance in relative weight or fatness than diet or physical activity. Establishing the time course of these events will require long-term prospective studies with repeated measures of adiposity, diet, and physical activity, including more research to determine the contribution of individual dietary components and dietary patterns, including the energy density of the diet.

There is a need to identify the type and quantity of physical activity that promotes normal child development and promotes health. Methodologies used in assessing activity in large studies must be improved before trends and variations in physical activity levels can be identified, and proof concerning the role of physical activity in childhood obesity can be properly established.

The role of sedentary activities, such as television viewing – and not simply the absence of specific forms of physical activity – is now recognised as important and should be assessed. These distinctions are important as they are not mutually exclusive; children who play a lot of sport may also watch a lot of television.

Further research is required to establish whether critical levels of physical activity exist, below which it is difficult to regulate body weight. There is also a need to determine the mechanism through which physical activity exerts its effect – either through the energy cost of increased activity *per se* or through a secondary effect on appetite and food intake.

Few aspects of the social environment of children are consistently associated with indices of fatness in children. Nevertheless, the heterogeneity of socio-economic conditions throughout Europe and the diversity of factors underlying them make it critical that their impact on the growth status of children be continuously and carefully monitored.

Finally, the study of gene-environment interactions is a key area for future research, as a means both of identifying individuals at the highest risk of developing obesity and in predicting the outcome of specific treatment interventions. However, the design and analysis of such experiments may be difficult.

4. *Intervention – primary and secondary prevention of overweight and obesity in European children and adolescents*

The apparent increase in the number of obese children and adolescents underlines the necessity for intervention focusing both on primary prevention and secondary prevention (treatment) strategies. The particular need for primary prevention strategies is emphasised by the documented failure of obesity treatments to achieve long-term success (particularly in adults) and the fact that once obesity is established, weight loss may not reverse its adverse health effects. Nonetheless, there is a lack of awareness of the importance of primary prevention programmes in most European countries, not just among the general public but also among the medical professions.

Primary prevention

The aim of primary prevention strategies is to establish healthy, active lifestyles among young people, which enable them to attain and maintain body weight and adiposity within ranges compatible with good health. Primary preventative measures can be directed towards high-risk individuals, high-risk groups, or the whole population.

Targeting high-risk individuals, who at an early stage are identified as being likely to develop obesity, is relatively costly. Normally such individuals only emerge when treatment is required. Selective prevention that targets groups of people at risk because of genetic or environmental factors, and which aims to improve their knowledge and skills in order to avoid obesity, may be possible to initiate through kindergarten/nurseries, schools, colleges and community centres. However, the overall high prevalence of obese children and adolescents in Europe suggests that the whole population approach would be most effective. At this level, healthy lifestyle messages can reach large numbers of both obese and non-obese children and adults in a cost-effective way. This approach may also beneficially influence other population risk factors such as high blood pressure and diabetes.

There has been little comprehensive research as to the effectiveness of preventative strategies. To date only one report of a primary prevention programme for European schoolchildren is available, from Germany, and as yet no results have been published. Again, this serves to underline the lack of emphasis placed on preventative strategies in Europe.

Secondary prevention – treatment

The treatment of childhood obesity aims to regulate body weight and body fat, through modifications to eating and exercise behaviour, whilst ensuring normal growth and development. The treatment strategy must involve the whole family, as frequently it is the family behavioural patterns which must change for treatment to succeed.

An important first component of the treatment is behavioural therapy, although this approach is only suitable for older children; with younger children behaviour control may be applied through parents or other adults in charge of the children. The behavioural approach allows both the individual and their family to recognise and modify the associations between eating behaviour and activity levels and external events or stimuli, for example social activities and mood. Permanent changes in attitude to eating and activity may influence body weight in the long-term.

The second treatment component is modification of dietary intake. This may involve the reduction or stabilisation of total dietary energy intake and the modification of both the macronutrient composition and the energy density of the food consumed. It may also focus on other aspects, such as the number of eating occasions and between-meal eating. The extent of dietary restriction may not only depend on the degree of obesity, but also on age. With younger children and those who are still actively growing, it is sufficient to only moderately restrict dietary intake to maintain body weight and "grow into body height", rather than aiming for weight loss. Close medical supervision of obese children is needed during treatment to ensure that normal linear growth is achieved. Little is known about the effects of dietary restriction on food preference and food habits in the longer term.

The third treatment component is the promotion of physical activity, or more specifically, of active lifestyles. Again this should involve the family. The value of modest increases in physical activity should be distinguished from that of more vigorous exercise. Light activity may contribute significantly to total energy expenditure if sustained for substantial parts of the day and may be particularly important for children, in view of evidence that they are involved increasingly in sedentary activities. Obese children are frequently afraid of participating in sport because of their appearance and lack of fitness. Therefore, exercise programmes should include "lifestyle exercise", i.e. walking instead of being driven, and using stairs rather than elevators, as well as structured sporting activities. Children and adolescents should be encouraged to aim for at least one 30-minute period of moderate activity daily.

A wide range of different treatment programmes embracing these approaches are offered to obese children and adolescents in Europe; these include outpatient clinics, dietary camps, individual, group and family therapy, and school-based programmes. However, there are few data from randomised treatment trials (and even fewer long-term data) to permit the scientific assessment of the relative advantages of these programmes. There is not yet enough information to determine the influence of the type and duration of therapy and their effects on long-term maintenance of a healthy weight or reduction of the co-morbidities associated with overweight.

Conclusions and research needs

Obesity is a public health problem and its prevention must be addressed from a population perspective rather than from a focus on individuals. Population-based preventative strategies fostering healthy dietary and physical activity choices should be developed. Such public health action requires an integrated approach encompassing environmental, educational, economic and legislative measures. The implementation of these measures will require general acceptance that the prevention of obesity, generally and in children, is not just the responsibility of individuals, their families, or health professionals, but requires a commitment from within all sectors of society. To date in Europe, there have not been any well-evaluated public health programmes aimed at population-level prevention of obesity.

A health care system which permits the early detection and management of obesity in children and adolescents is essential. The minority of children with specific gene defects contributing to their obesity should be identified and treated appropriately. However, changes in diet and activity habits are the main focus of treatment strategies for obesity. Both personal motivation for weight control and the support of family commitment for lifestyle changes are additional critical factors.

Further research into the treatment of obesity in children should be directed towards the development of successful programmes to evaluate the effectiveness of the individual treatment components (i.e. the specific individual aspects of both diet and of physical activity) and the development of successful family-oriented interventions and behavioural modifications.

Research also is required to determine the impact of interventions in childhood and adolescence on the long-term risks of obesity and of its co-morbidities in adult life.

Finally, it is important that the current enthusiasm for the promotion of increased levels of physical activity does not obscure the need to promote healthy balanced diets. It is also essential to recognise the susceptibility of this age group to the development of eating disorders such as anorexia nervosa and bulimia. This vulnerability highlights the need for carefully evaluated intervention studies which examine these issues.

EXECUTIVE SUMMARY OF REVIEW PAPERS

1. *Overweight and obesity in European children and adolescents – risks to health*

- The health risks of obesity in European children are similar to those reported for American children and adolescents. In the short-term these include both physical and psycho-social problems.
- In childhood, changes in physical appearance and their psycho-social consequences are of equal importance to the medical consequences of obesity.
- Cardiovascular risk factors associated with increased adult morbidity and mortality may be observed in obese children and adolescents; these include hyperinsulinaemia and impaired glucose tolerance, blood lipid abnormalities and raised blood pressure, as well as decreased physical activity.
- The pattern of body fat distribution may be important in childhood as well as in adults. In adolescent girls there is evidence of an association of abdominal body fat distribution with an adverse metabolic risk factor profile.
- The long-term health risks of childhood obesity are still unclear. Assessment of relationships between obesity in childhood and adulthood is hampered by a lack of research and inconsistencies in methodology.
- Nevertheless, obese children are more likely than normal weight children to become obese adults; obesity in the second decade of life is a strong predictor of adult obesity.

Research is needed to:

- Establish the prevalence of the co-morbidities associated with childhood obesity.
- Track the early complications in obese children and establish the relationships with health risks in adulthood.

2. *Epidemiology of childhood overweight and obesity in Europe*

- The estimation of prevalence and secular trends in childhood obesity in Europe is restricted by the wide range in definitions of overweight and obesity used in different studies.
- The Childhood Obesity Working Group of the International Obesity Task Force (IOTF) has developed cut-off criteria with relative (age-specific) BMI charts.
- Additional standardised measures of adiposity, based on skin-fold thickness, should be included when assessing obesity in childhood.
- Data from cross-sectional studies indicate geographical differences in the prevalence of childhood obesity within Europe, with the highest rates in Eastern and Southern European countries and the lowest rates in Northern Europe.
- There are also inter-country variations in secular trends in growth and maturation of European children.
- Overall, children are taller at given ages than in the past. In some countries, but not all, weight for height also has increased, indicative of increased adiposity.
- Generally, methodological variations and statistical limitations of currently available data make the comparisons of prevalence and secular trends in Europe difficult.
- Nonetheless, there is evidence, as in the US, of a general trend of increasing obesity in European children and adolescents.

Research is needed to:

- Establish the prevalence and compare trends in childhood overweight and obesity using the IOTF definitions and cut-off points.
- Establish if there are sub-groups of children in European populations who – because of certain environmental conditions – may be especially susceptible at particular ages to the risks of obesity.

3. *Aetiology of childhood overweight and obesity in Europe*

- Obesity is a multifactorial disorder resulting from the interaction of genetic and environmental factors. It is the consequence of a long-term imbalance between energy intake and energy expenditure, but the precise aetiology remains uncertain.
- Parental obesity is a key risk factor for childhood obesity and genetic factors may account for 25%-40% of inter-individual differences in adiposity.
- Although some gene defects associated with obesity have been identified, rather than directly causing the disorder, they are believed to influence susceptibility to increased fatness in response to environmental factors such as dietary intake and physical activity.
- Familial patterns of adiposity may also be explained by familial similarities in eating patterns, dietary composition, and physical activity.
- The collection of data on dietary intake in children is subject to methodological problems and available data may not reflect habitual intake. Dietary intake data from European children reveal no definite conclusions concerning the contribution of energy intake to the prevalence of obesity.
- The contributions of the macronutrient composition of the diet, including that of dietary fat, and of energy density, are also unclear and in need of further study.
- The study of physical activity levels in childhood is subject to methodological difficulties.
- Most available data are cross-sectional and their interpretation is difficult, although some trends are apparent. Boys are more active than girls, and activity levels decline with age after peaking in the early teenage years.
- Although sedentary activities (such as television viewing) have increased among children and provide an indirect indication of a decline in overall activity, there is no convincing direct evidence, as yet, that lack of physical activity is the dominant factor in childhood obesity in European children.
- However, low habitual activity levels may track into adulthood, predisposing to weight gain in adults. Low physical activity is also a cardiovascular risk factor.
- Various social factors, notably socio-economic status, may be involved in the aetiology of childhood obesity, but available European data are equivocal, in part reflecting inter-country variation in classifications, sampling, and analysis.
- Socio-economic changes within former communist Eastern European countries may have influenced growth status. In Western Europe, the trend towards harmonisation of social standards may have blurred social class associations.

Research is needed to:

- Determine the contribution of individual dietary components, dietary patterns, and energy density to the development of childhood obesity using reliable methodology.
- Improve the methodologies used to assess activity levels in large studies in order to establish physical activity trends among European children and the association with obesity, including the extent and influence of the trend in sedentary leisure activities.
- Establish whether critical thresholds of physical activity exist in relation to body weight regulation.
- Monitor both child growth status and familial dietary and physical activity patterns in different European countries in relation to changing demographic and socio-economic factors.
- Develop appropriate methodology to examine gene-environment interactions which may eventually help both to identify those individuals at risk of obesity and predict their response to specific interventions.

4. *Intervention – primary and secondary prevention of overweight and obesity in European children and adolescents*

- The increasing prevalence of obesity underlines the importance of both primary prevention and treatment strategies, but in many European countries, most people, including health professionals, are unaware of this.
- Primary prevention strategies aim to establish healthy, active lifestyles among young people, helping them to attain and maintain body weight within accepted ranges.
- Primary prevention can target high risk individuals or groups, or the whole population. The prevalence of obesity in European children suggests that the whole population approach is most appropriate and may benefit adults as well.
- Treatment of established overweight and obesity in childhood involves modifications to eating and exercise/activity behaviour patterns, whilst ensuring normal growth and development. The whole family should be involved for the treatment to succeed.
- Behavioural therapy is a key component of treatment – identifying cues for specific behavioural patterns in food intake and activity.
- Modification of dietary intake may involve reduction or stabilisation in energy intake and/or the manipulation of dietary macronutrient composition or energy density. The approach will depend on the degree of overweight and the age of the child.
- The promotion of physical activity encourages people to develop more active lifestyles not just through the uptake of vigorous exercise such as sporting activities, which initially may be difficult for obese children, but through substantial increases in the amount of light activity undertaken daily, such as walking and climbing stairs.
- The emphasis on physical activity should not obscure the need to promote healthy eating patterns.
- Various treatment programmes are offered to obese children and adolescents throughout Europe, but there have been few randomised long-term treatment trials to assess their relative advantages and specifically their long-term success.
- In devising both primary and secondary strategies, it is essential to recognise the susceptibility of young people to the development of eating disorders.
- Obesity prevention in Europe requires public health action, encompassing an integrated approach to environmental, educational, economic and legislative issues.

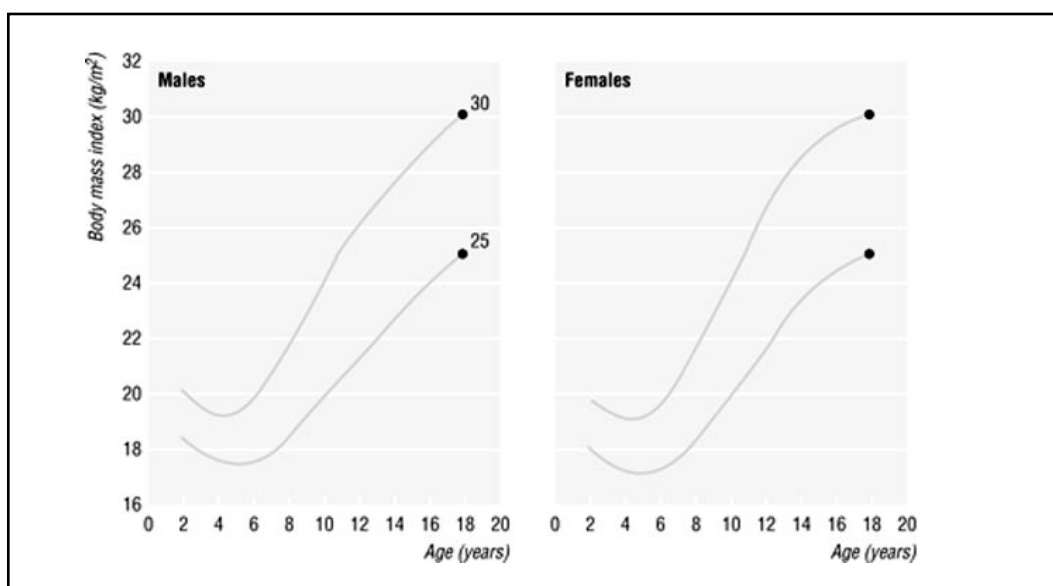
Research is needed to:

- Develop both successful primary prevention and treatment programmes which evaluate behavioural modification and the role of family-based intervention, as well as aspects of diet and physical activity.
- Determine the impact of intervention in childhood on the long-term risks of obesity and its co-morbidities in adult life.

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ANNEX



International cut-off points for body mass index by sex for overweight and obesity, passing through body mass index 25 and 30kg/m². Data from Brazil, Great Britain, Hong Kong, the Netherlands, Singapore and United States (Cole *et al*, 2000). Reproduced with permission from the *British Medical Journal*.

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