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BREASTFEEDING AND THE RISK OF CHILDHOOD OBESITY

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1.0 SUMMARY

Obesity is one of the greatest public health challenges of the 21st century. Its prevalence has tripled in many countries in the WHO European Region since the 1980s, and the numbers of those affected continue to rise at an alarming rate, particularly among children. Obesity is already responsible for 2-8% of health costs and 10-13% of deaths in different parts of the Region.

The aim of the thesis is to summarize the current knowledge on the topic breastfeeding and the preventive effect of overweight and obesity. Firstly, I focus on the etiology of overweight and obesity. Then I define overweight and obesity, and how to assess these terms by Body Mass Index (BMI) for adults, and age-and-gender specific percentile charts for children. The paper presents further the prevalence of overweight and obesity in children and adolescents, and then in relation to infant feeding. The long-term benefits of being breastfed are discussed thereafter. The role of breastfeeding in protection against obesity is then presented. Thereafter, the many general health problems related to overweight and obesity, followed by the infant feeding and the health problems related to overweight and obesity is considered. The next topic is breastfeeding and infant growth and maternal diabetes. Finally we come to the chapters on current preventive strategies from WHO and European Union, and breastfeeding promotion, protection and support according to WHO and European Union. In the conclusion I discuss the preventive effect of overweight and obesity by breastfeeding.

2.0 INTRODUCTION

Obesity has become a global pandemic and is a major risk factor for chronic diseases such as hypertension, heart diseases, diabetes mellitus type 2 and several cancers. This condition is an extremely expensive cost in the health care budgets. (1) It is a multifactorial disease arising from complex interactions between genes and the environment. (2)

In industrialised countries overweight is the most frequent nutritional disorder in children and adolescents, with a continuing increase of its prevalence. The reason why it is so crucial for obesity prevention interventions to start early on in life is that therapeutic interventions in obese children aiming at weight loss are costly and have less than satisfactory long-term success rates. Identification and strategies for effective prevention of obesity is particularly attractive. (1)

Pediatric clinicians have already noted an alarming increase in type 2 diabetes in adolescents, for which obesity is the chief cause. Obesity is a type of malnutrition and its cause is always questioned by parents. Fundamentally, obesity arises from an excess of energy intake compared with energy expenditure over time. (2)

Exclusive breast feeding the first six months of life provides good nutrition and is an essential component of health and human rights for women and children, and important for poverty reduction.(1)

The aim of the thesis is to summarize the current knowledge on the topic breastfeeding and the preventive effect on overweight and obesity.

3.0 REVIEW

3.1 Etiology of overweight and obesity

Obesity is a multifactorial disease arising from complex interactions between genes and the environment. Prenatal and postnatal development may have a role in the development of obesity. Although the influence of genetics has been observed in studies on twins cases of truly “inherited” obesity caused by a genetic defect are very rare in human beings. Genetic influences are associated with obesity, but it is difficult to explain the recent “epidemic” of obesity in United States purely on genetic grounds. The association between obesity and television watching, dietary intake, different rates of obesity in urban and rural areas, and changes in obesity with seasons indicates the role of the environment in becoming overweight or obese. Early infant nutrition is one of the most powerful environmental factors that determine early growth and development, and it may also influence gene expression. There is a strong interaction between genetics and environment that influence degree of adiposity. It has long been recognized that obesity “runs in families”. For young children, if one parent is obese, the odds ratio is approximately 3 for obesity in adulthood, but if both parents are obese, the odds ratio increases to more than 10. Before 3 years of age, parental obesity is a stronger predictor of obesity in adulthood than the child’s weight status. Interactions between genetic, biological, psychological, socio-cultural, and environmental factors clearly are evident in childhood obesity. (2)
Breastfeeding may not be as effective as moderating familial factors, such as dietary habits and physical activity, in preventing children form becoming overweight. (6)

3.2 Assessment of overweight and obesity

The definition of obesity is the condition of excessive fat in the body, and has significant health consequences. It is the result of undesirable weight gain caused when people consume more energy than they expend. Obese people store more fat in the abdomen, which is associated with an increased risk of developing certain diseases. Obesity in childhood often continues into adulthood. It brings an enormous burden of both disability and mortality, as well as an economic challenge. A healthy lifestyle is essential in counteracting obesity. (19)

Body mass index (BMI) is calculated as the ratio of weight in kilograms to the square of height in meters (weight (Kg) / height (m)2). It has been widely used as a measure of relative weight. In adults, a BMI above 25 is overweight, and a BMI over 30 defines obesity. But in children, BMI changes with age, therefore, it is not possible to define a specific BMI cut point that defines overweight of obesity. Newly released BMI age-and-gender-specific percentile charts for children do exist and can be used for assessment of BMI percentile. A BMI above the 85th percentile is labelled "at-risk for overweight" and a BMI above 95th percentile is labelled overweight and obese. (2)

3.3 Prevalence of overweight and obesity in children and adolescents

The epidemic of obesity in children and adolescents in the world has reached alarming levels, with more than 1 billion overweight adults of which 300 million are considered clinically obese. Obesity are affecting both developed and developing countries of all socioeconomic groups including all age groups thereby posing an alarming problem, described by World Health Organization (WHO) as an "escalating global epidemic". Worldwide, over 22 million children under the age of 5 years are severely overweight, as are 155 million children of school age. This implies that one in 10 children worldwide is overweight. This global average reflects a wide range of prevalence levels, with the prevalence of overweight in Asia and Africa averaging well below 10% and in the Americas and Europe above 20%. The proportion of school-age children affected will almost double by 2010 compared with the most recently available surveys from the late 1990s up to 2003. In the European Union, the number of children who are overweight is expected to rise by 1.3 million children per year, with more than 300,000 of them becoming obese each year without urgent action to counteract the trend. By 2010 it is estimated 26 million children in EU countries will be overweight, including 6.4 million who will be obese. Obesity rates has increased more than twofold over the past 25 years in the USA, almost threefold in the past 10 years in England, and almost fourfold over a similar time frame in Egypt. In the USA the prevalence of obesity in adolescents has increased dramatically from 5% to 13% in boys and from 5% to 9% in girls between 1966-70 and 1988-91. In a single year from 2000 to 2001, the prevalence of obesity increased among U.S. adults from 19.8% to 20.9%. If sustained this rate over the next 10 years, the prevalence of obesity will rise by another 74%, with one third of the U.S. population becoming obese by 2030. (3)

Tables 1 and 2 present the data on prevalence of overweight and obesity in children and adolescents in Europe according to WHO's data.

Table 1: Prevalence of overweight and obesity in children.

Country	Gender	Age (years)	Prevalence overweight (%)	Prevalence obesity (%)	Survey period	Data collection method
Belgium	Both genders	2-9	19.0	7.8	2004	Self-reported
Bulgaria	Both genders	5-9	13.5	4.5	2004	Measured
Bulgaria	Female	5-9	9.9	2.2	2004	Measured
Bulgaria	Male	5-9	16.8	6.6	2004	Measured
Cyprus	Both genders	2-6	14.1	5.5	2004	Measured
Cyprus	Female	2-6	15.6	5.7	2004	Measured
Cyprus	Male	2-6	12.8	5.4	2004	Measured
Denmark	Female	6-8	21.0*	4.0*	2003	Measured
Denmark	Male	6-8	14.8*	4.6*	2003	Measured
France	Both genders	7-9	18.1	3.8	2000	Measured
France	Female	7-9	18.3	3.6	2000	Measured
France	Male	7-9	17.9	3.9	2000	Measured
Germany	Both genders	5-6	12.6*		2001-2002	Measured
Germany	Female	5-6	15.2*		2001-2002	Measured
Germany	Male	5-6	10.1*		2001-2002	Measured
Greece	Female	2-6	16.3	11.4	2003	Measured
Greece	Male	2-6	18.1	11.2	2003	Measured
Iceland	Both genders	9	18.5		2004	Measured
Iceland	Female	9	20.0		2004	Measured
Iceland	Male	9	17.0		2004	Measured
Ireland	Both genders	4-9	25.8	6.6	2001-2002	Measured
Ireland	Female	4-9	29.2	7.5	2001-2002	Measured
Ireland	Male	4-9	22.5	5.8	2001-2002	Measured

Italy	Both genders	6-11	27.2*	6.5*	2000-2002	Measured
Italy	Female	6-11	29.5*	7.0*	2000-2002	Measured
Italy	Male	6-11	24.8*	5.9*	2000-2002	Measured
Netherlands	Both genders	2-9	14.5	3.4	2005	Self-reported
Netherlands	Female	2-9	16.2	4.5	2005	Self-reported
Netherlands	Male	2-9	12.9	2.4	2005	Self-reported
Norway	Both genders	8-9	18.5	3.6	2000	Self-reported
Norway	Female	8-9	18.8	4.0	2000	Self-reported
Norway	Male	8-9	17.3	3.0	2000	Self-reported
Poland	Both genders	1-9	22.0	6.7	2000	Measured
Poland	Female	1-9	21.1	6.3	2000	Measured
Poland	Male	1-9	22.8	7.0	2000	Measured
Portugal	Both genders	7-9	31.5	11.3	2002-2003	Measured
Portugal	Female	7-9	33.7	12.3	2002-2003	Measured
Portugal	Male	7-9	29.4	10.3	2002-2003	Measured
Russian Federation	Female	6-7	14.0		1998	Measured
Russian Federation	Male	6-7	14.0		1998	Measured
Serbia	Both genders	6-10	14.9*	4.1*	1995-2002	Measured
Serbia	Female	6-10	15.7*	4.4*	1995-2002	Measured
Serbia	Male	6-10	14.2*	3.9*	1995-2002	Measured
Slovakia	Both genders	7-9	15.2	4.6	2001	Measured
Slovakia	Female	7-9	16.8	4.2	2001	Measured

Slovakia	Male	7-9	13.6	4.9	2001	Measured
Spain	Both genders	2-9	31.3	10.4	1998-2000	Measured
Spain	Female	2-9	32.4	10.5	1998-2000	Measured
Spain	Male	2-9	30.2	10.3	1998-2000	Measured
Sweden	Both genders	4 and 8	19.1	3.0	2003	Self-reported
Sweden	Female	4 and 8	19.2	2.6	2003	Self-reported
Sweden	Male	4 and 8	19.0	3.4	2003	Self-reported
Switzerland	Both genders	6-9	18.3	4.0	2002-2003	Measured
Switzerland	Female	6-9	19.5	4.0	2002-2003	Measured
Switzerland	Male	6-9	17.0	4.1	2002-2003	Measured
United Kingdom of Great Britain and Northern Ireland	Both genders	5	22.4*	5.8*	2001-2002	Measured
United Kingdom of Great Britain and Northern Ireland	Female	5	26.4*	6.9*	2001-2002	Measured
United Kingdom of Great Britain and Northern Ireland	Male	5	18.3*	4.6*	2001-2002	Measured

Notes:
* denotes subnational data
** denotes year of publication
BMI: body mass index
NA: not available
NCHS: United States National Center for Health Statistics
SD: standard deviation
References:
Cole TJ et al. Establishing a standard definition for child overweight and obesity worldwide: international survey. British Medical Journal, 2000, 320:1240-1243.

Disclaimer:
The table above presents the most recent nationally representative data collected by a country. However, the most recent local data are also presented in absence of nationally representative data.
The prevalence of overweight includes the prevalence of obesity. Overweight and obesity are defined by using international age- and gender-specific cut-off points for BMI, passing through 25 kg/m^2 and 30 kg/m^2 by the age of 18 years, respectively (Cole et al, 2000).

According to WHO categorization, data were categorized (where possible) into the following age groups; children aged 0-9 years; adolescents aged 10-19 years and adults aged 20 years and above.

Intercountry comparisons should be interpreted with caution owing to different data collection methods, response rates, survey years and age ranges.

Table 2: Prevalence of overweight and obesity in adolescents.

Country	Gender	Age (years)	Prevalence overweight (%)	Prevalence obesity (%)	Survey period	Data collection method
Austria	Both genders	10-16	12.8	1.9	2001-2002	Self-reported
Belgium	Both genders	10-17	12.2	3.0	2004	Self-reported
Bulgaria	Both genders	10-19	14.8	3.6	2004	measured
Bulgaria	Female	10-19	12.0	2.4	2004	measured
Bulgaria	Male	10-19	17.6	4.7	2004	measured
Croatia	Both genders	7-15	17.4*	3.9*	2000-2001	measured
Croatia	Female	7-15	17.3*	3.5*	2000-2001	measured
Croatia	Male	7-15	17.5*	4.2*	2000-2001	measured
Cyprus	Both genders	10-17	24.7	5.8	1999-2000	measured
Cyprus	Female	10-17	21.1	4.5	1999-2000	measured
Cyprus	Male	10-17	28.4	7.1	1999-2000	measured
Czech Republic	Both genders	10-16	10.1	1.0	2001-2002	Self-reported
Denmark	Both genders	14-16	20.9*	3.5*	2003	measured
Denmark	Female	14-16	14.4*	2.7*	2003	measured
Estonia	Both genders	10-16	7.5	1.0	2001-2002	Self-reported
Finland	Both genders	12-18	15.1	3.0	2003	Self-reported
Finland	Female	12-18	11.6	2.2	2003	Self-reported
Finland	Male	12-18	19.4	3.8	2003	Self-reported
France	Both	10-16	11.6	1.6	2001-	Self-

	genders				2002	reported
Germany	Both genders	10-16	11.4	1.7	2001-2002	Self-reported
Greece	Female	13-19	16.1	3.6	2003	measured
Greece	Male	13-19	29.6	8.9	2003	measured
Hungary	Both genders	15-18	15.6	4.6	1997-2000	measured
Hungary	Female	15-18	15.0	4.2	1997-2000	measured
Hungary	Male	15-18	16.4	5.1	1997-2000	measured
Iceland	Both genders	15	15.0		2004	measured
Iceland	Female	15	10.0		2004	measured
Iceland	Male	15	20.0		2004	measured
Ireland	Both genders	11-16	24.4	5.9	2001-2002	measured
Ireland	Female	11-16	25.3	6.3	2001-2002	measured
Ireland	Male	11-16	23.4	5.5	2001-2002	measured
Israel	Both genders	10-16	11.1	1.8	2001-2002	Self-reported
Italy	Both genders	10-16	17.4	2.5	2001-2002	Self-reported
Latvia	Both genders	10-16	5.9	0.5	2001-2002	Self-reported
Lithuania	Both genders	10-16	5.1	0.4	2001-2002	Self-reported
Malta	Both genders	10-16	25.4	7.9	2001-2002	Self-reported
Netherlands	Both genders	10-19	11.2	1.5	2005	Self-reported
Netherlands	Female	10-19	11.4	2.5	2005	Self-reported
Netherlands	Male	10-19	11.0	0.5	2005	Self-reported
Norway	Both genders	12-14	11.5	1.8	2000	Self-reported

Norway	Female	12-14	11.5	1.1	2000	Self-reported
Norway	Male	12-14	11.5	2.5	2000	Self-reported
Poland	Both genders	10-18	14.5	2.0	2000	measured
Poland	Female	10-18	11.0	1.8	2000	measured
Poland	Male	10-18	18.1	2.2	2000	measured
Portugal	Both genders	10-16	18.0	3.0	2001-2002	Self-reported
Russian Federation	Female	13-14	4.0		1998	measured
Russian Federation	Male	13-14	13.0		1998	measured
Serbia	Both genders	11-18	16.7*	3.8*	1995-2002	measured
Serbia	Female	11-18	14.8*	3.0*	1995-2002	measured
Serbia	Male	11-18	18.6*	4.7*	1995-2002	measured
Slovakia	Both genders	10-18	12.9	2.4	2001	measured
Slovakia	Female	10-18	11.9	2.2	2001	measured
Slovakia	Male	10-18	13.8	2.7	2001	measured
Slovenia	Both genders	10-16	14.9	2.0	2001-2002	Self-reported
Spain	Both genders	10-17	24.0	5.6	1998-2000	measured
Spain	Female	10-17	16.5	2.7	1998-2000	measured
Spain	Male	10-17	31.7	8.5	1998-2000	measured
Sweden	Both genders	11	16.0	1.5	2003	Self-reported
Sweden	Female	11	17.0	1.0	2003	Self-reported
Sweden	Male	11	15.0	2.0	2003	Self-reported
Switzerland	Both genders	10-12	17.4	3.5	2002-2003	measured
Switzerland	Female	10-12	18.7	3.4	2002-	measured

					2003	
Switzerland	Male	10-12	16.0	3.6	2002-2003	measured
The former Yugoslav Republic of Macedonia	Both genders	10-16	12.9	2.4	2001-2002	Self-reported
Turkey	Both genders	12-13	13.9*	2.0*	2001-2002	measured
Turkey	Female	12-13	12.9*	2.3*	2001-2002	measured
Turkey	Male	12-13	14.9*	1.7*	2001-2002	measured
Ukraine	Both genders	10-16	6.0	0.5	2001-2002	Self-reported
United Kingdom of Great Britain and Northern Ireland	Both genders	10-16	19.0	4.5	2001-2002	Self-reported

Notes:
* denotes subnational data
** denotes year of publication
BMI: body mass index
NA: not available
NCHS: United States National Center for Health Statistics
SD: standard deviation

References:
Cole TJ et al. Establishing a standard definition for child overweight and obesity worldwide: international survey. British Medical Journal, 2000, 320:1240-1243.

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The prevalence of overweight includes the prevalence of obesity. Overweight and obesity are defined by using international age- and gender-specific cut-off points for BMI, passing through 25 kg/m^2 and 30 kg/m^2 by the age of 18 years, respectively (Cole et al, 2000).

According to WHO categorization, data were categorized (where possible) into the following age groups; children aged 0-9 years; adolescents aged 10-19 years and adults aged 20 years and above.

Intercountry comparisons should be interpreted with caution owing to different data collection methods, response rates, survey years and age ranges.

European health for all database (HFA-DB). WHO Regional. (17)

3.4 Prevalence of overweight and obesity in relation to infant feeding

The authors, Hediger, M. L. et al. (2001), study a sample of 2685 US-born children between the ages of 3 and 5 years, with height and weight measures, and information on infant feeding. A body mass index (BMI) between the 85th and 94th percentile was considered as overweight and a BMI in the 95th percentile or higher was considered as obesity. After adjusting for potential confounders, there was 37% lower risk of overweight for ever breastfed children compared with those never breastfed. There was no reduced risk of obesity and there was no clear dose-dependent effect of the duration of full breastfeeding on being overweight or obese, and no threshold effect. The strongest predictor of child obesity was the mother concurrent weight. The rate of obese children nearly tripled with maternal overweight and more than quadrupled with maternal obesity. (6)

Infants who are fed breastmilk more than formula, or who are breastfed for longer periods, may have a lower risk of being overweight during older childhood and adolescence. This is the result of a study on 8186 girls and 7155 boys aged 9 to 14 years. Overweight was defined as in the above study, but in this one, even controlling for a mother's BMI, breastfed infants were protected against obesity. In the first 6 months of life, 62% of subjects were only or mostly fed breastmilk, and 31% were only or mostly fed formula. 48% were breastfed for at least 7 months while 31% were breastfed for 3 months or less. At age 9 to 14 years, 5% of girls and 9% of boys were overweight. Among those who had been only or mostly fed breastmilk, compared with those only of mostly fed formula, the risk of overweight was 22% lower after adjustment for age, sex, sexual maturity, mother's BMI, and other variables reflecting social, economic, and lifestyle factors. Compared with subjects who had been breastfed for 3 months or less, those who had been breastfed for at least 7 months had a 20% lower risk of overweight, according the study by the authors Gillman M. W. et al (2001). (6)

Several studies in Western societies have reported the protective effects of breastfeeding, but not all studies. The protective effects have been questioned on the grounds of potential confounding factors be maternal overweight and insufficient adjustments for social class. The impact of social class might be operative by different associated lifestyles. Studies in relatively homogenous populations regarding social class might therefore allow controlling for confounding factors by different associated lifestyles. In socialist societies such as Czechoslovakia in the 1970s and 1980s, living conditions of children and their families were widely homogenous and limited with the regard to the available food items. The 5th Nationwide Anthropometric Survey of Children and Adolescents in the former Czechoslovakia performed in 1991 in which extensive data of sociodemographic and other risk factors for childhood obesity had been collected, allowed us to study the impact of

breastfeeding on overweight and obesity. Because there were data on children aged 6 to 14 years, they could also assess the consistency of the breastfeeding effects in the different age groups. Breastfeeding was very common in Czech Republic from 1976 to 1985: 90.7% were ever breastfed and only 9.3% were never brestfed. The number of children in breastfeeding category 1 to 3 months was higher (44.1%) than in the other breastfeeding categories. The prevalence of obesity was 3.2% in breastfed children compared with 4.4% in non-breastfed children. Although longer duration of breastfeeding was associated with a decreased prevalence of overweight (BMI >90th percentile) 12.4% (never breastfed) to 9.0% (>6 months breastfed), no such duration dependent effect was seen for obesity (BMI > 97th percentile). The fact that the baby's intake varies at each feed during breastfeeding, a lower energy density of human milk compared with formula milk, and thus a better self-control of food consumption in breastfed children, are possible explanations for the observed effect of breastfeeding. Non-breastfed children had fewer siblings, were more likely to watch TV for longer hours per day and where less likely to eat fruits. Their parents had lower education levels, were more often obese, and their mothers were more likely to smoke. (7, 14)

In the study by the authors Parson, T. J. et al. (2003), all children born in England, Wales and Scotland in 1958 were studied, with the result that, differently from the above article on Czech children, no relation was found between breastfeeding and BMI. Data were obtained for 98% of 17733 births. BMI was calculated from heights and weights, at 7, 11, 16 and 33 years. Breastfeeding was protective against increased BMI in females at ages 16 and 33 years, and in males at 33 years, but this effect was reduced and no longer significant after adjustment for confounding factors. (7)

In a British study by the authors Li, L. et al (2003), of 2613 children, offspring born from the 1958 cohort described above- no protective effect of breastfeeding on obesity was found. Adjustments for confounding factors- birth weight; mother's smoking during pregnancy- did not alter these findings. (7)

In three consecutive surveys performed in Eastern Germany (1992-3; 1995-6 and 1998-9) with 5- to 14-year-old school children, more than 7000 were assessed in order to analyze the trends in overweight and obesity, according to selected factors. A significant increase was shown for 11-14 y and for 8-10 y, but not for the school entrants aged 5-7 y. Low-birth weight and higher parental education were protective factors against overweight and obesity, while breastfeeding was protective only with regard to obesity. This effect was stronger if the children were exclusively breastfed. (7)

Among a huge sample of children (177304 up to 60 months of age), the authors of this study, Grummer-Strawn, L. M. et al. (2004), examined whether increased duration of breastfeeding is associated with a lower risk of obesity in a low-income American population. A statistical analysis was performed controlling for gender, ethnicity, and birth weight. For 12587 children,

data from pregnancy were available also. The longer the duration of breastfeeding beyond 6 months, the higher the protective effect and the lower the risk of overweight among non-Hispanic whites, but not among Blacks or Hispanic. Breastfeeding for any duration was also protective against underweight. (7)

In a review of 18 studies, the author, Butte, N. F. (2001), concludes that the protective effect of breastfeeding on later obesity remains controversial. 12 studies found a non significant effect, while only 4 showed a protective effect. Parental obesity continues to be the strongest determinant for childhood obesity; this may be partly due to genetic factors (studies on twins and adopted children had already provided estimates of genetic contribution) and partly to shared dietary habits. This review confirms that childhood obesity is caused by several factors; disentangling the effect of breastfeeding is difficult and requires control of many confounding variables on which information is not always available or complete. (7)

The author, Dewey, K. G. (2003), reviews the different studies published up to 2003 that investigate childhood obesity and breastfeeding. She concludes that to understand the relationship, it is necessary to know how to control as many confounding variables as possible; but calls attention on the difficulty to control: 1) child-feeding practices and parental control over feeding, and 2) physical activity. Breastfeeding might reduce child overweight by metabolic programming in early life, but this has to be studies in more depth. (7)

The participants in the Oslo Youth study were born in the 1960s, a decade marked by relatively low breastfeeding prevalence in Norway. The breastfeeding prevalence has since increased, and is currently one of the highest in the Western world. As the results of previous studies are inconclusive, the aim of the authors was to investigate the impact of being breastfed during infancy in the 1960s in Oslo, Norway, on the risk of being overweight or obese during adolescence and 20 years later. The baseline data collection of the Oslo Youth Study was conducted in 1979 (mean age 13 years) in Oslo, Norway. Participants completed a questionnaire at school and underwent a brief health examination. An identical follow-up study was conducted in 1981. At both surveys, parents were also asked to complete questionnaires. As part of the Oslo Youth Study an intervention program to prevent the onset of smoking, increase physical activity and improve dietary habits was implemented and evaluated. Analyses were preformed unadjusted, as well as with adjustments for father's and mother's mean BMI and education level (high school/graduate, no/yes), mother's smoking during pregnancy, and the participant's sex. Mothers and fathers educational levels were combined to one variable such that the highest educational attainment was selected. In an additional analysis, adjustments for intervention status (no/yes), leisure time physical activity (at least twice weekly, no/yes), and smoking (no/yes) were made in 1979/1981 and in 1999, as well as for Tanner's stage in 1979/1981 (three levels) and for the participant's educational attainment (at least one year at university, no/yes) and mean energy intake in 1999. In the

general linear model analyses, all cofactors were included as continuous variables with the mean of five levels for smoking, physical activity, Tanner's stage, and education, and two levels for gender and intervention status. (12)

The results of the study showed that among boys in 1979/1981, the prevalence of overweight and obesity applying Cole's cut off points was 6.6 and 1.2%, respectively. Corresponding numbers for girls were 7.3 and 0.7%. Among the 635 1979/1981 participants, 158 subjects (24.9%) were never breastfed, 272 (42.8%) were breastfed for 1 to 3 months, and 205 (32.2%) for 4 months or more. Corresponding numbers for the 352 subjects also participating in 1999 were 78 (22.2%), 153 (43.5%) and 121 (34.4%), respectively. (12)

In adolescence, the proportion of overweight, according to the definition based on the 90th percentile, among those who had been breastfed was significantly lower than among those not breastfed. With regard to obesity, only those who had been breastfed for more than 3 months had a significantly lower proportion of obese compared to those not breastfed. When using Cole et al.'s definitions of overweight, 12.0, 6.3 and 3.9% were overweight among those not breastfed, those breastfed for 1 to 3 months, and those breastfed for more than 3 months, respectively. Corresponding numbers for obesity according to Cole et al. were 2.5, 0.7 and zero, respectively. Across the breastfeeding categories, mean BMI was lower among those breastfed; however, the result did not reach significance. (12)

For the adult participants in 1999, no statistical significant association between breast feeding and overweight was observed. There was a significant relationship between rate of obesity and breastfeeding, but this relationship became non-significant after adjusting for sex, fathers and mothers BMI and education, and mothers smoking during pregnancy. Across the breastfeeding categories, as for the adolescent age range, mean BMI was lower among those breastfed; however, the result did not reach significance. (12)

In the follow-up of The Oslo Youth Study the authors observed that adolescents who had been breastfed as infants had a lower risk of being overweight or obese; however, after adjustments for potential confounders this relationship weakened and became non-significant. These findings are in accordance with some studies, but not all. There may be several explanations for this inconsistency, including problems inherent in observational studies, different methods used to assess supplemental feeding, different definitions of breastfeeding and different methods and criteria applied for assessing and adjusting for possible confounders. Studies that have analyzed the relationship between breastfeeding and BMI in adulthood, have not found significant relations. Their findings differ somewhat, showing that the risk of adult obesity is reduced among those breastfed for more than 3 months compared to those not breastfed in unadjusted analyses. Furthermore, the point estimates of the adjusted analyses were not considerably changed compared to the crude analyses; however, the relation was no longer statistically significant. It has been argued that

the increased risk of overweight and obesity among children who have not been breastfed does not reflect a shift in the entire distribution of BMI, but rather that the distribution is skewed to the right in formula fed children. Thus, the results of von Kries et al., indicates that breastfeeding protects against later overweight and obesity, may not be replicated if only mean BMI is considered. The authors data, however, indicate that there might be a shift in the entire weight distribution towards higher values, as they found a somewhat increased mean BMI in addition to a higher proportion obese subjects among those not breastfed, especially in adolescence. With increasing age, environmental and behavioural factors, which promote obesity, may diminish any protective effect of breastfeeding. Breastfeeding emerged as a protective factor against overweight and obesity in adolescence, but this effect diminished and was no longer statistically significant 20 years later. There was a dose-response relationship between breastfeeding in infancy and subsequent risk of overweight and obesity. The results support the theory that the protective effect partly works through physiologic mechanisms, although it cannot be ruled out that breastfeeding partly serve as an indicator of lifestyle and socioeconomic factors. (12)

In the study by the authors von Rudiger, K. et al. (1999), from southern Germany, with 9357 children aged 5 and 6 years, they found that the prevalence of obesity in children who had never been breastfed was 4.5% compared with 2.8% in breastfed children. A clear dose response effect was identified for the duration of breastfeeding on the prevalence of obesity: the prevalence was 3.8% for 2 months of exclusive breastfeeding, 2.3% for 3-5 months, 1.7% for 6-12 months, and 0.8% for more than 12 months. Similar relations were found with the prevalence of being overweight. The protective effect of breastfeeding was not attributable to differences in social class or lifestyle. After adjusting for potential confounding factors, breastfeeding remained a significant protective factor against the development of obesity and being overweight. In industrialized countries promoting prolonged breastfeeding may help decrease the prevalence of obesity in childhood. (11)

A Norwegian study from 2003 wanted to analyse factors associated with breastfeeding use of sweetened drinks at 12 months, and to compare dietary habits among breastfed and non-breastfed infants. They found that maternal age, education and smoking status were important factors for breastfeeding at 12 months. Breastfed infants had a lower intake of sweetened drinks and added sugars than non-breastfed infants. From a public health perspective, continued promotion of breastfeeding is needed to reduce inequalities in breastfeeding. Moreover, prevention of high intakes of sweetened drinks and added sugars should start in infancy. (15)

A birth cohort study conducted in the United Kingdom aimed at determining whether different feeding patterns and energy intakes in infancy affect body weight and body mass index (BMI) later in childhood. Among 582 formula- or mixed-fed infants, energy intake at 4 months was

higher in infants who were given solid foods earlier. Higher energy intake at 4 months predicted greater weight gain between birth to age 1, 2, or 3 years and larger body weight and BMI at ages 1 to 5 years. A systemic review examines the influence of initial infant feeding on obesity in later life. 61 studies reported on the relationship of infant feeding to a measure of obesity in later life; of these 28 (298.900 subjects) provided estimates of risk. In these studies, breastfeeding was associated with 11-15% reduced risk of obesity, compared with formula feeding. In eleven small studies of less than 500 subjects, the risk reduction was particularly strong (45-67%), but was still apparent in larger studies of 500 or more subjects (10-15%). In six studies that adjusted for all three major potential confounding factors (parental obesity, maternal smoking, and social class), the risk reduction was lower (7-14%), but still present. (8)

In a study called Breastfeeding and lowering risk of obesity, the researchers looked at more than 30000 Scottish children who were either exclusively breastfed or fed on formula. All children were assessed around the ages of 3 to 3.5 years for body mass index and breastfeeding status during infancy. Researchers identified children as obese if their BMI fell in either the top 2% or top 5% of children in their age. When obesity was defined as top 2% BMI or higher, children who were breastfed had a 30% reduced incidence of obesity. The reduction was slightly lower when obesity was defined as the top 5%. The findings held true even after the results were adjusted to take factors such as socioeconomic status, sex, and birth weight into account. (8)

In 1995-96, a study of 2106, nine and ten year olds in Germany found a “markedly lower overweight prevalence among breastfed than non-breastfed children in Dresden and Munich”. The researchers also noted that, “a longer overall duration of exclusive breastfeeding was associated significantly with decreasing prevalence of overweight”. (8)

In the USA, a 1996-97 study of 15341, 9 to 14 years olds found “that infants who were predominantly fed breastmilk in the first six months of life had a lower incidence of overweight 9 to 14 years later”- this lower incidence was approximately 22%. The authors concluded that longer the duration of breastfeeding, the greater the protection against obesity. (8)

3.5 The long-term benefits of having been breastfed

The author of the paper “The long-term benefits of having been breastfed”, Fewtrell, M. S. (2004), notes that although the short-term benefits of breastfeeding are well-established, there has been increasing interest in possible long-term benefits of breastfeeding for health and development. Data now available from a cluster-randomised trial of a breastfeeding intervention in term infants and follow-up of a randomised trial of early nutrition in preterm infants, suggest that breastfeeding has beneficial effects on later cardiovascular risk factors, reduces risk of obesity during childhood, improves cognitive development and can reduce risk of obesity during childhood, improves cognitive development and can reduce incidence of atopy. The author concludes that breastfeeding should now be promoted for its long-term as well as its short-term benefits. (9)

Over the past two decades there has been a shift in emphasis in the aim of nutritional management, from simply meeting nutrient requirements and preventing deficiencies to a consideration of the potential biological effects of nutrition on later outcome. It is apparent from a number of animal species and now from humans that early nutrition may act as a programming agent. Programming has been defined as the process whereby a stimulus or insult, acting during critical periods early in life, has along-term consequences for the structure or function of the organism. (9)

There is evidence that breastfeeding protects against obesity later in childhood. This is particularly relevant in the context of rapidly increasing levels of child and adult obesity. The odds ratios (OR) for the protective effect of breastfeeding against obesity are remarkable similar across several studies, ranging from 0.75-0.84. Moreover, in some studies there is evidence of a dose response effect with increasing duration of breastfeeding. For example, Von Kries et al. in a study of 9357 children from the south of Germany found that the prevalence of obesity (defined as BMI above the 97th percentile for population) at age 5-6 years was 4.5% in those never breastfed and fell with increasing duration of EBF. Furthermore, the effect of breastfeeding remained after adjusting for potential confounding factors such as social class or lifestyle. After adjustments for confounders, the OR for development of obesity in breastfed children was 0.75, and for being overweight, 0.79. It is possible that the apparently protective effect of breastfeeding on obesity is related to the lower nutrient intakes and slower weight gain of breastfed infants early in life, and this is currently being investigated by a number of groups. In contrast to these findings on the development of obesity during childhood, Parsons et al. examined the associations between infant feeding and obesity in a 33 year follow-up of the 1958 British Birth Cohort. They found that breastfeeding and BMI were unrelated in childhood, but that breastfeeding was protective against increased BMI at 16 and 33 years in women and at 33 years in men.

However, after adjusting for social class, mother's BMI and mother's smoking during pregnancy, the effects became insignificant. It is difficult to reconcile this finding with the fairly consistent results of more recent studies relating infant feeding to obesity risk during childhood. Further follow-up and other cohorts into adult life are clearly required. Nevertheless, even if breastfeeding only protects against obesity during childhood and adolescence this would be significant in the context of obesity-related diseases such as type 2 diabetes, which increasingly occurs in this age group. (9)

The need exists for longitudinal studies that carefully assess childhood growth as well as parental control over infant feeding practices. Similarly, more information is needed on the hormonal effects of breastfeeding that may influence long-term energy metabolism. (13).

3.6 The role of breastfeeding in protection against obesity

There are several factors to be considered:

1. Breastmilk is the physiological standard for normal human infant growth and development. All mammals produce milk, and each milk is specifically nutritionally composed to meet the needs of that animal. Humans are designed to grow at a certain rate, to develop in certain ways. The use of infant formula is still in its "infancy", and finding out about the long-term effects that this radical change in infant's diet has had on the health of our population is important.
2. Disturbed metabolism in infancy. It is now considered that exposure to excessive calories in infancy, can lead the human infant's metabolism to respond by increasing the number of fat cells it lays down in the infant's body. Thus in the future, extra fat can be stored in more cells than otherwise would have been available.
3. Programming of leptin physiology. A recently found protein in human milk, leptin, serves to counter-regulatory hormone to insulin. It may also act as a circulating satiety factor. The amount of milk a baby takes in is not mediated by the parent or caregiver, who is tempted to get the baby to "drink it all up", or "eat everything on the plate". Leptin, and the baby's reactions to his/her milk intake, functions to ensure that only what is needed is drunk.
4. Breastfeeding is an adjustable process. Baby's feeding intakes vary according to individual needs, and the mother's supply adjusts automatically to meet these needs, provided the baby has easy and at-need access to the breast. The breastfed baby self regulates during complementary feeding as well. Mothers of breastfed babies have a more relaxed attitude to their toddler's intake of solid food and their toddlers

consequently eat a wider range of solids and are taller and leaner than their bottle-fed counterparts.

5. Breastmilk is a live fluid, impossible to replicate, full of activity, taste and with subtle differences in composition form feed to feed. (8)

With regards to appetite regulation, Perez-Escamilla et al showed that Honduran babies adjusted their milk intake volume in an inverse proportion to the energy density of their mother's breastmilk. It has also been proposed that the reason that milk fat content toward the end of the feeding episode (i.e. "hind milk") is higher than at the start of the episode ("fore milk") is that it signals the baby that the feeding episode is coming to an end. Obviously, formula-fed babies are not exposed to such "physiological signalling" as the fat concentration in formula remains constant throughout the feeding episode. A corollary of this is that among formula-fed babies it is the caretaker and not the infant who controls the child's caloric intake. Second, breastfed babies gain less weight than formula-fed infants the first year of life. Third, formula-fed babies have higher insulin levels circulating in their blood stream, as a result of the higher protein content in infant formula, which in turn stimulate a higher deposition of fat stores. Fourth, it is possible that breastmilk influences the development of a taste profile that can foster a preference for lower energy diets later in life. (7)

Human milk also contains bioactive factors that may modulate tissue growth and development. Breast milk contains both epidermal growth factor and tumor necrosis factor alpha, both of which are known to inhibit adipocyte differentiation in vitro. (1)

Some human milk proteins (immunoglubulins) are relatively resistant to low pH and proteolysis and hence are not fully digested and absorbed. A high protein intake in excess of metabolic requirements may enhance the secretion of insulin and insulin-like growth factor. Higher plasma concentrations of insulin were observed in formula fed infants compared with breast-fed infants, potentially accounting for a higher fat deposition and the early development of adipocytes. (2)

3.7 Health problems related to overweight and obesity

Obesity is the nutritional disorder coming into picture more commonly in every age group. Childhood obesity is seen setting the ground for many of the adult diseases. The more life threatening problems are associated with cardio-vascular disease, insulin resistance, type 2 diabetes mellitus, certain type of cancers and gallbladder disease. There is also a range of non-fatal health problems associated with obesity, which include respiratory difficulties, chronic musculoskeletal problems, skin problems and infertility. The likelihood of developing type 2 diabetes mellitus and hypertension rises steeply with increasing body fatness. Confined to older adults for most of the 20th century, this disease affects obese children even before puberty. Approximately 85% of people with diabetes are type 2, and of these, 90% are obese or overweight. (3)

This condition is decimating the health care budgets of countries worldwide. In the USA, the direct and indirect costs of obesity are estimated to be over US$ 100 billon per year as a result of direct medical expenditures and lost productivity caused by chronic diseases. (7)

3.8 Infant feeding and health problems related to overweight and obesity

Preventing obesity should be a public health concerns and assumes importance because weight loss interventions in obese children are not only costly but rarely successful. While short-term benefits of breastfeeding reduce the risk of obesity during childhood. Breastfeeding's beneficial effects on later cardiovascular risk factors including blood pressure and plasma lipid profile also assume great importance. Recent research has in fact produced important information on primary prevention of obesity as with every month of breastfeeding reduced the risk of childhood overweight by 4%. This knowledge could be translated to action as a fundamental first step for reducing a child's risk of obesity and related long-term consequences in the form of diseases such as type 2 diabetes. Emphasis is important, as there is a dose related response with increasing breastfeeding duration. Fairly consistent results are available from recent studies where baby's breastfed for nine months had a 31% overall reduction in risk of obesity. This evidence clearly justifies targeting infancy since it is going to be the key while designing interventions for prevention of obesity. Ensuring optimal breastfeeding practices could be the first on this list and avoidance of any artificial feeding during infancy will stand critical in these efforts. The aim should be optimizing infant growth. It is possible that the apparently protective effect of breastfeeding on obesity is related to the

lower nutrient intakes and slower weight gain of breastfed infants early in life, and this is currently being investigated by a number of groups. (8)

High blood pressure: The association between infant feeding and blood pressure in later life is controversial. A systemic review of 25 studies concludes with positive findings may have exaggerated claims that breastfeeding in infancy reduces blood pressure later in life. The results of larger studies suggests that feeding in infancy has, at most, a modest effect on systolic blood pressure, of limited clinical or public health importance, and no effect on diastolic blood pressure. Consumption of human milk has been shown to have many benefits for infants-both pre-term and full term- including a reduced risk of necrotizing enterocolitis, atopy, infections and improved later cognitive development. The hypothesis that consumption of human milk may lower blood pressure is supported by the authors Owen, C. G. et al, (2003), randomised trial. Both mean and diastolic blood pressures were lower comparing infants fed donated human milk with those fed pre-term formula. Even among those babies whose mothers decided to provide breastmilk in addition to the assigned formula diet, diastolic, systolic and mean blood pressure were lower. Further investigation may elucidate mechanisms for early life nutritional programming leading to low or high blood pressure. Breastfeeding was associated with lower systolic blood pressure at 7 years in a study done with more than 7000 UK children. Of all mothers, 83% reported exclusive breastfeeding beyond 2 months (although some water might be included in this definition, it was restrictive to all other liquids except breastmilk). Of those who breastfed, 49% did so for 6 months. The systolic and diastolic blood pressures of breastfed children were 1.2mmHg lower and 0.9mmHg lower, respectively, compared with children who were never breastfed, after controlling for age, sex, room temperature and field observer. Overall, there was a 0.2mmHg reduction in systolic blood pressure for each 3 months of any breastfeeding. The importance of this study is that it took place in 1990's, when infant formula contained less salt than formula manufactured earlier. Even so, children fed infant formula compared to those breastfed presented higher blood pressure. One explanation is the higher sodium content of infant formula. The authors also discuss the implications of this small reduction: lower systolic pressure in 1% of the population is associated with approximately 1.5% reduction in all-cause mortality. (7)

Cholesterol: The authors Owen, C. G. et al. (2002) examined the influence of infant feeding methods on total serum cholesterol (TC) and low density lipoprotein (LDL) cholesterol, both associated with high incidence of coronary heart disease and atherosclerosis. They conducted a cross-sectional study of 13-16 year-olds and reviewed a number of observational studies on the effects of infant feeding on cholesterol in infancy (less than 1 year), childhood/adolescence (1-16 years), and adulthood (17 years or over). 1532 individuals (92% white; 55% male; mean age: 15.1 years) in ten British towns were

examined; and 37 studies with 52 observations on TC/LDL (26/7 in infancy, 17/4 in childhood of adolescence and 9/6 in adulthood) were reviewed. The results show that breastfeeding is associated with increased mean TC and LDL levels in infancy, but lower levels in adulthood. These results suggest that breastfeeding may have long-term benefits for cardiovascular health. Breastfeeding is associated with reduced cholesterol concentration later in life, but previous studies have not used random assignment of infant diet with prospective follow-up. The authors did so in 926 infants born pre-term and randomly assigned to receive donated banked breastmilk or pre-term formula in a second trial, as sole diet or as supplement to mother's milk in both trials. 216 participants were followed up to age 13-16 years. Adolescents who had been randomised to banked breastmilk had a lower C-reactive protein (CRP; a measure og the inflammatory process associated with arteriosclerosis) and LDL to HDL (high density lipoprotein, associated with a lower risk of heart diseases) ratio than those given pre-term formula. A greater proportion of human milk intake in infancy was associated with lower ratios of LDL to HDL and of other lipoproteins associated with heart disease, independent of gestation and potential confounding factors. The authors concluded that their data provide experimental evidence for the long-term benefits of breastmilk feeding on the risk of arteriosclerosis. (7)

Diabetes: To determined whether breastfeeding duration, food supplementation, or age at introduction of gluten-containing foods influence the risk of developing auto-antibodies against islets (the insulin-producing tissue of pancreas), a study of 1610 children was conducted from 1989 to 2003 in inpatient/outpatient clinics in Germany. Blood samples were obtained at birth, age 9 months, 2, 5 and 8 years. Dropout rate was 14.4% by the age of 5 years. Breastfeeding data were obtained by questionnaires and food supplementation data by family interview. Life-table islet auto-antibody frequency was 5.8% by the age of 5. Reduced total or exclusive breastfeeding duration did not significantly increase the risk of developing islet auto-antibodies. Food supplementation with gluten-containing foods before the age of 3 months, however, was associated with a significant, four-fold increase in islet auto-antibody risk. Children who first received gluten-containing foods after the age of 6 months did not have increased risks for islet or celiac disease (a severe lifelong disease due to gluten intolerance) auto-antibodies. The authors, Ziegler, A. G. et al. (2003), concluded that ensuring compliance to WHO infant feeding guidelines is a possible way to reduce the risk of developing type 1 diabetes auto-antibodies. (7)

A case-control study was carried out in Sweden on 517 children and in Lithuania on 286 children 0 to 15 years old with newly diagnosed type 1 diabetes mellitus. The study included three age- and sex-matched health controls. In Sweden, exclusive breastfeeding longer than 5 months (longer than 2 months in Lithuania), total breastfeeding longer than 7 or 9 months, and breastfeeding substitution later than the third month were shown to be protective against

diabetes when adjusted for all other factors. The authors advise that postponing introduction of breastmilk substitutes might protect children form type 1 diabetes. (7)

Constipation: Breastfeeding may be a protective factor against constipation in the first 6 months of life. This is the conclusion drawn after a study of 275 infants consecutively enrolled in two primary care clinics in the city of Embu, near Sao Paulo. Constipation was found in 25% of them; the prevalence was higher between 6 and 24 months (39%) than in the first 6 months (15%). The statistical analysis demonstrated that formula-fed infants were 4.5 times more liable to develop constipation than infants who were predominantly breastfed. The daily dietary fibre intake was similar among the constipated and non-constipated infants. Constipation was defined by the elimination of hard stool associated with one of the following: painful or difficult defecation, hard or round cracked stools and less than three defecations a week. (7)

30 infants and young children aged 4 months to 3 years with chronic constipation and anal fissure (surgical causes were excluded) were compared with 30 children in the same age range with normal bowel habits, in the study by Adrian, F. et al (2003). The mean daily consumption of cow's milk was significantly higher in the former (756 ml, range 200-1500) than in the latter group (253 ml, range 0-1000). Children with chronic constipation and anal fissure were breastfed for a significantly shorter period (5.8 months, range 0-18) than the other children (10.1 months, range 2-24). (7)

3.9 Breastfeeding and infant growth

The study by the authors Kramer, M. S et al (2002), wanted to find out if prolonged and exclusive breastfeeding (EBF) were associated with lower infant weight and length at a later age. The study suggests that it may actually accelerate weight and length gain in the first few months, with no detectable deficit by 12 months. Within a randomised trial conducted in Belarus, 17.046 healthy, full-term, singleton breastfed infants weighing more than 2500 g were followed up at 1, 2, 3, 6, 9, and 12 months for measurements of weight and length. Data were analysed according to randomisation, but also combining the two randomised groups and comparing 1378 infants weaned in the first month and those breastfed for the full 12 months of follow-up with either 3 months or more, or 6 months or more of EBF. In the analysis by random assignment, mean weight was significantly higher in the intervention group by 1 month of age (4341 vs. 4280 g). The difference increased through 3 months (6153 vs. 6047), declined slowly thereafter, and disappeared by 12 months (10564 vs. 10571). Length followed a similar pattern. In the analysis by type of feeding, infants weaned in the first month were slightly lighter and shorter at birth and their weight-for-age and length-

for-age declined by 1 month, but they caught up to the other groups by 6th months and were heavier and longer by 12 months. (6)

Some studies have reported that children weaned late show lower height-for-age. The study by the authors, Simondon, K. B. et al. (2001), shows that prolonged breastfeeding actually increased length, and that the negative correlation between height-for-age and duration of breastfeeding is probably due to earlier weaning of healthy, well-nourished children. A cohort of 443 children recruited from dispensaries at 2 months of age was visited in their homes at 6-months intervals when they were approximately 1.5 to 3 years old. Weight, length, arm circumference and triceps skin fold thickness were measured. Six-month increments were analysed in relation to breastfeeding (breastfed compared with weaned children or breastfeeding duration), and maternal housing. The mean duration of breastfeeding was 24.1 months. At 3 years, height-for–age was greater for those who were weaned earlier, but this association disappeared after adjustment for height-for-age in infancy. Length increments were significantly greater in both the second and third years of life in children breastfed for longer duration and tended to be greater in breastfed than in weaned children in the second year of life. In the third year of life, breastfed children had greater length increments than did weaned children in the subgroup with poor housing. Breastfeeding had no significant influence on weight gain. (6)

Recent meta-analyses concluded that having been breastfed is associated with a 13-22% reduced odds for overweight in childhood and later in life, and the meat-analysis by Harder et al. confirmed a dose response effect according to duration of breast-feeding. The basis for such an effect may be behavioural, related to maternal feeding styles that are less controlling and more responsive to infant cues of hunger and satiety. Alternatively, or additionally, the infant's physiologic response to the nutritional or hormonal content of breastmilk may explain effects of breastfeeding on growth. However, several issues are unresolved, including the potential for residual confounding to explain the effect. Moreover, it is possible that the impact of breastfeeding on childhood obesity may be attenuated or reversed among children whose mothers have diabetes or may be enhanced if mothers are overweight. Increased glucose and insulin content of breastmilk of diabetic mothers may contribute to effects of breastfeeding on infant growth, although some investigators have found no difference in macronutrient content of breastmilk of well-controlled diabetic mothers. The importance of this result lies in the potential for breastfeeding to reduce excess risk of obesity and diabetes, which may occur among offspring of diabetic or overweight mothers. (10)

The authors, Mayer-Davis et al. (2006), sought to evaluate whether maternal diabetes or weight status attenuates a previously reported beneficial effect of breastfeeding on childhood obesity and found that for all subjects combined, breastfeeding was associated with reduced overweight (compared with normal weight) in childhood. Compared with exclusive use of

formula, the odds ratio (OR) for exclusive breastfeeding was 0.66, adjusting for age, sex and Tanner stage. Results did not differ according to maternal status (non-diabetes/normal weight OR 0.73; non-diabetes/overweight 0.75 and diabetes 0.62). Further adjustments for potential confounders attenuated results, but results remained consistent across strata of maternal status. They concluded that breastfeeding was inversely associated with childhood obesity regardless of maternal diabetes status or weight status and these data provide support for all mothers to breastfeed their infants to reduce the risk for childhood overweight. They also said that it is possible that the beneficial effects of breastfeeding may contribute to breaking the cycle of overweight and diabetes, which may occur among offspring of diabetic mothers. (8)

Differences in the growth pattern of breastfed and formula-fed infants during the period of exclusive milk-feeding are well recognized and have been attributed to differences in nutrient intake. Researchers have also noted a number of endocrine/metabolic differences between breast and formula feeders, suggesting that the development of fat cells is more tightly controlled in the breast-fed baby. (2)

3.10 Current preventive strategies

I will now present the current recommendations from WHO European Ministerial Conference on Counteracting Obesity from Istanbul, Turkey, 15-17 November 2006.

1. WHO European Ministerial Conference on Counteracting Obesity:

Challenge:

1.1 The epidemic of obesity poses one of the most serious public health challenges in the WHO European Region. The prevalence of obesity has risen up to three-fold in the last two decades. Half of all adults and one in five children in the WHO European Region are overweight. Of these, one third are already obese, and numbers are increasing fast. Overweight and obesity contribute to a large proportion of noncommunicable diseases, shortening life expectancy and adversely affecting the quality of life. More than one million deaths in the Region annually are due to disease related to excess body weight.

1.2 The trend is particularly alarming in children and adolescents, thus passing the epidemic into adulthood and creating a growing health burden for the next generation. The annual rate of increase in the prevalence of childhood obesity has been rising steadily and is currently up to ten times higher than it was in 1970.

1.3 Obesity also strongly affects economic and social development. Adult obesity and overweight are responsible for up to 6% of health care expenditure in the European Region; in addition, they impose indirect costs (due to loss of lives, productivity and related income) that are at least two times higher. Overweight and obesity most affect people of lower socioeconomic groups, and this in turn contributes to a widening of health and other inequalities.

1.4 The epidemic has built up in recent decades as a result of the changing social, economic, cultural and physical environment. An energy imbalance in the population has been triggered by a dramatic reduction of physical activity and changing dietary patterns, including increased consumption of energy-dense nutrient-poor food and beverages (containing high proportions of saturated as well as total fat, salt and sugars) in combination with insufficient consumption of fruit and vegetables. According to available data two thirds of the adult population in most counties in the WHO European Region is not physically active enough to secure and maintain health gains, and only in a few countries does the consumption of fruit and vegetables achieve the recommended levels. Genetic predisposition alone can not explain the epidemic of obesity without such changes in the social, economic, cultural and physical environment.

1.5 International action is essential to support national policies. Obesity is no longer a syndrome of wealthy societies; it is becoming just as dominant in developing countries and countries with economies in transition, particularly in the context of globalization. Taking intersectoral action remains a challenge, and no country has yet effectively managed to bring the epidemic under control. Establishing strong internationally coordinated action to counteract obesity is both a challenge and an opportunity, as many key measures are cross-border both in character and in their implication.(5)

2. What can be done: goals, principles and framework for action

2.1The obesity epidemic is reversible. It is possible to reverse the trend and bring the epidemic under control. This can only be done by comprehensive action, since the root of the problem lies in the rapidly changing social, economic and environmental determinants of people's lifestyles. The vision is to shape societies where healthy lifestyles related to diet and physical activity are the norm, where health goals are aligned with those related to the economy, society and culture and where healthy choices are made more accessible and easy for individuals.

2.2 Curbing the epidemic and reversing the trends the ultimate goal of action in the Region. Visible progress, especially relating to children and adolescents, should be achievable in most countries in the next 4-5 years and it should be possible to reverse the trend by 2015 at the latest.

2.3 The following principles need to guide action in the WHO European Region:

2.3.1 High-level political will and leadership and whole-government commitment are required to achieve mobilization and synergies across different sectors.

2.3.2 Action against obesity should be linked to overall strategies to address non-communicable diseases and health promotion activities, as well as to the broader context of sustainable development. Improved diet and physical activity will have a substantial and often rapid impact in public health, beyond the benefits related to reducing overweight and obesity.

2.3.3 A balance must be struck between the responsibility of individuals and that of government and society. Holding individuals alone accountable for their obesity should not be acceptable.

2.3.4 It is essential to set the action taken within the cultural context of each country or region and to acknowledge the pleasure afforded by a healthy diet and physical activity.

2.3.5 It will be essential to build a partnership between all stakeholders such as government, civil society, the private sector, professional networks, the media and international organizations, across all levels (national, sub-national and local).

2.3.6 Policy measures should be coordinated in the different parts of the Region, in particular to avoid shifting the market pressure for energy-dense food and beverages to countries with less regulated environments. WHO can play a role in facilitating and supporting intergovernmental coordination.

2.3.7 Special attention needs to be focused on vulnerable groups such as children and adolescents, whose inexperience or credulity should not be exploited by commercial activities.

2.3.8 It is also a high priority to support lower socioeconomic population groups, who face more constrains and limitations on making healthy choices. Increasing the access to and affordability of healthy choices should therefore be a key objective.

2.3.9 Impact on public health objectives should have priority consideration when developing economic policy, as well as policies in the area of trade, agriculture, transport and urban planning.

2.4 A framework, linking the ain actors, policy tools and settings, is needed to translate these principles into action.

2.4.1 All relevant government sectors and levels should play a role. Appropriate institutional mechanisms need to be in place to enable this collaboration.

- Health ministries should play a leading role in advocating, inspiring and guiding multisectorial action. They should set the example when facilitating healthy choices among employees in the health sector and health service users. The role of the health system is also important when dealing with people at high risk and those already overweight and obese, by designing and promoting prevention measures and by providing diagnosis, screening and treatment.

- All relevant ministries and agencies such as those for agriculture, food, finance, trade and economy, consumer affairs, development, transport, urban planning, education, education and research, social welfare, labour, sport culture, and tourism have an essential role to play in developing health promoting policies and actions. This will also lead to benefits in their own domain.

- Local authorities have great potential and a major role to play in creating the environment and opportunities for physical activity, active living and a healthy diet, and they should be supported in doing this.

2.4.2 Civil society can support the policy response. The active involvement of civil society is important, to foster the public's awareness and demand for action and as a source of innovative approaches. Nongovernmental organizations can support strategies to counteract obesity. Employers', costumers', parents' youth, sport and other associations and trade unions can each play a specific role. Health professionals' organizations should ensure that their members are fully engaged in preventive action.

2.4.3 The private sector should play an important role and have responsibility in building a healthier environment, as well as for promoting healthy choices in their own workplace. This includes enterprises in the entire food chain from primary producers to retailers. Action should be focused on the main domain or their activities, such as manufacturing, marketing and product information, while consumer education could also play a role, within the framework set by public health policy. There is also an important role for sectors such as sports clubs, leisure and construction companies, advertisers, public transportation, active tourism, etc. the private sector could be involved in win-win solutions by highlighting the economic opportunities of investing in healthier options.

2.4.4 The media have an important responsibility to provide information and education, raise awareness and support public health policies in this area.

2.4.5 Intersectoral collaboration is essential not only at national but also at international level. Who should inspire, coordinate and lead the international action. International organizations such as the United Nations Food and Agriculture Organization (FAO), the United Nations Children's Fund (UNICEF), the World Bank, the Council of Europe, the International Labour Organization (ILO), and the Organisation for Economic Cooperation and Development (OECD) can create effective partnerships and thus stimulate multisectoral collaboration at national and international levels. The European Union (EU) has a principal role to play through EU legislation, public health policy and programmes, research and activities such as the European Platform for Action on Diet, Physical Activity and Health.

2.4.6 Policy tools range from legislation to public/private partnerships, with particular importance attached to regulatory measures. Government and national parliaments should ensure consistency and sustainability through regulatory action, including legislation. Other important tools include policy reformulation, fiscal and public investment policies, capacity-building and partnership, research, planning and monitoring. Public/private partnerships with a public health rationale and shared specified public health objectives should be encouraged. Specific regulatory measures should include: the adoption of regulations to substantially reduce the extent and impact of commercial promotion of energy-dense foods and beverages, particularly to children, with the development of international approaches, such as a code on marketing to children in this area; and the adoption of regulations for safer roads to promote cycling and walking.

2.4.7 Action should be taken at both micro and macro levels, and in different settings. Particular importance is attached to settings such as the home and families, communities, kindergartens, schools, workplace, means of transport, the urban environment, housing, health and social services, and leisure facilities. Action should also cover the local, country and international levels. Through this, individuals should shift to a portfolio of interventions

designed to change the social, economic and physical environment to favour healthy lifestyles.

2.4.8 Action should be aimed at ensuring an optimal energy balance by stimulating a healthier diet and physical activity. While information and education will remain important, the focus should shift to a portfolio of interventions designed to change the social, economic and physical environment to favour healthy lifestyles.

2.4.9 A package of essential preventive actions should be promoted as key measures; countries may further prioritize interventions from this package, depending on their national circumstances and the level of policy development. The package of essential action would include: reduction of marketing pressure, particularly to children, promotion of breastfeeding; ensuring access to and availability of healthier food, including fruit and vegetables; economic measures that facilitate healthier food choices; offers of affordable recreational/exercise facilities, including support for socially disadvantaged groups; reduction of fat, free(particularly added) sugars and salt in manufactured products; adequate nutrition labelling; promotion of cycling and walking by better urban design and transport policies; creation of opportunities in local environments that motivate people to engage in leisure time physical activity; provision of healthier foods, opportunities for daily physical activity, and nutrition and physical education in schools; facilitating and motivating people to adopt better diets and physical activity in the workplace; developing/improving national food-based dietary guidelines and guidelines for physical activity; and individually adapted health behaviour change.

2.4.10 Attention should also in continue to be focused on preventing obesity in people who are already overweight and thus at high risk, and on treating the disease of obesity. Specific actions in this area would include: introducing timely identification and management of overweight and obesity in primary care, provision of training for health professionals in the preventing of obesity; and issuing clinical guidance for screening and treatment. Any stigmatization or overvaluation of obese people should be avoided at any age.

2.4.11 When designing and implementing policies successful interventions with demonstrated effectiveness need to be used. These include projects with proven impact on the consumption of healthier foods and levels of physical activity such as: schemes to offer people free fruit at school; affordable pricing for healthier foods; increasing access to healthier foods at workplaces and in areas of socioeconomic deprivation; establishing bicycle priority routes; encouraging children to walk to school; improving street lighting; promoting stair use; and reducing television viewing. There is also evidence that many interventions against against obesity, such as school programmes and active transport, are highly cost-effective. The Who Regional Office for Europe will provide decision-makers with examples of good practice and case studies. (5)

3. Progress and monitoring

3.1 The present charter aims to strengthen action against obesity throughout the WHO European Region. It will stimulate and influence national policies, regulatory action including legislation ans action plans. A European action plan, covering nutrition and physical activity, will translate the principles and framework provided by Charter into specific action packages and monitoring mechanisms.

3.2 A process needs to be put together to develop internationally comparable core indicators for inclusion in national health surveillance systems. These data could then be used for advocacy, policy-making and monitoring purposes. This would also allow for regular evaluation and review of policies and actions and for dissemination of findings to a wide audience.

3.3 Monitoring progress on a long-term basis is essential, as the outcomes in terms of reduced obesity and the related disease burden will take time to manifest them. Three-year progress report to prepare at the WHO European level, with the first due in 2010. (5)

The second current preventive strategy I present is called “Infant and young child feeding: standard recommendations for the European Union”. It has been developed within the European Commission funded project EUNUTNET (European Network for Public Health Nutrition: Networking, Monitoring, Intervention and Training) to complete the Blueprint for Action for the Protection, Promotion and Support of Breastfeeding in Europe, the result of a previous European Commission funded project.

The introduction: Breastfeeding is the natural way to feed infants and young children. Exclusive breastfeeding for the first six months of life ensures optimal growth, development and health. After that, breastfeeding with appropriate complementary foods continues to contribute to the infant’s and young child’s growth, development and health. Early cessation of breastfeeding have important adverse health, social and economic implications for women, children, the community and the environment, result in greater expenditure on national health care provision, and may increase inequalities in health. Despite difficulties in interpreting data, it is clear that current initiation, exclusivity and duration rates of breastfeeding in virtually every country worldwide, including EU countries where they are high, there is a marked fall-off in the first six months and throughout most of Europe the exclusive breastfeeding rate at six months is low. The most common identified barriers to the initiation and continuation of breastfeeding include:

- Insufficient coverage and quality of prenatal education on infant and young child feeding
- Suboptimal maternity hospital policies and practices
- Lack of timely follow-up and competent support

- Misinformation and lack of guidance and encouragement from health workers
- Lack of or poor implementation of the International Code of Marketing of Breast milk Substitutes
- Early return to work in the absence of workplace facilities and support for breastfeeding
- Lack of family and broad societal support and in some countries, media portrayal of formula as the norm.

Appropriate complementary feeding and transition towards a well balanced diet of nourishing family foods are also important for the growth, development and health of young children. Promoting healthy eating behaviours in young children is acknowledged, with the promotion of physical activity, as one of the main interventions for the control of the current epidemic of obesity.

The aim of the document is to provide recommendations that will inform all health workers- whether in primary health care, in hospitals or other community health care settings- caring for parents and children during pregnancy, childbirth and in the first three years of life, of the best evidence-based practices to protect, promote and support optimal feeding of infants and young children in their different work settings.

3.11 Breastfeeding promotion, protection and support

Breastfeeding is an unequalled way of providing ideal food for the healthy growth and development of infants; it is also an integral part of the reproductive process with important implications for the health of mothers. A recent review of evidence has shown that, on a population basis, exclusive breastfeeding for 6 months is the optimal way of feeding infants. Thereafter infants should receive complementary foods with continued breastfeeding up to 2 years of age or beyond. (17)

To enable mothers to establish and sustain exclusive breastfeeding for 6 months, WHO and UNICEF recommend:

- Initiation of breastfeeding within the first hour of life
- Exclusive breastfeeding – that is the infant only receives breastmilk without any additional food or drink, not even water
- Breastfeeding on demand – that is as often as the child wants, day and night
- No use of bottles, teats or pacifiers

Breastmilk is the natural first food for babies, it provides all the energy and nutrients that the infant needs for the first months of life, and it continues to provide up to half or more of a child's nutritional needs during the second half of the first year, and up to one-third during the second year of life. Breastmilk promotes sensory and cognitive development, and protects the infant against infectious and chronic diseases. Exclusive breastfeeding reduces infant mortality due to common childhood illnesses such as diarrhoea or pneumonia, and helps for a quicker recovery during illness. Breastfeeding contributes to the health and well-being of mothers; it helps to space children, reduces the risk of ovarian cancer and breast cancer, increases family and national resources, is a secure way of feeding and is safe for the environment. While breastfeeding is a natural act, it is also a learned behaviour. An extensive body of research has demonstrated that mothers and other caregivers require active support for establishing and sustaining appropriate breastfeeding practices. WHO and UNICEF launched the Baby-friendly Hospital Initiative in 1992, to strengthen maternity practices to support breastfeeding. The foundation for the BFHI is the Ten Steps to Successful Breastfeeding described in Protecting, Promoting and Supporting Breastfeeding: a Joint WHO/UNICEF Statement. The evidence for the effectiveness of the Ten Steps has been summarized in a scientific review document. (17)

The BFHI has been implemented in about 16.000 hospitals in 171 countries and it has contributed to improving the establishment of exclusive breastfeeding world-wide. While

improved maternity services help to increase the initiation of exclusive breastfeeding, support throughout the health system is required to help mothers sustain exclusive breastfeeding. (17)

WHO and UNICEF developed the 40-hour Breastfeeding Counselling: A training course to train a cadre of health workers that can provide skilled support to breastfeeding mothers and help them overcome problems. Basic breastfeeding support skills are also part of the 11-day Integrated Management of Childhood Illness training course for first-level health workers, which combine skills for adequate case management with preventive care. Evaluation of breastfeeding counselling delivered by trained health professionals as well as community workers has shown that this is an effective intervention to improve exclusive breastfeeding rates. (17)

Ten steps to successful breastfeeding

Every facility providing maternity services and care for newborn infants should follow these ten steps to successful breastfeeding

1. Have a written breast-feeding policy that is routinely communicated to all health care staff.
2. Train all health care staff in skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breast-feeding.
4. Help mothers initiate breast-feeding within a half-hour of birth.
5. Show mothers how to breast-feed, and how to maintain lactation even if they should be separated from their infants.
6. Give newborn infants no food and drink other than breast milk, unless medically indicated.
7. Practise rooming-in - allow mothers and infants to remain together - 24 hours a day.
8. Encourage breast-feeding on demand.
9. Give no artificial teats or pacifiers (also called dummies or soothers) to breast-feeding infants.
10. Foster the establishment of breast-feeding support groups and refer mothers to them on discharge from the hospital or clinic.

Source:http://www.euro.who.int/nutrition/Infant/20020808_1?language=French (17)

4.0 CONCLUSION

Globally, there are more than 1 billion overweight adults, at least 300 million of them obese. Over 22 million children under the age of 5 years are severely overweight, as are 155 million children of school age. This implies that one in 10 children worldwide is overweight. Obesity is a complex condition, with serious social and psychological dimensions, affecting all ages and socioeconomic groups. The health consequences range from increased risk of premature death, to serious chronic conditions that reduce the overall quality of life, including type 2 diabetes, cardiovascular disease, hypertension and stroke, and certain forms of cancer. Increased consumption of more energy-dense, nutrient-poor foods with high levels of sugar and saturated fats, combined with reduced physical activity, have led to obesity rates that have increased three-fold or more since 1980 in some areas of the world. The obesity epidemic is not restricted to industrialized societies; this increase is often faster in developing countries than in the developed world. Of special concern is the increasing incidence of child obesity. This epidemic reflects the large changes in society and in behavioural patterns of communities over recent decades, economic growth, modernization, urbanization and globalization. The genes are important in determining a person's susceptibility to weight gain, and the energy balance is determined by calorie intake and physical activity. The rapidly increasing epidemic is a warning sign that it is necessary to take appropriate actions. The focus should be on the risk factors and preventive measures. One of the most important preventive measures is breastfeeding. Almost all studies show reduced risk of overweight and obesity in childhood when breastfed. Many of them conclude that the benefits form breastfeeding is dose dependent. The longer the child is breastfed the lower is the risk of overweight and obesity. Today's recommendations are exclusive breastfeeding for the first six months. The short-term benefits of breastfeeding are well-established, but the long-term benefits of having been breastfed have still not been studied enough. It may be beneficial for reducing cardiovascular risk factors, improve cognitive development, reduce risk of atopy as well as reduce risk of later overweight and obesity. Both societies and governments need to act to curb the epidemic. National policies should encourage and provide opportunities for greater physical activity, and improve the availability and accessibility of healthy foods. They should also encourage the involvement of different government sectors, civil society, the private sector and other stakeholders.

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