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Det helsevitenskapelige fakultet, UiT Norges arktiske universitet

Prevention of Obesity in Norway

-a literary analysis of what works and areas of improvement.

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Master's thesis in Profesjonsstudiet i medisin MED-3950 masteroppgaven/Kull 2012



Foreword

The process of writing this paper has been one of both frustration and learning. I have done what I could have never imagined myself to do, just a few years back, and it has taught me so much. But this paper could have never been completed without the skills and knowledge of my supervisor Maria Larsen, who have guided me through this process and been available day and night, weekdays and weekends. I hereby want to acknowledge my great appreciation for her help. Thank you!

I highly appreciated the help of Gudbjørg and Hanna for taking the time to give me great tips and insight in regard to my paper!

To my dear friends and family, who have put up with me through a stressful and turbulent journey, I am very grateful. Kiran, who have been my rock throughout the whole process, without him I would not know what to do. I am forever grateful!

I hope this paper can bring some insight to the important topic of prevention of obesity and inspire to more work in this area. It has become more and more clear to me the great work that lies before us as health professionals and I will definitely bring with me what I have learned through the process of writing this paper, in my future work as a doctor, as I hope to make a difference in the lives of my patients, towards a healthy, happy life, preferably without obesity.

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Abstract

Background: The rising numbers of obesity worldwide and in Norway calls for action on both treatments and prevention.

Aim: The aim of this study is to explore the causes and prevalence of obesity worldwide, and to furthermore explore current prevention strategies against obesity in Norway.

Method: Analysis of literature found through search in online databases like PubMed, Medline, UpToDate, Google scholar and the national online libraries in Norway for action plans and policies on the prevention of obesity. Key words used during search were causes of obesity, prevention of obesity, obesity and diet, and obesity and exercise/physical activity.

Results: The causes of obesity are complex and consist of both energy balance, genetics, socioeconomic status, factors that influence an individual's choices and lifestyle habits. There are several policies in place in Norway for the prevention of obesity on both national, community and individual level.

Conclusion: A lot is already been done to prevent and treat obesity, more knowledge on the effectiveness of strategies is needed however for further improvement to take place.

Introduction

Obesity is defined by World Health Organisation (WHO) as abnormal or excessive fat accumulation that may impair health (1), and is most often defined as Body mass index above 30, also waist circumference as a measure of visceral fat is of great importance.. The worldwide prevalence of obesity had more than doubled from 1980 till 2014, and numbers from 2013 showed that 41 million children under the age of 5 were either overweight or obese (1). In Norway, about 18% of women and 22% of men were obese in 2007/2008, the numbers appear to be rising, and about 16% of girls, and 13% of the boys were obese in 2015, these numbers seem to be stagnating. Obesity is positively associated with an increased risk for developing among others, cardio vascular disease (CVD), type 2 diabetes, hypertension, dyslipidemia, osteoarthritis and many forms of cancer (2). Obesity significantly lowers life expectancy in both men and women and is linked with an increased risk of all-cause-mortality (3).

It is not only the persons health that is at risk, but obesity is also of socioeconomic importance, as obesity and its related diseases is a big part of health budgets. The total health-care costs for obesity are, according to the WHO, estimated in 2007 to be between 2-6% in many countries (4).

The causes of obesity are largely studied, but still one cannot point at one single cause, but rather many causes. The conclusive evidence for causation of obesity is still under investigation but many major factors for obesity are already known. National institute of health (NIH), United State of America states that lack of energy balance over time most often causes obesity. According to NIH, energy balance means the amount of energy or calories one gets from food and drinks equals the amount of energy one's body uses for things like breathing, digesting, and being physically active. If the amount of energy intake is higher than the amount energy the body uses, then it results in overweight and obesity (5).

A large number of studies have been done on the causes and prevention of obesity, and yet still obesity has become a global epidemic that seems to be hard to halt or reverse. The challenge with prevention seems to be maintaining long-term results of

initial weight loss, especially after cessation of intervention or treatment. As more knowledge is gained on effective prevention methods, and the major causes, one might be able to see increased success in reversing the obesity trend. Through this study I wish to contribute to increased knowledge in this field, as the importance of prevention and treatment, both for the individual and the community, cannot be understated.

As obesity is increasing worldwide, and in Norway, and we know that it has a significant impact on health, and also has socioeconomic impact, the aim of this literary study is to explore the causes and prevalence of obesity worldwide, and furthermore explore current prevention strategies against obesity in Norway.

Method

The study is a literature analysis of review articles, single studies, international action plans, and Norwegian action plans. Literature for the study was found through search in databases like PubMed, Google Scholar, Medline and UpToDate. Key search words used were national prevention of obesity, causes of obesity, obesity and diet, obesity and exercise/physical activity, Obesity and sleep or screen time, effective prevention of obesity. For Norwegian literature, I search through government websites for action plans and studies on causes and prevention of obesity. Search of literature was done between August 2016 and May 2017.

Results

BMI versus waist circumference for definition of obesity

Body Mass Index (BMI) is an index of weight-for-height that is used commonly throughout the world. Cut off values for adults are set for four different weight categories; underweight, normal weight, overweight and obese that further divides into three different sub-categories, as shown in the table 1. Objectively a person having a BMI above 30 Kg/m² is considered obese (6).

The BMI method of classification for obesity recommended by WHO has its limitations such as, where the body fat is located and if the person's body weight is due to fat or muscle mass. In such cases, the waist circumference or waist-hip ratio is an alternative method for measuring and classifying obesity. Both BMI and waist circumference are useful tools to follow the development of weight in a population and to establish the health risk associated with increased obesity. More studies are needed however to determine the best method for predicting the risk for diseases in relationship to overweight and obesity (7, 8).

Weight Category	BMI Kg/m²
Under weight	< 18.5
Normal weight	18.5 - 24.9
Overweight	25 – 29.9
Obese	Class I: 30 – 34.9 Class II: 35 – 39.9 Class III (Severe obesity): > 40

Table 1: WHO classification of weight categories based on BMI (9).

Prevalence of Obesity

Worldwide

WHO estimated in 2014 that more than 1.9 billion adults were overweight and of these 600 million were obese. That equaled around 11% of the world's male population and 15% of the female population. The worldwide prevalence of obesity had more than doubled from 1980 till 2014, and numbers from 2013 showed that 41 million children under the age of 5 were either overweight or obese (1).

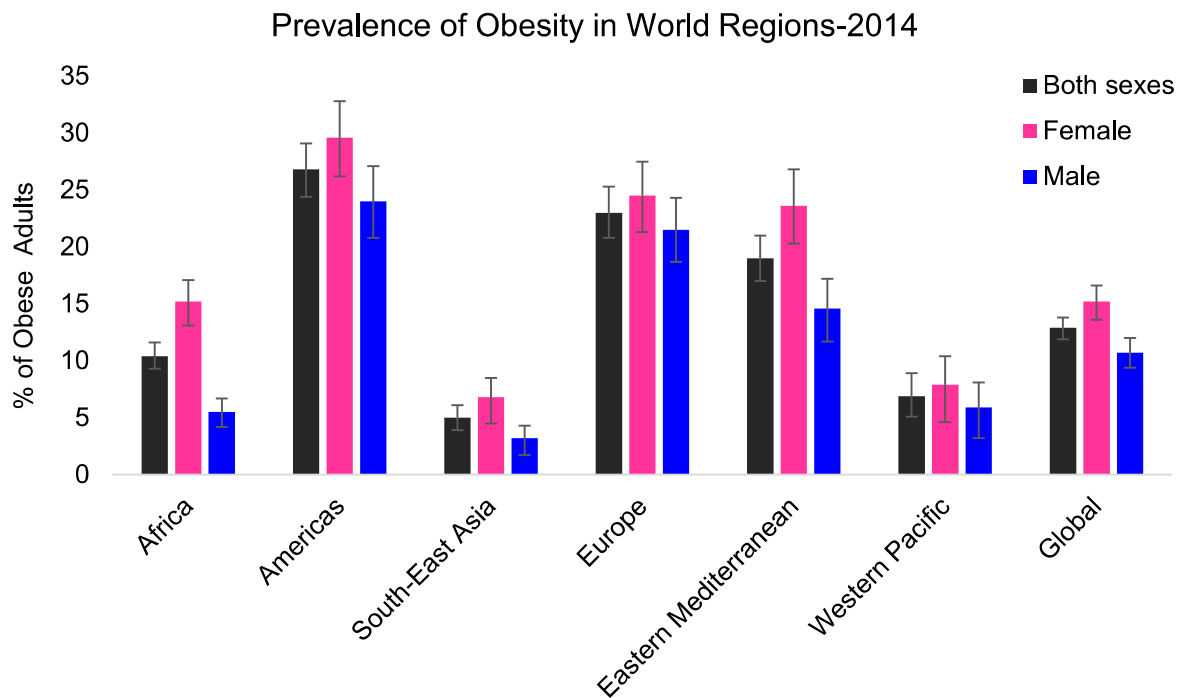


Figure 1: Prevalence of Obesity in World Regions (6).

Norway

Although there are few health studies in Norway regarding the prevalence of obesity, numbers from the three HUNT studies and Tromsø undersøkelsen, showed that the number of adults with overweight and obesity increased for women and men between 1985 and 2008, but that the increase in prevalence has been moderate as compared to the increase in women's prevalence of obesity, see figure 2 (10, 11).

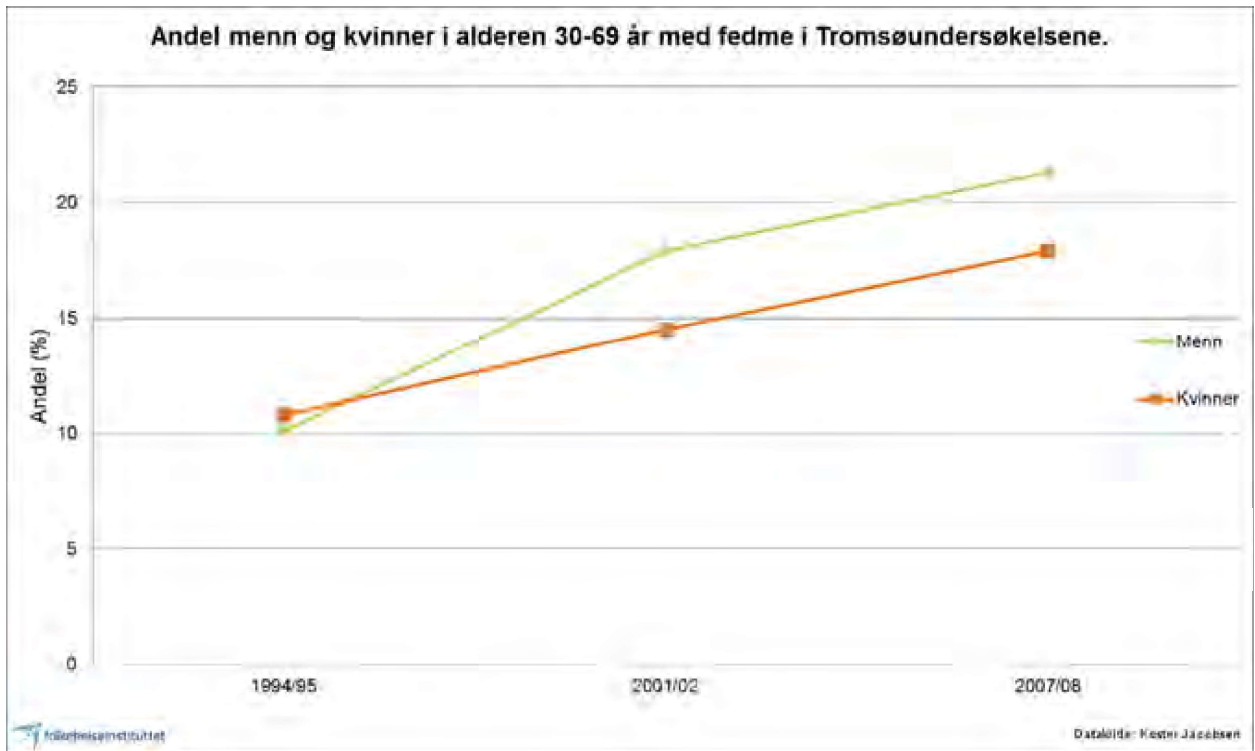


Figure 2: Percentage with obesity (BMI ≥ 30 kg / m²) in the Tromsø studies. Men and women (kvinner) aged 30-69 years. Age-adjusted figures (12)

The development of overweight and obesity amongst children and youth in are followed in Norway through the ongoing Child Growth Study of Norway, as a part of the *WHO European Childhood Obesity Surveillance Initiative (COSI)*. It is the only study in Norway that covers the entire country and follows the development in 8 and 9 year olds over time. This study together with the results from (13, 14), showed that the percentage of overweight children increased between 1970 and 2000, but little change in the prevalence of obesity amongst 8 and 9 year olds from 2008 to 2015, see figure 3 (15).

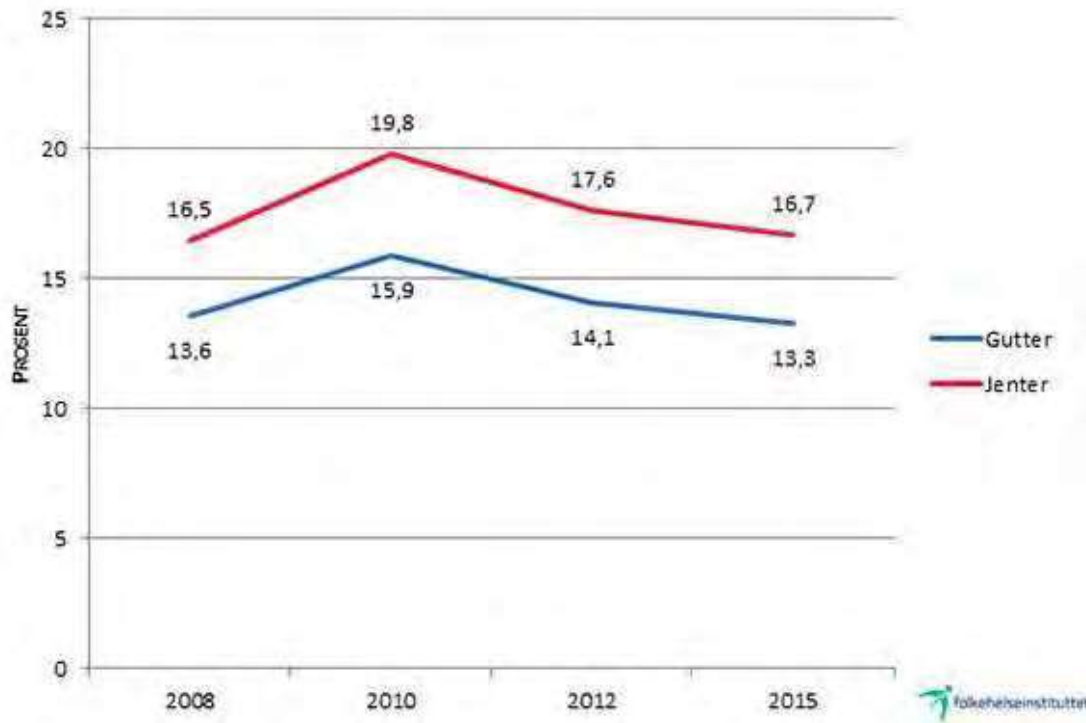


Figure 3 Percent of overweight including obesity amongst boys (gutter) and girls (jenter) ages 8-9 from 2008-2015 (12).

Causes of Obesity

Among the major known contributing factors of obesity such as lack of exercise, consumption of fatty or sugary foods etc., researchers find conflicting results making it difficult for prevention of obesity. Here, I will briefly discuss few of the major factors causing obesity and try to address the ambiguity in the research.

Diet and macronutrients

There is conflicting evidence into which foods are more likely to cause obesity. In the past excessive consumption of fatty foods was considered reason for obesity, however more recently excessive consumption of carbohydrates particularly sugar is considered the reason for increasing rates of obesity. One reason for this shift is that even though the consumption of energy from fat has decreased substantially in the past two decades in USA but obesity rates are on massive increase (16). Consumption of proteins from

animal meat (unprocessed red meat +0.43 kg, processed meats +0.42 kg) resulted in increase in weight (17) and is associated with increased risk of CVD, T2DM and certain types of cancer (18, 19). However, consumption of proteins from fish, nuts, beans, whole grain and low-fat dairy reduced risk for CVD and T2DM (20, 21).

Lifestyle

Among the various lifestyle factors, smoking cessation (new quitters +2,35 kg, former smokers 0.06 kg.) and consumption of carbohydrate rich foods such as potato chips (+0.77 kg), potatoes (+0.58 kg), sugar-sweetened beverages (SSB) (+0.45 kg) caused highest weight gain followed by consumption of meat (unprocessed red meat +0.43 kg, processed meats +0.42 kg), alcohol use (+0.19 kg per drink per day), television watching (+ 0.14 kg per hour per day) and sleep (more weight gain with <6 or >8 hrs. of sleep). Bornhorst et al concluded that long sleep duration may lead to healthier choices of food choices in children, and that there is a potential relation between high screen time use and increased consumption frequencies of foods high in fat, free sugar and salt (22).

Consumption of fish and fish oil

Buckley and Howe 2010 reviews several studies on the consumption of fish and fish oil in relation to obesity. They state that there is limited evidence available from large scale, long term studies, and the findings that occur are contradicting. Among the studies they reviewed, He *et al* (23) found a reduced prevalence of overweight in men with high consumption of fish compared with low consumption on fish, on a weekly basis. Whereas Iso *et al* (24) found increased prevalence of obesity amongst women with high consumption of fish compared with women who had low consumption of fish (25).

Sugar sweetened beverages

A clear association between sugar sweetened beverages (SSB) consumption and weight gain and increased risk for T2DM has been established in several studies (26-28). However, a meta-analysis of several studies showed that studies funded by food

industries reported significantly smaller effects undermining the facts (28).

Consumption of SSBs had a positive association with obesity and consumption of two servings of SSBs results in 26% higher risk for T2DM (27, 29). In a clinical trial, reduction of one serving/day of SSBs resulted in weight loss of -0.49 kg at 6 months and 0.65 kg at 18 months (30). Consumption of SSBs can also increase risk for visceral adiposity, increased hepatic de novo lipogenesis and hypertension (31).

Physical activity

Reduced physical activity was found to be a bigger determinant for obesity than excessive intake of calorie dense foods, or foods high in fat content according to Roland *et al.* They also discussed that some individuals may be more prone to a sedentary lifestyle, due to their genes, making them more susceptible for gaining weight (32). Knight *et al* reviewed several studies and found that the amount of physical activity needed to prevent long term weight gain, or successfully maintaining a normal weight in the elderly population is an average of 60 minutes of daily moderately intense activity, mostly walking. In addition, there was a 48% reduction in the likelihood of becoming overweight as a young adult when adolescents partook in extracurricular wheel related activities four times a week, and an added 28% reduction in the odds of becoming overweight when participating in PE every weekday (33). In a review by Milton *et al* they found a positive relationship between body composition and physical activity (PA). PA was associated with greater lean body mass and a reduced risk of overweight and obesity, but this association was not found in women. They concluded that for the most part lack of PA is linked with increased BMI and waist circumference, but this either not always the case or a provable fact (34).

Kiranmala *et al* reviewed several studies and stated that for the most part it is possible to show the link between greater amount of PA and lower BMI, % body fat etc., and vice versa. Increase in a sedentary lifestyle including TV watching, pc/videogames, lack of regular PA and failure to participate in PE classes in school is linked with prevalence of overweight and obesity in both children and adults. However, there is a lack of consistency in the evidence and one is therefore not able to state a cause-effect

relationship (35). This may in part be due to the gross simplified thinking of the human metabolism as “calories in, calories out”, as these two variables are not independent variables but both have an effect on each other. Increasing calorie expenditure also increases hunger for more calories (36).

Family, socioeconomic and environment

Global statistics shows that wealthy countries have higher obese adult population as shown in figure 4. In the Norwegian capital, the adult population is heavier in the eastern than in western districts, especially women (37), and previous Norwegian studies showed lower percentage of obesity among 40-year-olds with a high level of education than among 40-year-olds with a lower education (38). However, among the wealthy countries poorer families have a higher tendency for obesity and mother who are usually overweight tend to provide a home that fosters childhood obesity (39). There is a growing consensus among researchers that family environment plays a key role in obesity epidemic reviewed in (40). Children entering obesity clinic almost always have obese parents (41). Maternal overweight is positively associated with child overweight (42). Mother's BMI accounted for 17% of Children's BMI variance at age 8 and parental BMI accounted for 13.5% BMI variance at age 12 suggesting a strong correlation between parental obesity and childhood obesity (43). Another study in China, found that childhood obesity is not effected by nutrition but by the physical inactivity associated with screen (TV/computer) time and time taken to eat meals together (44).

Prevalence of Obesity in World Bank Income Groups in 2014

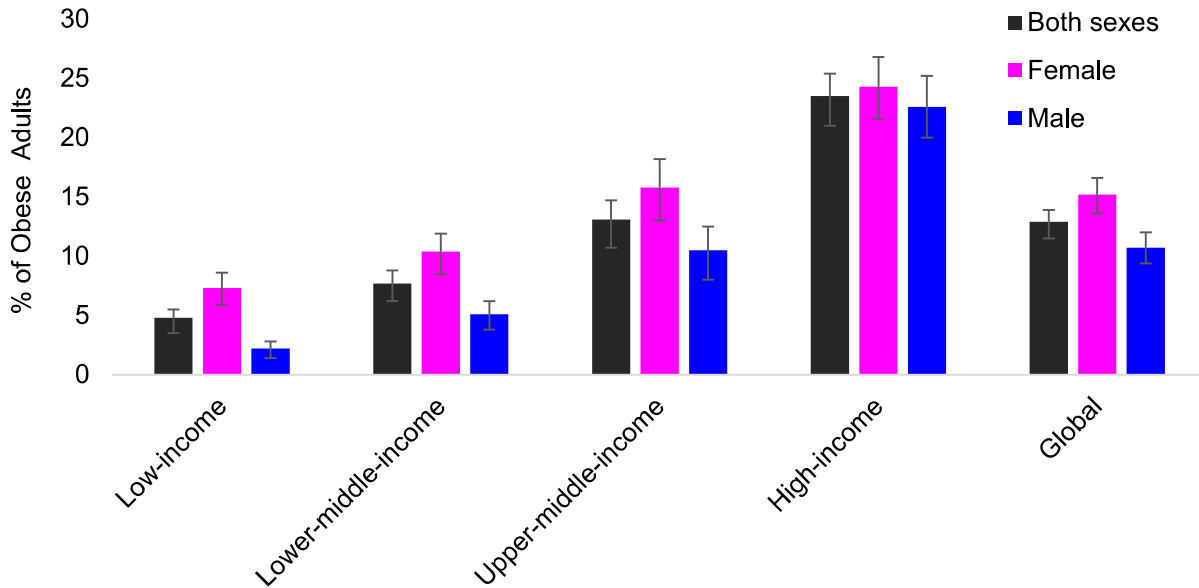


Figure 4. Prevalence of obesity in world bank income groups in 2014 (6).

Gut microbiome

Some studies have looked at the relationship between gut microbiome and obesity. Ley *et al* observed that human gut microbiota revealed a higher Firmicutes to Bacteroidetes ratio in obese adults. When these adults changed to a caloric restricted diet, their gut microbiota showed relative increase in Bacteroidetes. However, this relationship was not explored in the lean group (45). Asjlev *et al* found that the use of antibiotics (AB) in infants (< 6 months) increased the risk of obesity when the mother was normal weight, but not when mothers were overweight or obese. This suggests that the use of AB alters the gut microbiome which could contribute to changes in obesity risk (46). Infants (0-23 months) that were exposed to broad spectrum AB were found to be obese later in life, also after accounting for several risk factors including sex, urban primary care practice, insurance type, diagnosis of asthma, and steroid use. The same association was not found with the use of narrow spectrum AB, and is maybe due to the major shift in intestinal flora caused by the use of broad spectrum AB (47).

The Key to successful weight loss

Diet and macro nutrients

In regard to weight loss, several studies also found less weight loss in groups who consumed low-fat diets, compared with groups on high fat diets (21-23). Sacks *et al* concluded that irrespective of the macronutrient consumption (fat, carbohydrates and proteins), weight loss is achieved if total amount of calorie intake is reduced. However, there was no mention of whether the weight loss was sustained on a long-term basis beyond the 2-year period of the study lasted. Sacks and Shai showed that consumption of high protein diets is better for weight loss (23, 26). This may however be due to the tendency of low carbohydrate content in protein rich diets and higher energy expenditure in protein metabolism (27, 28). Carbohydrates with low glycemic index (GI) were found to be positively associated with weight loss (37). Such carbohydrates can also reduce the risk of T2DM, CVD, breast cancer and all diseases combined (38). Carbohydrates with a high GI are associated with weight gain and increased risk for CVD (39).

Lifestyle

Weight loss was associated with consumption of vegetables (-0.10 kg), whole grains (-0.17 kg), fruits (-0.22 kg), nuts (-0.26 kg), yogurt (-0.37 kg), and physical activity (-0.80 kg) and resulted in loss of weight (24, 25).

Consumption of fish oils

When it comes to weight loss and fish consumption, Thorsdottir *et al* found in a randomized control trial of 8 weeks on overweight young adults that adding fish or fish oil to a calorie restricted diet resulted in 1 kg more lost weight after 4 weeks and after 4-8 weeks, an average of 0,45 times the observed weight lost in week 1-4 for those who ate fish as compared to no fish or fish oil consumption in the diet (36).

Physical activity

When it comes to weight loss and physical activity, Chin *et al* examined the effectiveness of diet + exercise combined interventions versus exercise interventions

without calorie restriction, on inducing weight loss and BMI, changes in body composition, among others. They also discussed the role of PA in maintaining weight loss. From the studies they reviewed, they showed that interventions combining PA and diet intervention (DI), were more effective than diet only interventions in inducing weight loss (WL). These interventions produced an average of 8-11% WL at 6 months. Moderate to high intensity aerobic exercise (AE) 3-5 times per week without DI, resulted in about 2-3% WL at 6 months as compared to baseline. Interventions targeting only increased daily PA, i.e. “daily step counts” resulted in 1-1.5% WL of initial weight after 3-6 months. They also concluded that exercises have an important role in the active treatment phase, both to initiate WL, but also because it can lead to greater WL maintenance after active treatment phase (51).

Strategies in place for prevention in Norway

The WHO Europe and the Nordic countries have developed frameworks, guidelines and policies to combat the growing numbers of obesity, and the government of Norway has participated in the development of a number of them; The European Food and Nutrition Action Plan 2015-2020 (48). WHO European Action Network on reducing marketing pressure on children (49, 50), Joint Action on Nutrition and Physical Activity (JANPA) (51), Nordic Nutrition Recommendation 2012: Integrating nutrition and physical activity (52), and The European charter on counteraction obesity (53), among others. Norway and the Norwegian government has also been a part of this work and has developed their own action plans on physical activity, diet and nutrition. To halt the rise of obesity in the nation it is necessary to intervene at both national, community and individual level, and have interventions targeted to the entire population, groups at high risk of developing overweight/obesity, and towards those who are already struggling with the disease. Interventions and treatments geared at those who are already struggling must be both effective and available to prevent further development of obesity.

The NOURISHING framework, figure 5, is a proposal of policies put together by the World Cancer Research Fund International (WCRFI) to give comprehensive, clear and specific strategies to nations fighting against the obesity epidemic (54). Norway implemented policies from many of the areas within this framework. Below I will attempt to further describe the policies as well as high light other actions taken by the

Norwegian government, who either directly and indirectly are a part of combating obesity in the nation, I will also aim to evaluate their effectiveness, see Tabel 2 for list of interventions.

Domain		Policy area	Examples of potential policy actions
Food environment	N	Nutrition label standards and regulations on the use of claims and implied claims on foods	eg, nutrient lists on food packages; clearly visible "interpretive" and calorie labels; menu, shelf labels; rules on nutrient and health claims
	O	Offer healthy foods and set standards in public institutions and other specific settings	eg, fruit and vegetable programmes; standards in education, work, health facilities; award schemes; choice architecture
	U	Use economic tools to address food affordability and purchase incentives	eg, targeted subsidies; price promotions at point of sale; unit pricing; health-related food taxes
	R	Restrict food advertising and other forms of commercial promotion	eg, restrict advertising to children that promotes unhealthy diets in all forms of media; sales promotions; packaging; sponsorship
	I	Improve the nutritional quality of the whole food supply	eg, reformulation to reduce salt and fats; elimination of trans fats; reduce energy density of processed foods; portion size limits
	S	Set incentives and rules to create a healthy retail and food service environment	eg, incentives for shops to locate in underserved areas; planning restrictions on food outlets; in-store promotions
Food system	H	Harness the food supply chain and actions across sectors to ensure coherence with health	eg, supply-chain incentives for production; public procurement through "short" chains; health-in-all policies; governance structures for multi-sectoral engagement
Behaviour-change communication	I	Inform people about food and nutrition through public awareness	eg, education about food-based dietary guidelines, mass media, social marketing; community and public information campaigns
	N	Nutrition advice and counselling in health-care settings	eg, nutrition advice for at-risk individuals; telephone advice and support; clinical guidelines for health professionals on effective interventions for nutrition
	G	Give nutrition education and skills	eg, nutrition, cooking/food production skills on education curricula; workplace health schemes; health literacy programmes

Figure 5. NOURISHING Framework (54).

Implementation of actions and policies from the NOURISHING framework in Norway:

Health related taxes.

Norway have implemented taxes on sugar, chocolate, and sugar sweetened beverages. Although these taxes aren't primarily due to health reasons, they also have health implications. In 2017 the tax on sugar is at 7,81 NOK (\$ 0.94), the tax on chocolate and sugar products are is currently at 20,19 NOK/kg (\$2.43). The tax on non-alcoholic beverages that contain added sugar or other sweeteners vary from 2,34 NOK/liter (\$0.40) for beverages to 20,19 NOK/liter (\$ 2.43) for concentrated syrups. There is also a tax on the containers for beverages starting at 1,7 NOK/per container (\$0.12).

Marketing to children – self regulatory and government guidelines.

Norway legislated Broadcasting Act No. 127 of 1992 (Chapter 3.1). This act prohibits targeted marketing of any product including food and beverages to children under 18 in children's programmes on television, radio and teletext. This ban is only applicable to broadcast media originating from Norway. Norwegian Government has set standards on further range of communication channels and called for a voluntary initiative by industries and was agreed in 2013. This standard applies to marketing to children under the age of 13. Norwegian Ministry of Health signed a Memorandum of Cooperation with the Federation of Food Enterprises and the Association of Soft Drink Companies in 2011 to encourage companies not to advertise soft drinks to children aged 12 or under. The Memorandum applies to soft drink marketing in movie theatres and on TV if the audience consists of at least 50% children, and includes marketing activities on the internet and in the press.

Keyhole label, Mandatory nutrient lists on packaged food, Rules on health claims

The Key hole label was established by the Swedish Government in 1989, and was launched as a common Nordic label on June 17, 2009 in Sweden, Denmark and Norway. Its purpose is to help consumers choose products that contain less salt, sugar, and saturated fat, and more whole grains. Its voluntary to use the label, but products must conform to the nutritional requirements. Pre-packaged food must have nutrient contents on the back of the package, since December 2016.

Fruit at school ("Skolefrukt")

Schools in Norway have since 2007 provided a fresh piece of fruit or vegetable at lunch time. This was originally free, but as of 2014 parents now have to sign up for the students to get the fruit and they also have to pay a small fee. Ovrum and Bere 2013 found that this policy resulted in an average of 25% more fruit consumption in the kids who received fruit at school. Parents of these students also increased their fruit consumption by 12,5% (55).

Mandatory removal of trans fats in food products

Norwegian Food Act was amended in 2014 to prohibit the sale of fats or food with fats that contains more than 2g of trans fats pr 100g of fat. This does not apply to naturally occurring trans fats.

Behaviour change communication – public awareness, mass media and informational campaign and social marketing on healthy living

The Norwegian Health Directorate launched a national dietary advice campaign called Small steps – big difference ("Små grep, stor forskjell") in 2012. This is a national dietary advice campaign encouraging people to make changes to their diet to improve their health over time. Information on the campaign can be found on many social media platforms and all advices given on the pages are taken from the national counsels on diet and nutrition. The Facebook page would do well with some more promotion as it has only about 140 000 likes, in a population of around 5 million people "Små grep" (56).

Government action plans on nutrition (72).

Intervention in kindergartens and schools:

The government want to use food as an educational tool in kindergartens to increase the numbers of kindergartens serving healthy meals. Involving the kids in the making of the food served, teaching them about healthy foods and why they are important are one of the strategies proposed by the government. Due to this the government has introduced a program called FishFun "Fiskesprell". It's a dietary program for kindergartens and schools which educates and enables preschool and school teachers to teach children and students about seafood and fish, how to prepare it and the health benefits from eating seafood. The project has had great success, and has resulted in increased consumption of fish. They also give courses to parents (57)

Lunch break in school should be at least 20 minutes to allow kids to enjoy a healthy meal the government works to develop good materials for teachers and student to use in the food and cooking classes at schools. Every middle-school student who has cooking classes at school gets a free cookbook, called «Kokebok for alle – fra boller til

burritos», the book contains recipes that are in agreement with the national nutritional recommendations, and information about healthy options.

Marketing and food industry:

The government and the food industry has agreed to reduce salt, saturated fat and sugar content in pre-packaged foods. The goal is a gradual reduction of salt content in food, to at least half of what it is today. The government also wants to focus on nutrition when hiring food providers to health sector and other public facilities.

Information campaigns and communication:

Developing materials for counties to use in prisons and reception centres for refugees. A brochure of the Keyhole label has been printed in 14 different languages to reach as many as possible from a foreign background. There are several different websites available on food and nutrition, and aids to help individuals to a better diet. There are also specific websites for obese people who wants to get help on diet, physical activity and learn from other people's experiences. Here I list some of these websites: helsenorge.no, kostverktøyet.no, kostholdsplanleggeren.no (58-60). sunnframtid.no, martportalen.no (61, 62) and [lettereåleve](http://lettereåleve.no) (63).

Interventions in the municipalities and institutions run by them – health stations, Healthy Lifestyle Centres ("Frisklivssentraler"), nursing homes, prisons etc.:

The government has formulated policies for many of the institutions in the municipalities in the country, to improve the diet in the population at different levels of life. Policies on breastfeeding and guidelines on infant nutrition has been developed, as breastfeeding is positively associated with decreased risk of obesity later in life and because effect of behavioural treatment to induce healthy lifestyle habits for the reduction of obesity has been found to be more effectual when treatment is started early compared to later in life (64, 65). A course for all school nurses and midwives on breastfeeding, vitamin D and healthy food in kindergarten has been developed. Laws on the rights of breastfeeding mothers has been established, encouraging working mothers to continue breastfeeding (66). Guidelines on the prevention and treatment of obesity to children and adults, and guidelines for measuring and weighing children has been developed (67-69).

Training courses on nutrition and diet for people working in institutions run by the child protective services and foster parents are a part of the action plan on nutrition. A course for people in need of treatment called Good food for better health ("Bra mat for bedre helse") is provided in many Healthy Lifestyle Centres ("Frisklivssentraler") and in some counties in other locations for anyone interested. They are based on the concept for motivational interviews and aims to achieve a better and lasting improvement in diet over time. (70). Another focus in the action plan is the improvement of diets to people living in psychiatric institutions, nursing homes and prisons. This is sought to be achieved by increasing the knowledge about nutrition among the people working in these institutions.

Research, monitoring and development

The government will follow the trends in the Norwegian diet and promote research within areas of food, nutrition and health. It aims to increase the knowledge about the relationships between mental health and diet and wants a better knowledge about the effectiveness of the different actions an intervention to promote a healthier diet in the population.

Some of the research done in these areas are the BRA study, a project to find effective ways to increase the consumption of vegetables among children in kindergartens (71). The FABO study is a randomized controlled trial that aims to evaluate the effect of Family-based behavioural social facilitation therapy (FBSFT) in the treatment of severe obesity in children and adolescents compared to treatment as usual (TAU) in an ordinary health care setting, on BMI, BMI SDS, body composition, cardio-metabolic health, eating habits, physical activity as well as psychological well-being. Study sample consists of 120 children aged 8-16, who are referred to the Obesity Outpatient Clinic at the Haukeland University Hospital. (72). In the ESSENS study, the connection between individual, home and school/neighbourhood environment and dietary behaviours such as, intake of fruits, vegetables, soft drink and unhealthy snacks, among adolescents in eastern Norway, were studied. They found that a higher frequency of food/drink purchase in the school canteen was related to a higher consumption of soft drinks and snacks. Higher frequency of food/drink purchase in shops around school during break,

or on the way to and from school was related to a higher consumption of snacks or soft drinks (73). Ane Kokkvoll *et al.* studied the effectiveness of single family intervention (SIFI) versus multiple- family intervention (MUFI) on childhood obesity. The study lasted for three years and the primary outcome was change in BMI (74). The hospital in Vestfold in Norway is involved in many studies on obesity, one of them is the 4XL-study – Obesity Surgery in Adolescents. The aim of the study is to determine whether surgical treatment of adolescents aged 13-18 with morbid obesity, gives more health benefits than standard conservative treatment, and if laparoscopic gastric bypass is a method with high safety and low complication rate. The primary outcome measure is change in BMI, which will be measured in year 1, 2, 5 and year 10. Results are estimated to be in by December 2017, but the completion date is not until 2027(75).

Government action plans on physical activity

Government action plans on physical activity (76), and their areas of priority are briefly discussed below.

Increased activity in leisure time and everyday life

Making the outdoors readily available for people of all fitness levels through good hiking trails and marked routes, seems to be an area of great potential and importance, as Ipsos MMI did a community survey on oppdrag av "Friluftslivets Fellesorganisasjon" in 2012, on the levels of physical activity, and preferred physical activity in the general population. The results of the survey showed that the preferred means to increase the level of physical activity according to 61% of the answers, was through participation in outdoors activities, preferably close to home or in the nearby area, 15% preferred to raise their level of physical activity through going to a gym, 6 % answered outdoor sports, and 5 % indoor sports (77). A campaign run by the directorate of health called Dine30 (30 minutes a day), promotes physical activity in everyday life through social media. However, based on the around 40 000 likes of the facebook.page, its reach is not great (78). Other initiatives run by NGOs to increase leisure time activity, are Get Out! ("Stikk UT!") They provide maps of hiking trails and mark the trails with "Stikk UT!" signs, outdoor schools/courses for children, giving an alternative to families receiving financial support from the government to be physically active for a low price (79), and

Out("Ut" - ut.no) a website and app providing information on hiking trails all over Norway, as well as cabins to sleep in when taking longer hikes (80).

Increased activity in kindergartens, schools and workplaces and a transportation system that encourages people to walk, run, or bike to work and school.

Arranging the outdoor areas to make them suitable for being physically active. Educate staff on the importance of physical activity. Involve parents and the local environment to engage in physical activity with the children. The government implemented 76 hours of extra physical activity ("FYSAK"), in addition to PE classes, for 5th to 7th graders in 2009. Seven basic criteria's regulating the implementation of FYSAK were formulated. Evaluation of this policy reveals room for improvement as there is frequent use of uneducated personnel to lead out in FYSAK, little variation in the activities carried out, students often have little motivation to participate as FYSAK is not graded, activity levels during FYSAK drops between 5th and 7th grade, and it has been a challenge to engage the more inactive students (81, 82). The National Cycling Strategy targets children and parents and aims to make cycling to school and work safe and attractive by providing separate bicycle lanes, safe road crossing, safe parking for bikes, and dressing rooms with showers (83). The goal of the government is to have 80% of all children aged 6-15 either walk or cycle to school. Regular cycling is a good source to a better health, according to (84) children that bike to school every day increase their cardio fitness, have a lower BMI and less risk of developing obesity, compared with children who are taken to school by car. Report from the Active School kids campaign showed that it had little to no effect, as long as the campaign managers were unable to change the parents impression on the safety of the roads, despite good quality road and according to safety standards (85). Changing the Working Environment Act from making employers obligated to consider physical activity as a part of employees safety, into employers being obligated to facilitate for physically active opportunities, before, during or after work (48). Employee sports ("Bedriftsidretten"), a branch under the Norwegian sports federation and an organisation that specifically works to provide sports and outdoor activities to increase the well-being, mental and physical health of employees, run many different projects throughout the country, cooperating with the local governments. A few of their initiatives are biking to work, active workplace, soccer,

handball, weekly running races with different difficulty levels and Ten mountain tops (“Ti på Topp”) – a concept that provides clearly marked tracks, information about the hike, hikes suitable for all levels of fitness and a logging system to motivate for completing as many hikes as possible within a season (86, 87).

Increased activity in the local environment

Through making health a consideration and priority when planning for road and housing construction, arranging parks, placement of junk food stores in relation to schools and kindergartens. Developing green areas in the local communities, making sure no one lives more than 500 meters from the nearest hiking trail. In a pilot project called the “Springvannsheia Prjocet” a green area in the community was transformed and made more accessible through proper lighting, easy roads and lots of resting areas. The goal was to make the outdoors for everyone, especially to activate the elderly, the youth, people in psychiatric institutions and others in need of activity for a better quality of life. As a result of this project, they have been able to engage many new user groups that were not using the facilities before (88, 89). Using lottery funds to restore and build new low threshold facilities in the communities that would encourage all to become more physically active. One such facility is a free outdoor training park, called “Tufteparken”. It has become one of the most popular outdoor training parks and is created to promote public health in the local communities. The park is designed to fit all levels of physical activity at the same time it is also geared towards improved fitness level. It can be used by all ages groups, for play or to train using one’s own body as weight, and is thus very family friendly. This project is featured through social media, was first developed in 2011 and in 2016 there were more than 30 parks in different places and towns throughout Norway (90, 91).

Active according to capacity

Active alliance (“Aktivitetsalliansen”) consists of 7 health promoting actors that work together to promote physical activity, an active lifestyle, healthy diet and preventive medicine. Their aim is to remove obstacles and inspire to become more physically active. Encouraging adults to take more responsibility for their health and being good role models for children. They work to increase knowledge on physical activity and to

help doctors promote and prescribe physical activity to their patients, provide advice and wishes to politicians on actions for improved health in the population (92). Healthy Lifestyle Centre (HLC) in Modum ("Frisklivssentralen Modum") is one of many "frisklivssentraler". In 2015 258 counties had a HLC, and the government recommends that all counties have one. The centres provide help for patients needing to make lifestyle changes, and the goal is for patients being able to implement the changes they learn on a long-term basis. Factors that boost long-term results after active treatment are found to be a sense of belonging, feeling a sense of achievement and a new perspective on one's body, diet and physical activity (93). Evaluation of the HLCs have shown that they are effective in reaching those who do not participate in other services like fitness centres etc. Participating in the programs at HLCs can provide necessary help for maintaining a healthier lifestyle a year after the end of the program, it can also help with weight loss, improved fitness and quality of life (94).

Working for increased physical activity through communication, knowledge and research

National Center for food, health and physical activity was founded in 2013 by the department of health and the department of knowledge. It is to be a recourse to kindergartens, schools, health stations, the school nurses and universities in implementing the national policies within health and education. Its focus is health promoting work and finding strategies to integrate physical activity and healthy diet in all school subjects, advocating for teaching more subjects outside rather than in a classroom, often referred to as "uteskole" or "outside school" (95). Some of the research in Norway on physical activity are the ASK – Active Smarter Kids is research project to study the effects of increased physical activity incorporated among the theoretical subjects on health, academic level and well-being in 5th graders in Sogn og Fjordane, Norway (96, 97). The "Helsefremmende Oppvekst i Horten kommune" (the HOPP-project) aims to promote health, learning and well-being for children and youth and prevent overweight and obesity, inactivity and other lifestyle disease. It was organized to involve public institutions in the community, and the project leaders developed their own inventions on physical activity and healthy diet, in line with the national guidelines,

in order for them to be as fitted to the local community as possible. The interventions were evaluated and "best practice" was developed based on the evaluation (98, 99).

The "Barn, bevegelse og oppvekst" (BBO) research project on children in 1st to 4th grade, followed 100 healthy children in 3 schools in Norway over 4 years between 2000-2004. They found that increased physical activity was associated with lower BMI and reduced screen time. The project also gathered information from similar studies done in Sweden and Denmark and published the results in the book "BARN – BEVEGELSE – OPPVEKST" by Per Egil Mjaavatn and Kari Asen Gudersen (97, 100). Another Swedish study looked at mobile based intervention to prevent obesity, they found no statistically significant effect on fat mass index, between intervention group and control group, but there was a considerable difference between the groups in secondary outcomes like intake of fruit and vegetables, and time spent on sedentary or physical activities (101).

The HEIA- project studied 6th and 7th graders and aimed to increase physical activity and the consumption of fruit/vegetables, and to decrease screen time and consumption of sugar sweetened beverages. It resulted in increased physical activity in the intervention group, mostly among the girls and normal weight children. The increase in physical activity showed to have positive effects on BMI and BMIz score, but only in the girls (102). The research group "Physical activity and public health" is based on the University of Tromsø Campus (UiT) and their main purpose is to generate knowledge for implementation of initiatives to increase physical activity in the population. It is an interfaculty group with members from several faculties at UiT (103).

Discussion

This literary study aimed to explore different causes of obesity, and highlight different prevention strategies in action, mostly in Norway.

The causes of obesity are many and complex. They go beyond the calorie balance theory, as factors like genes, environment at home and in the community during childhood and economy also plays a role, among other things. Due to this reason, it is not a simple thing to create a prevention or treatment intervention. One may be able to

target some of the causative factors but maybe not all in an intervention program, and even the best of programs are still struggling to produce good long-term results. To achieve success one needs to succeed in implementing lifestyle changes that will last also after the intervention. It is understandable that keeping up changes will be more difficult outside of a structured program as the stress of everyday life, limited time to prepare meals and engage in physical activity, influences of advertisements on food and beverages and availability of food products in stores are factors that tend not to favor healthy lifestyle habits.

However, implementations on the national and community levels could help individuals by making it easier to make the healthy choices, even without having to make a choice. The Norwegian government is contributing to this when making deals with the food industry, making regulations for schools and kindergartens, and thinking health when planning roads and city infrastructure – making sure green areas and other low threshold facilities are readily available to the people. In this way, many of the factors that make healthy choices harder are targeted, this as well as promising studies conducted in Norway and internationally can contribute to a higher success rate when it comes to preventing obesity, and halting the obesity epidemic.

Small steps in a steady pace will get further than a one- time leap, and the government is therefore encouraging small, manageable changes in lifestyle, that will make a considerable difference in the long run, to help people in need of change to stay motivated to keep it going. Governments outside of Norway are also taking action and by coming together in counsels and meetings, it is possible to learn from each other's experiences and together make a globally decided change in rules and policies that regulate the industries and health institutions around the world.

I have been able to identify a number of primary (16) and secondary (8) prevention initiatives and programs, some that can be targeted to both primary and secondary prevention, and I am certain there are more that will go unmentioned in this analysis. It seems right that the main focus would be on primary prevention, as studies have shown early prevention gives better results, than treatment after obesity is already established in an individual. It is very positive to note that Norway, the government, NGOs and other

volunteers, seems to be taking the prevention of obesity seriously and making it a priority within the various departments, institutions and organizations. However, as the obesity prevalence is still high and rising in many parts of the populations, it seems more effort is needed to tackle this epidemic.

The prevention of obesity is not only important for the individual patient's health, but also of economic importance for the society. The costs of obesity and obesity comorbidities are partly due to the direct costs, i.e. visits to primary care doctors, hospitalization and pharmaceutical costs (104, 105), and partly due to indirect costs, such as injury related work disability, premature death, increased number of sick days and disability pension in the obese part of the population compared with the normal weight part (106, 107). In the US, the annual estimated medical cost for obesity and obesity-related diseases was around \$78.5 billion per year in 1998 and rose to \$147 billion by 2008. The medical cost for an obese person is approximately \$1429 more than a normal weight counterpart (108).

According to the Nordic Plan of Action on better health and quality of life through diet and physical activity from 2006 the calculated total annual cost of overweight and obesity in Sweden is EUR 1,7 billion, which equals to roughly 0,7 % of the gross domestic product of Sweden. This was expected to double by the year 2030 if the trends on obesity rates remained the same. The same plan also calculated the total annual costs of overweight and obesity for the Nordic countries. They concluded, although the costs aren't directly transferable between the five countries, that the costs would be EUR 4.7 billion and approximately EUR 196 per person per year, or between 0.5-1% of the total GDP for the Nordic countries. The estimated costs for the remaining Nordic countries would be EUR 1 billion for Denmark, EUR 1.1 billion for Finland, EUR 56 million for Island, and 0.8 billion for Norway (109).

Knowing the cost of obesity, one must compare them to the cost of interventions for prevention, as it may be found that there is money to save in prevention, rather than treatment. Therefore, it is important the government departments are willing to budget for prevention as well as treatment.

A strength of the study could be number of studies analyzed. Limitations of the study are the grandness of the topic, and the great amount of information on it. Many of the studies mentioned are still ongoing and have therefore yet to publish finished results. Many completed studies or reviews are unclear on the actual intervention made or do not provide long term results, it is always a challenge to measure diet intake and the amount of physical activity, as people may wish not to report all foods consumed and the measuring devices for physical activity may not be completely accurate.

Conclusion

The causes of obesity are complex, but some important factors are diet, nutrition, and socioeconomic status. Weight loss interventions should consist of the right nutritional and dietary advice as well as physical activity, as it has been found to contribute to maintenance of weight loss after treatment, and for the primary prevention of obesity.

In Norway, there are already many strategies in place to prevent obesity, there are also a number of treatment centres that work with treating obesity. Healthcare professionals, especially the school nurses and the family doctors can contribute a great deal to the prevention of obesity by targeting early prevention in the form of overweight pregnant mothers and young children that are growing out of their percentiles in regard to weight and BMI, and thus being able to suggest interventions, before obesity occurs. Further studies are needed for further knowledge on the causes of obesity and improvement the prevention strategies in place to combat obesity.

Communities can encourage healthy lifestyles by providing facilities that make the formation of healthy habits easier for the inhabitants. In this way both politicians, health care professionals, businessmen and individuals can take joint responsibility for the health of the population and the prevention of obesity.

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Tables

Table 1 source: WHO. Body mass index - BMI: WHO; 2017 [Available from: <http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi>].

Table 2 source: Isabella Hansen, mk-12, 2017.

Project Target group	Intervention type	Background/ Intervention	Evaluation/ Results (where available)
	Diet/Nutrition		
Health related taxes General population	Health promoting	Taxes on sugar, chocolate, sweetened beverages and their containers.	Increased pricing of unhealthy food options may not help those who could benefit most from eating a healthier diet
Keyhole label General population	Health promoting	Label to inform buyers of the healthier option within different food categories. Food producer	The government finds the label useful and will work to increase awareness of the label and what it

		voluntarily uses the label, but must conform to regulations for using it, including less salt, sugar, saturated fat, and more dietary fibre.	means through social media campaigns.
Bra mat for bedre Helse Overweight or obese patients in Healthy lifestyle Centres. Local population	Primary prevention/ Secondary prevention	Course provided in HLCs aimed at helping patients to a healthier diet.	The course has been well received and can also be provided to the local population where there is interest.
Fiskesprell Children in kindergartens, schools, parents and teachers.	Health promotiong/ Primary prevention	Dietary program to use in kindergartens and schools, to increase consumption of fish and seafood. The course is also provided to teachers and parents.	Effective in increasing fish and seafood consumption among kindergarten and school children, and parents. Effective in equipping teachers to more effectively introduce children to fish and seafood, and teach them about its importance and health benefits.
Kokebok for alle	Health	Cook book used	The book is given

<p>Students in middle school participating in cooking classes, and their teachers.</p> <p>General population</p>	<p>promoting/ Primary prevention</p>	<p>in middle school cooking classes with information about healthy food, practical cooking and recipes based on the national nutrition guidelines.</p>	<p>for free to all middle school students and teachers, it is well received and can also be bought in local book stores.</p>
<p>Kostholdsplanleggeren, matportalen, kostverktøyet, and others.</p> <p>General population Overweight or obese Individuals.</p>	<p>Primary prevention/ Secondary prevention</p>	<p>Websites to assist in planning a meal, providing information about portion sizes, calories and healthier options.</p>	
<p>Breastfeeding campaign</p> <p>Mothers School nurses Midwives</p>	<p>Health promoting/ Primary prevention</p>	<p>Campaign to increase number of breastfed babies, as well as laws on the rights of working, breastfeeding mothers.</p>	
<p>NM I lunsj</p> <p>8th to 10th graders</p>	<p>Health promoting/ Primary prevention</p>	<p>National competition arranged by the directorate of health to help students engage more and take ownership of the</p>	<p>More than 90 teams across Norway participated in the competition.</p>

		school canteen, what foods that are offered and create a positive environment during lunch breaks.	
<p>Reducing salt, sugar and saturated fat in food</p> <p>General population Food industry</p>	Health promoting	Holistic agreement between the government and the food industry to reduce fat, sugar and saturated fat from foods.	
<p>Guidelines on infant nutrition</p> <p>School nurses Mothers Midwives</p>	Health promoting	National guidelines to help school nurses and midwives be better equipped to advice mothers on infant nutrition, to establish healthy eating habits in infants.	
<p>Training course for school nurses and midwives</p> <p>Midwives School nurses</p>	Health promoting/ Primary prevention	Training course for all midwives and school nurses on breastfeeding, vitamin D supplements and healthy food in kindergartens. To better equip them to work with mothers and	

		families with young children, in regards to healthy diet.	
	Physical activity		
Dine30! Adult general population	Health promoting/ Primary prevention	Campaign promoting 30 minutes of physical activity per day through brochures, facebook and youtube.	About 30 000 likes on facebook page. Government is working to increase awareness of the campaign as a health promoting/primary prevention tool.
UT.no General population	Health promoting/ Primary prevention	Making the outdoors more accessible through information on trails and cabins collected in website	
StikkUT! Local general population both children and adults	Health promoting/ Primary prevention	Making the outdoors more accessible through information on trails, marking trails and outdoor schools for children and more. Cooperation project between NGO and local government.	Prioritised groups are children in kindergartens and schools, minority groups and the physically disabled. Activities are mostly free of charge for children and thus effective in reaching children with lower socio-economic status.

<p>FYSAK</p> <p>Children in 5th to 7th Grade.</p>	<p>Primary prevention/ Secondary prevention</p>	<p>School based intervention to increase daily amount of physical activity for children at school. 76 hours more of physical activity over the course of three years, or 40 minutes more per week from 5th to 7th grade. There are per now, 7 criteria for implementation.</p>	<p>Students tend to be demotivated to participate, and less active students often do not engage in activity. The project needs clearer guidelines to improve implementation and participation of the children. Qualified personnel required to lead out activities to engage less active children. Requiring students to change and shower may increase participation</p>
<p>Active School Kids</p> <p>Children in 1st, 3rd and 6th grade, teachers and parents.</p>	<p>Primary prevention/ Secondary prevention</p>	<p>Government campaign to increase the number of children walking or cycling to school.</p>	<p>No difference in amount if children walking/cycling to school at start/end of campaign. Ineffective if parents do not perceive the road to school as safe for walking/cycling, independent of good/safe roads.</p>
<p>The</p>	<p>Health</p>	<p>Development of</p>	<p>The project lead</p>

<p>Springvannsheia Project</p> <p>Local general population especially the normally less active- including the elderly, youth, mentally ill, etc.</p>	<p>promoting/ Primary prevention/ Secondary prevention</p>	<p>a green area in the town on Lillesand, to make it more attractive and accessible to people of all fitness levels. Providing safe walking track, enough lights and lots of resting areas.</p>	<p>to increased use of the green area, positive feedback form users in the local community and managed to engage new user groups.</p>
<p>Aktivitet på resept/ Green prescription</p> <p>Overweight or obese patients of doctors in primary health care</p>	<p>Primary prevention/ Secondary prevention</p>	<p>General practitioners prescribing physical activity to patients / Fiscal initiative to motivate doctors to talk about, encourage and help patients to achieve positive lifestyle changes</p>	
<p>Healthy lifestyle Centres (HLCs)</p> <p>Patients referred due To overweight or obesity</p>	<p>Secondary prevention</p>	<p>Lifestyle centres patients can be referred to, and be strengthened to take control of individual health. Centres provide exercise groups, counselling courses for increased physical activity, healthy diet and tobacco cessation,</p>	<p>HLCs recruits people who do not participate in other services. GP's are of the opinion that they offer good services. Participation in the programs offered can lead to weight loss, improved physical fitness and maintaining</p>

		among others.	health behaviour change.
Tufteparken General population, all ages	Health promoting/ Primary prevention	Free outdoor training park, available for everyone, to lower the threshold for becoming more physically active	Increasing popularity, in 2016, more than 30 parks all over Norway.
Bedriftsidretten Employees and employers.	Health promoting/ Primary prevention/ Secondary prevention	Organisation promoting and creating opportunities for physical activity for workers. General population can also benefit from many of their initiatives.	

Table 2: Health promoting and obesity preventive interventions on diet and physical activity in Norway.

Source: Isabella Hansen, MK-12, May 2017.

Figures

Figure 1 source: WHO Global database of Body Mass Index: WHO; 2017 [Available from: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html].

Figure 2 source: Vollrath MET, Torgersen, Leila., Meyer, Haakon Eduard. Overweight and obesity in Norway - Public health report 2014 Norway: Norwegian Institute of Public Health; 2014 [Available from: <https://www.fhi.no/en/op/public-health-report-2014/risk--protective-factors/overweight-and-obesity-in-norway---/#main>].

Figure 3 source: Vollrath MET, Torgersen, Leila., Meyer, Haakon Eduard. Overweight and obesity in Norway - Public health report 2014 Norway: Norwegian Institute of Public Health; 2014 [Available from: <https://www.fhi.no/en/op/public-health-report-2014/risk--protective-factors/overweight-and-obesity-in-norway---/#main>].

Figure 4 source: WHO Global database of Body Mass Index: WHO; 2017 [Available from: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html]

Figure 5 source: Hawkes C, Jewell J, Allen K. A food policy package for healthy diets and the prevention of obesity and diet-related non-communicable diseases: the NOURISHING framework. *Obes Rev.* 2013;14 Suppl 2:159-68

Attachments

GRADE vurdering av 5 artikler

Referanse:			GRADE	
Kokkvoll m.fl.: Single versus multiple-family intervention in childhood overweight – Finnmark Activity School: a randomized trial Archives of Disease in Childhood, December 2013, doi:10.1136/archdischild-2012-303571.			Dokumentasjonsnivå	1b
			Anbefaling	A
Formål	Materiale og metode	Resultater	Diskusjon/kommentarer	
To compare a new comprehensive lifestyle programme performed in groups of families with overweight (included obese) children with a more conventional single-family programme. The study design and interim anthropometrical results after 12 months are presented.	Design Altogether 97 overweight and obese children aged 6-12 years with BMI corresponding to cut-off point ≥ 27.5 in adults were included. Study participants were randomised to multiple-family intervention (MUFI) or single-family intervention (SIFI) in a parallel design. MUFI comprised a 3-day inpatient programme at the hospital with other	BMI increased by 0.37 units in the MUFI compared to 0.77 units in the SIFI ($p=0.18$). BMI SDS decreased by 0.16 units in the MUFI group compared to 0.07 units in the SIFI group ($p=0.07$). Secondary endpoint waist circumference decreased 0.94 cm in the MUFI group and increased 0.95 cm in the SIFI group, $p=0.04$.	Styrker Randomised design Blinding of the primary outcome assessors Moderate withdrawal from the study Inclusion of high-risk overweight children to enlarge the study population. Experienced paediatric nurses were chose to obtain the measurments Svakheter Higher variability in BMI than expected Nurses measuring the waist circumference, skinfold, and BIA were not blinded to group allocation.	

families and a multidisciplinary team, follow-up visits in their hometown individually and in groups, organised physical activity twice weekly and a 4-day family camp after 6 months. SIFI comprised individual counselling by paediatric nurse, paediatric consultant and nutritionist at the hospital and follow-up by public health nurse in the community. Solution focused approach was applied in both interventions. Primary outcome measures were changes in BMI kg/m² and BMI SD score (BMI SDS).

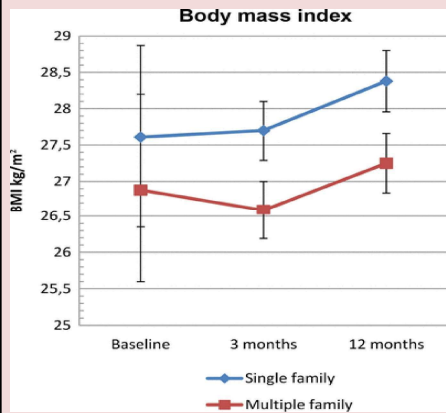
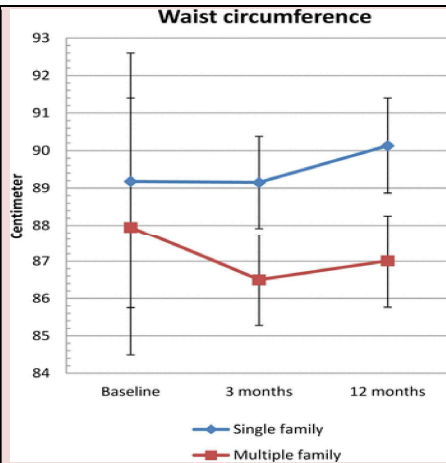
Konklusjon

Interim analysis after 12 months showed no between-group difference in terms of BMI or BMI SDDS. The MUFI group had a significant decrease in waist circumference compared to the SIFI group.

There was no difference in change in the primary outcomes BMI and BMI SDS between the MUFI approach and the SIFI approach after 1 year. There was a small between-group

families and a multidisciplinary team, follow-up visits in their hometown individually and in groups, organised physical activity twice weekly and a 4-day family camp after 6 months. SIFI comprised individual counselling by paediatric nurse, paediatric consultant and nutritionist at the hospital and follow-up by public health nurse in the community. Solution focused approach was applied in both interventions. Primary outcome measures were changes in BMI kg/m² and BMI SD score (BMI SDS).

Inklusjons- /eksklusjonskrit.
Inclusion Criteria: Overweight or obese, BMI >



Measurement of waist circumference is difficult to obtain and may be hampered by measurement error. Waist circumference is considered an objective measure, but it may be argued that this approach could bias study results. Paper written before 2 years of follow-up results were in, these would be needed to draw further conclusions.

<p>effect in the secondary outcome waist circumference in favour of the MUFI. Results after 2 years of follow-up are needed to draw further conclusions.</p>	<p>IOTF (International Obesity TaskForce) cut point 27.5 kg/m². Exclusion Criteria: Diseases not compatible with normal physical activity, diseases not compatible with group treatment. All Sexes Eligible for Study.</p>		
<p>Land</p>	<p>Interventional Study Type.</p>		
<p>Norway-Finnmark</p>	<p>Study Design: Allocation – Randomized, Intervention Model – Parallel Assignment, Masking – Single Blind (Outcomes Assessor), Primary Purpose – Treatment.</p>		
<p>År data innsamling</p>	<p>Ethics approval</p>		
<p>April 2009 – December 2013</p>	<p>The Regional Committee for Medical and Health Research Ethics approved the study</p>		

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Referanse: Danielsson et al. Response of Severely Obese Children and Adolescents to Behavioral Treatment <i>Arch Pediatr Adolesc Med.</i> 2012;166(12):1103-1108. Doi:10.1001/2013.jamapediatrics.319			GRADE	
			Dokumentasjonsnivå	III
			Anbefaling	C
Formål	Materiale og metode	Resultater	Diskusjon/kommentarer	
To investigate whether the degree of obesity predicts the efficacy of long-term behavioural treatment and to explore any interaction with age	A 3-year longitudinal observational study. Obese children were divided into 3 groups (6-9, 10-13, and 14-16 years) and also into 2 groups (moderately obese, with a body	A total of 643 children (49% female children) met the inclusion criteria. Among the youngest moderately obese children, 44% had a clinically significant reduction in BMI-SD score (mean reduction, -0.4 [95% CI, -0.55 to -0.32]). Treatment was less effective for the older	Styrker The strength of the study is the length of treatment period in combination with a relatively large number of patients. Svakheter The treatment was not identical for all children, but for the aims of the study this was of minor	

	<p>mass index [BMI]-standard deviation [SD] score [or z score] of 1.6 to <3.5, and severely obese, with a BMI-SD score of ≥ 3.5)</p> <p>The setting for the study was the National Childhood Obesity Center, Stockholm, Sweden.</p>	<p>moderately obese children. Twenty percent of children who were 10 to 13 years of age and 8% of children who were 14 to 16 years of age had a reduction in BMI-SD score of 0.5 units or more; 58% of severely obese young children showed a clinically significant reduction in BMI-SD score (mean reduction, -0.7 [95% CI, -0.80 to -0.54]). The severely obese adolescents showed no change in mean BMI-SD score after 3 years, and 2% experienced clinically significant weight loss. Age was found to be a predictor of a reduction in BMI-SD score (odds ratio, 0.68 units per year [95% CI, 0.60-0.77 units per year]).</p>	<p>importance. A possible confounder is identified sex differences in the group distribution. It is a single-centre study and the generalizability is therefore uncertain.</p> <p>Not a randomly selected study population. Well defined inclusion criteria. Relatively high percentage of dropouts, especially in the oldest age group, this may be a reason for poorer/no results found among the children in this age group. The study population had different stages of the disease during follow-up. Follow-up time lengthy, three years. Objective criteria used for measuring primary and secondary outcomes. Prognostic factors described. Data registered in prospective manner, and taken from database.</p>
Konklusjon			
Behavioural treatment was successful for severely obese children but had almost no effect on severely obese adolescents.	<p>The participants were children 6 to 16 years of age who started treatment between 1998 and 2006. Intervention was Behavioral treatment of obesity and the main outcome measures were change in BMI-SD score during 3 years of treatment; a reduction in BMI-SD score of 0.05 units or more was defined as clinically significant.</p>		
Land			
Sweden			
Ar data innsamling			

1989-2006			
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Referanse: Thorsdottir et al Randomized trial of weight-loss-diets for young adults varying in fish and fish oil content. International Journal of Obesity (2007) 31, 1560–1566; doi:10.1038/sj.ijo.0803643; published online 15 May 2007		GRADE	
		Dokumentasjonsnivå	Ib
		Anbefaling	A
Formål	Materiale og metode	Resultater	Diskusjon/kommentarer
To investigate the effect of including seafood and fish oils, as part of an energy-restricted diet, on weight loss in young overweight adults	Randomized controlled trial of energy-restricted diet varying in fish and fish oil content was followed for 8 weeks. Subjects were randomized to one of four groups: (1) control (sunflower oil capsules, no seafood); (2) lean fish (3x 150g portions of	An average man in the study (95kg at baseline receiving 1600 kcal/day) was estimated to lose 3.55kg (95% CI, 3.14-3.97) (1); 4.35 kg (95% CI, 3.94-4.75) (2); 4.50kg (95% CI, 4.13-4.87) (3) and 4.96kg (95% CI, 4.53-5.40) on	Styrker The design of the study is randomized. It is the first human randomized controlled trial to test the effect on weight loss from an energy-restricted diet including, lean or fatty fish, or fish oil vs a diet containing no seafood.

	<p>cod/week); (3) fatty fish (3x150g portions of salmon/week); (4) fish oil (DHA/EPA capsules, no seafood). The macronutrient composition of diets was similar between the groups and the capsule groups, were single blinded.</p> <p>Subjects were recruited through advertisements.</p>		
<p>Konklusjon</p>	<p>A total of 324 men and women (140 from</p>		
<p>In young, overweight men, the inclusion of either lean or fatty fish, or fish oil as part of an energy-restricted diet resulted in ~1 kg more weight loss after 4 weeks, than did a similar diet without seafood or supplement of marine origin. The addition of seafood to nutritionally balanced energy-restricted diet may boost weight loss.</p>	<p>Iceland, 120 from Spain and 60 from Ireland) aged 20-40 years BMI 27.5-32.5 kg/m².</p> <p>Measurements: Anthropometric data were collected at baseline, midpoint and endpoint. Confounding factors were accounted for, with linear models, for repeated measures with two-way interactions. The most important interactions for weight loss were (diet x energy intake), (gender x diet) and (gender x initial-weight).</p>	<p>diet (4) in 4 weeks, from baseline to midpoint. The weight-loss from midpoint to endpoint was 0.45 (0.41-0.49) times the observed weight loss from baseline to midpoint. The diets did not differ in their effect on weight loss in women. Changes in measures of body composition were in line with changes in body weight.</p>	<p>The statistical model designed to describe effects on weight including important determinants for weight loss is also of high value as it reflects the high impact of gender and initial weight on the outcome, which has to be taken into consideration. No reason to believe that the results could not apply in similar populations other than Iceland, Spain, and Ireland as no diet x country interaction was found, showing that the difference in weight loss between diet groups was seen to a similar degree in all countries. Physical activity was assessed during the intervention period and was found to be similar between diet groups</p> <p>Svakheter Inclusion of both men and women, as they were found to react differently. However, this could also be interpreted as an additional benefit of the study, as the pronounced gender difference was unexpected. Uncertainty in dietary</p>

<p>Traditional obesity prevention programs are time- and cost-intensive. Mobile phone technology has been successful in changing behaviours and managing weight; however, to our knowledge, its potential in young children has yet to be examined. We assessed the effectiveness of a mobile health (mHealth) obesity prevention program on body fat, dietary habits, and physical activity in healthy Swedish children aged 4.5 y.</p>	<p>315 children were randomly assigned to an intervention or control group. Parents in the intervention group received a 6-mo mHealth program. The primary outcome was fat mass index (FMI), whereas the secondary outcomes were intakes of fruits, vegetables, candy and sweetened beverages and time spent sedentary and in moderate-to-vigorous physical activity. Composite scores for the primary and secondary outcomes were computed.</p>	<p>No statistically significant intervention effect was observed for FMI between the intervention and control group (mean \pm SD: -0.23 ± 0.56 compared with -0.20 ± 0.49 kg/m²). However, the intervention group increased their mean composite score from baseline to follow-up, whereas the control group did not ($+0.36 \pm 1.47$ compared with -0.06 ± 1.33 units; $P = 0.021$). This improvement was more pronounced among the children with and FMI above the median (4.11 kg/m²) ($P = 0.019$). The odds of increasing the composite score for the 6 dietary and physical activity behaviours were 99% higher for the intervention group than the control</p>	<p>Styrker <u>Randomized controlled design</u> <u>Careful calculation of statistical power</u> <u>Use of an accurate method for primary outcome.</u> <u>Grounded in social cognitive theory.</u> <u>Developed in accordance with the mHealth framework</u> <u>Used well-established strategies for promoting behavioural change.</u></p> <p>Svakheter <u>Intervention was provided only in Swedish, therefore only families with at least one parents able to sufficiently comprehend Swedish could have been included.</u> <u>Cannot exclude the possibility of respondent bias through selective photography (e.g. drinking sweetened beverages and not taking a picture).</u> <u>Arbitrary cutoff (median 4.11 kg/m²) was used to distinguish the 2 groups because there are no established cutoff.</u></p>
<p>Konklusjon</p>			

This mHealth obesity prevention study in preschool-aged children found no difference between the intervention and control group for FMI. However, the intervention group showed a considerably higher postintervention composite score (a secondary outcome) than the control group, especially in children with a higher FMI. Further studies targeting specific obesity classes with preschool-aged children are warranted.

group (P = 0.08).

Land			
Sweden			
År data innsamling			
2014-2015			

Referanse: Bornhorst et al. WHO European Childhood Obesity Surveillance Initiative: associations between sleep duration, screen time and food consumption frequencies. Börnhorst <i>et al. BMC Public Health</i> (2015) 15:442 DOI 10.1186/s12889-015-1793-3			GRADE
			Dokumentasjonsnivå III
			Anbefaling C
Formål	Materiale og metode	Resultater	Diskusjon/kommentarer
Both sleep duration and screen time have been suggested to affect children's diet, although in different directions and presumably through different pathways. The present cross-sectional study aimed to simultaneously investigate the associations between sleep duration, screen	The analysis was based on 10 453 children aged 6-9 years from five European countries that participated in the world Health Organization European Childhood Obesity Surveillance Initiative. Logistic multilevel models were used to assess associations of parent-reported screen time as well as sleep duration (exposure variables) with consumption frequencies of 16	One additional hour of screen time was associated with increased consumption frequencies of 'soft drinks containing sugar' (1.28 [1.19; 1.39]; odds ratio and 99% confidence interval), 'diet/light soft drinks' (1.21 [1.14; 1.29]), 'flavoured milk' (1.18 [1.08; 1.28]), 'candy bars or chocolate' (1.31 [1.22; 1.40]), 'biscuits, cakes doughnuts or pies' (1.22 [1.14; 1.30]),	Styrker Simultaneous investigation of two risk factors for less and more favourable food choices, enables to interpret their potential interrelations. Large sample size, more than 10 000 children. Standardized assessment procedures of COSI and country-based sampling strategies designed to yield nationally representative data. Svakheter Due to cross sectional design results can only provide indications of associations, but cannot

<p>time and food consumption frequencies in children.</p>	<p>food items (outcome variables). All models were adjusted for age, sex, outdoor play time, maximum educational level of parents and sleep duration or screen time, depending on the exposure under investigation.</p>	<p><i>'potato chips (crisps), corn chips, popcorn or peanuts'</i> (1.32 [1.20; 1.45]), <i>'pizza, French fries (chips), hamburgers'</i> (1.30 [1.18; 1.43]) and with a reduced consumption frequency of <i>'vegetables (excluding potatoes)'</i> (0.89 [0.83; 0.95]) and <i>'fresh fruits'</i> (0.91 [0.86; 0.97]).</p>	<p>make casual inferences. Parentally reported sleep duration and screen time variables, as parents may usually observe the bed and get up times of their children, rather than the times the child is actually falling asleep or waking up, this may have introduced some error. Screen time may also be error-prone, especially if the child has media devices in the bedroom or spends a lot of time out of home.</p>
<p>Konklusjon</p>		<p>Conversely, one additional hour of sleep duration was found to be associated with increased consumption frequencies of <i>'fresh fruits'</i> (1.11 [1.04; 1.18]) and <i>'vegetables (excluding potatoes)'</i> (1.14 [1.07; 1.23]).</p>	<p>Information on media in the child's bedroom was not available and would have been an important covariant to include in the study. Measurement error in dietary intake data is one of the largest challenges, and misreporting cannot be precluded, in particular underreporting of specific food items by parents with overweight or obese children may have occurred.</p>
<p>The results suggest a potential relation between high screen time exposure and increased consumption frequencies of foods high in fat, free sugar or salt whereas long sleep duration may favourably be related to children's food choices. Both screen time and sleep duration are modifiable behaviours that may be tackled in childhood obesity</p>			<p>Study did not include portion sizes or specify differences within a food group e.g. just "fish" and not "healthy" fish meals or "unhealthy" fish meals.</p> <p>Study population was well defined. Study was designed to be representative of the</p>

prevention efforts.			<p>national population in that age group. Uncompleted questionnaires were excluded from the study, otherwise no information about non-responders. Gathering of data was standardized. Objective criteria were used to measure outcomes. Logistic multilevel models were used to analyse the data collected.</p>
Land			
Bulgaria, Czech Republic, Lithuania, Portugal and Sweden.			
År data innsamling			
2007-2008			