

REVIEW ARTICLE

Prevalence and time trends of obesity in Europe

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CLASSIFICATION OF OBESITY AND FAT DISTRIBUTION

The epidemiology of obesity has for many years been difficult to study because many countries had their own specific criteria for the classification of different degrees of overweight. Gradually during the 1990s, however, the BMI (weight in kg/height in m²) became a universally accepted measure of the degree of overweight and now identical cut-points are recommended. The most recent classification of overweight in adults by the World Health Organization (WHO) is shown in Table 1 (1).

Table 1 - Classification of overweight in adults by the World Health Organization.

Classification	BMI (kg/m ²)	Associated health risks
Underweight	<18.5	Low (but risk of other clinical problems increased)
Normal range	18.5-24.9	Average
Overweight	≥25.0	Increased
pre-obese	25.0-29.9	Moderately increased
obese class I	30.0-34.9	Severely increased
obese class II	35.0-39.9	Very severely increased
obese class III	≥40	

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In many community studies in affluent societies this scheme has been simplified and cut-off points of 25 and 30 kg/m² are used for descriptive purposes. Both the prevalence of very low BMI (<18.5 kg/m²) and very high BMI (40 kg/m² or higher) are usually low, in the order of 1-2% or less. Researchers in Asian countries have already criticized these cut-points. The absolute health risks (particularly of Type 2 diabetes mellitus) seem to be higher at any level of the BMI in Chinese and South-Asian people, which is probably also true for Asians living elsewhere. There are some developments that indicate that the cut-points to designate obesity or overweight may be lowered by several units of BMI (e.g. 23 kg/m² for overweight and 25 kg/m²) for obesity in Asian populations. In countries such as China and India, each with over a billion inhabitants, small changes in the criteria for overweight or obesity potentially increase the world estimate of obesity by several hundred million (currently estimates are about 250 million worldwide).

Much research over the last decade has suggested that for an accurate classification of overweight and obesity with respect to the health risks one needs to focus on abdominal fat distribution. Traditionally this has been indicated by a relatively high WHR. Recently, it has been proposed that the waist circumference alone may be a better and simpler measure of the health risks associated with abdominal fatness (2). In 1998 the National Institutes of Health (National Heart, Lung and Blood Institute) adopted the BMI classification and combined this with waist cut-off points (3). In this classification the combination of overweight (BMI between 25 and 30 kg/m²) and moderate obesity (BMI between 30 and 35 kg/m²) with a large waist circumference (≥102 cm in men or ≥88 cm in women) is proposed to carry additional risk (3).

In this review, I shall focus on the prevalence of overweight and obesity as indicated by the BMI. The emphasis is on recent surveys and time-trends and data have been selected that are based on representative population surveys with measured weight and height.

Table 2 - Prevalence of obesity (age standardized percentage with $BMI \geq 30 \text{ kg/m}^2$) in centers in EU countries participating in the first round of the MONICA study (May 1979 to February 1989) and the third round (June 1989 to November 1996). Modified from (7) with permission.

Country (Center) EU countries (+Switzerland and Iceland)	Men		Women		Sex ratio 3 rd round (women/men)
	1 st →3 rd round		1 st →3 rd round		
Belgium (Ghent)	9	10	11	11	1.10
Denmark (Glostrup)	11	13	10	12	0.92
Finland (North Karelia)	17	22	23	24	1.09
Finland (Kuopio)	18	24	20	25	1.04
Finland (Turku/Loimaa)	19	22	17	19	0.86
France (Toulouse)	9	13	11	10	0.77
France (Lille)	13	17	17	22	1.29
Germany (Augsburg, urban)	18	18	15	21	1.17
Germany (Augsburg, rural)	20	24	22	23	0.96
Iceland (Iceland)	12	17	14	18	1.06
Italy (Brianza area)	11	14	15	18	1.29
Italy (Friuli)	15	17	18	19	1.12
Spain (Catalonia)	10	16	23	25	1.56
Sweden (North)	11	14	14	14	1.00
Switzerland (Vaud/Fribourg)	12	16	12	9	0.56
Switzerland (Ticino)	19	13	14	16	1.23
United Kingdom (Belfast)	11	13	14	16	1.23
United Kingdom (Glasgow)	11	23	16	23	1.00
Mean	13.7	17.0	16.4	18.8	1.07

PREVALENCE AND TIME TRENDS OF OBESITY IN ADULTS IN EUROPE

In many reviews it has been shown that obesity (defined as a $BMI \geq 30 \text{ kg/m}^2$ or higher) is a prevalent condition in most countries with established market economies (4, 5). There is a wide variation in the prevalence of obesity among and within these countries. It is quite easy to find places with at least two-fold difference in the prevalence of obesity in one single country. In countries with established

market economies, obesity is usually more frequent among those with relative low socio-economic status and the prevalence increases with age until about 60-70 yr of age, after which it declines (6). In most of these established market economies it has been shown that the prevalence is increasing over time (4, 5). Tables 2 and 3 show the increases in the prevalence of obesity in men and women aged 35-64 yr in several centers participating in the WHO MONICA project (7). It is clear that there is a rapid

Table 3 - Prevalence of obesity (age standardized percentage with $BMI \geq 30 \text{ kg/m}^2$) of centers in countries in Central and Eastern Europe participating in the first round of the MONICA study (May 1979 to February 1989) and the third round (June 1989 to November 1996). Modified from Molorius et al. (7).

Country (Center) Central and Eastern European Countries	Men		Women		Sex ratio 3 rd round (women/men)
	1 st →3 rd round		1 st →3 rd round		
Poland (Warsaw)	18	22	26	28	1.27
Poland (Tarnobrzeg)	13	15	32	37	2.47
Russia (Moscow)	14	8	33	21	2.63
Russia (Novosibirsk)	13	15	43	43	2.87
Czech Republic (rural CZE)	22	22	32	29	1.32
Yugoslavia (Novi Sad)	18	17	30	27	1.59
Mean	16.3	16.5	32.7	30.8	2.03

increase in the prevalence of obesity in most centers from countries in the European Union, particularly in men. The prevalence of obesity in men and women in European countries in the EU region (Table 2) is similar with a women/men prevalence ratio of 1.07 (range: 0.56-1.29). In central and eastern European countries (Table 3) the prevalence is generally much higher in women than in men (average women/men prevalence ratio 2.03; range: 1.27-2.87).

In centers from countries in central and eastern Europe the prevalence of obesity in women may have stabilized or even slightly decreased but still the prevalence remains among the highest in Europe. A study by Molarius *et al.* (7) showed that the social class differences in the prevalence of obesity are increasing with time. Obesity is becoming increasingly a lower class problem in Europe.

There are only a few countries in Europe where the evaluation of time trends in obesity based on national survey data with measured height and weight is feasible. Figures 1 and 2 show the secular time trends of the prevalence of obesity in the UK and the Netherlands. Figure 3 shows the same data recorded in Finland. In the mid 1980s the prevalence of obesity in men was similar in these 2 countries but in the UK the increase in the prevalence has been much more dramatic than in the Netherlands (8).

Table 4 shows the prevalence of obesity in some less well studied countries including some which were previously part of the Soviet Union (9). In most of these surveys the prevalence in women was in the order of 15-20% and this was considerably higher than the prevalence observed in men.

Figure 4 shows the women/men ratio of prevalence of obesity ($BMI > 30 \text{ kg/m}^2$) in 1997 in the

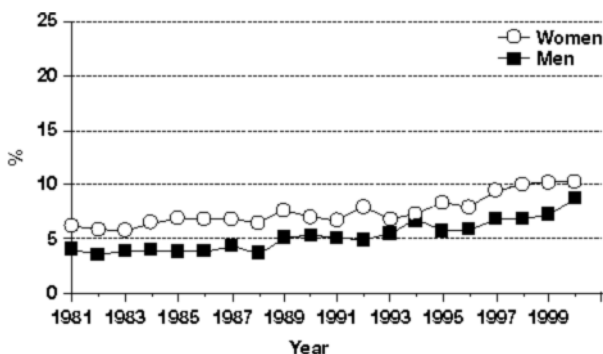


Fig. 1 - Time trends in the prevalence of obesity ($BMI \geq 30 \text{ kg/m}^2$) in the UK (data from the Health Survey for England).

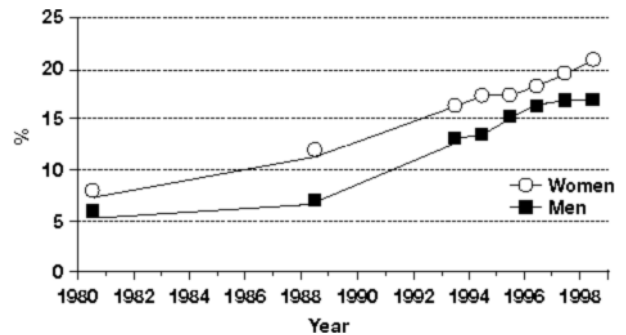


Fig. 2 - Time trends in the prevalence of obesity ($BMI \geq 30 \text{ kg/m}^2$) in the Netherlands [data from the National Institute of Public Health in Bilthoven and Statistics Netherlands (CBS)]. Modified from (9).

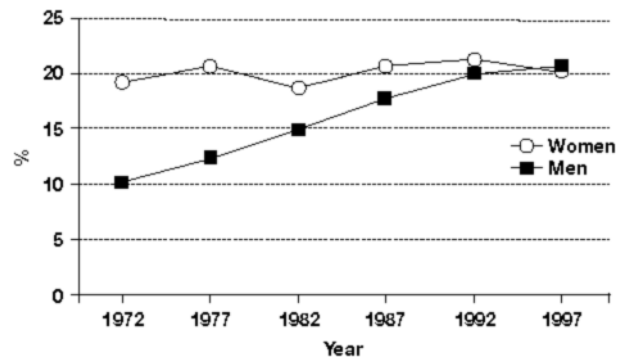


Fig. 3 - Time trends in the prevalence of obesity ($BMI \geq 30 \text{ kg/m}^2$) in Finland. Modified from (9).

UK, by age (older than 16 yr). The prevalence is similar in 25-65-yr-old men and women but it is progressively higher with age in women over the age of 65 yr and it is also higher in women compared to men in the youngest age group (16-24 yr). There are several possible explanations for the higher prevalence in women at older ages. It may be the result of a secular trend in which the prevalence of obesity has increased more in men from more recent birth cohorts than in women of the same age. An alternative plausible explanation is a biological one. After menopause women may experience a greater increase in body fat mass compared to men as a result of the drop in estrogen levels.

A third explanation may be that obese men die more often prematurely than obese women do. The age-standardized absolute risk of some obesity-related diseases such as coronary heart disease is higher among men than among women of the same age.

Table 4 - Overweight (BMI 25-29.9 kg/m²) and obesity (BMI ≥30 kg/m²) levels in the Baltic States. Modified from (8) with permission.

Country	Year of survey	Sample size	Percentage of overweight		Percentage of obese	
			Men	Women	Men	Women
Estonia	1997	1154	32.0	23.9	9.9	6.0
Latvia	1997	2292	41.0	33.0	9.5	17.4
Lithuania	1997	2096	41.9	32.7	11.4	18.3
Lithuania*	2000	2195	45.6	31.6	16.9	23.4
Kazakstan**	1995	3538	-	21.8	-	16.7
Uzbekistan**	1996	4077	-	16.3	-	5.4

*"Finbalt" study based on self-reported height and weight (Janina Petkeviciene, personal communication). **Modified from (18) with permission.

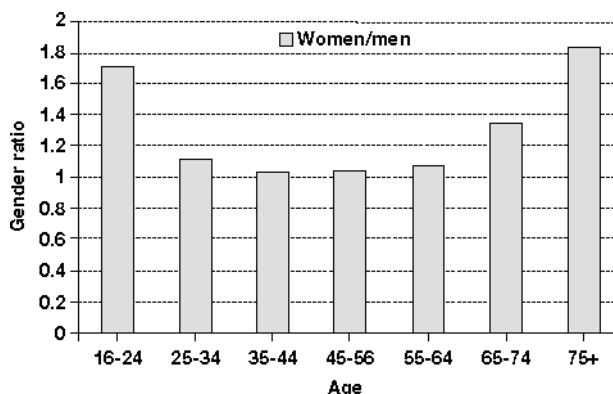


Fig. 4 - The gender ratio (women/men) of the prevalence of obesity (BMI ≥30 kg/m²) by age in the Health Survey for England (ages 16+), 1997. Modified from (9).

EXPLANATIONS FOR THE GROWING EPIDEMIC OF OBESITY

Life-style changes

On an ecological level or population level these time trends are not too difficult to explain although exact quantification of different factors is almost impossible. On the one hand there is an increase in the average energy supply *per capita*. The World Health Report (10) has estimated that the average energy supply *per capita* and day in the world was 2300 kcal in 1963, 2440 kcal in 1971, 2720 kcal in 1992 and it is estimated that in 2010 it will be 2900 kcal. These increases are obviously not evenly distributed across the world population and, sadly, many remain undernourished although in Asia (particularly China and India) and in most of Latin America malnutrition is declining. The number of people with access to at least 2700 kcal/day has increased from 0.145 billion in 1969-1971 to 1.8 billion in 1990-1992 and is estimated to grow to 2.7 billion in 2010. Even when corrected for the increase in the world population this implies a more than ten-fold increase in the number of people hav-

ing access to high caloric diets. The globalization of agricultural production and food processing has not only affected the quantity of energy available *per capita* but also the energy density.

At the same time there are continuing changes in the physical demands of work and leisure time. Increasingly we are at leisure during working hours and we workout during leisure time. Mechanization of many types of work and changes in transportation are causing ever-increasing numbers of people to be sedentary for most of the time.

Increasing sedentary behavior has been proposed to be one of the principal reasons for a further increase in the prevalence of obesity in countries with established market economies. Sedentary behavior is poorly measured by the number of hours engaged in sports only. Large and important differences can be seen in the number of hours spent at sedentary jobs and in front of television or computer screens during leisure time. Transportation is almost certainly a factor as well. For example, 30% of short trips in the Netherlands are done by bicycle and 18% by walking. In the UK these percentages are 8% by cycling and 12% by walking, and in the USA 1% by bicycle and 9% by walking. These daily activities accumulated over a year can easily explain the small but persistent changes in energy balance needed to greatly increase the prevalence of obesity.

Figure 5 shows the disturbances in energy balance necessary to shift individual BMI from 23 to 26 kg/m². Energy intake in excess of energy expenditure only needs to be 20 kcal/day to produce about 1 kg weight gain over a year. This is in the order of 5 minutes of walking per day less or an additional can of beer per week. There are compensating increases in energy expenditure, however, which may range from 15-25 kcal/day per kg of weight gain in women and men respectively (11) so that the actual increase in energy intake or reduction in energy expenditure to achieve major weight change are much larger.

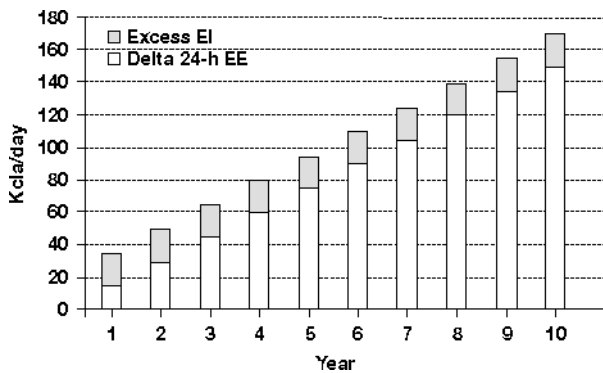


Fig. 5 - Hypothetical calculations of the magnitude of a positive energy balance to gain 10 kg over 10 yr. It is estimated that an excess energy intake (EI) of 20 kcal/day over a one-year period leads to a weight gain of about 1 kg. One kilogram of weight gain is estimated to lead to about a 15 kcal/day increase in 24-h energy expenditure (EE). Data for women from (11) with permission.

Given the changes in lifestyles over the last decades in many parts of the world it is not surprising that people gain weight on the average although for many individuals this seems to remain a mystery. With small changes in average bw the prevalence of obesity increases rapidly. For every unit increase in BMI there is an increase in the prevalence of obesity with 5 percent points (1).

Social, economic and cultural determinants of the prevalence of obesity

There are many factors that affect energy balance and are determinants of obesity. The major determinants can be classified into 3 groups (12):

- biological influences and unalterable factors (e.g. age, sex, hormonal factors, and genetics);
- behavioral influences (which are the result of complex psychological factors, including habits, emotions, attitudes, beliefs, and cognitions developed through a background of learning history).
- environmental influences (physical, economic, and socio-cultural environment)

Many behavioral and socio-cultural factors that affect energy balance and obesity relate to eating habits and physical activity. Out of the many gender-related social determinants of obesity, I shall briefly discuss the perception of overweight as a desirable or undesirable trait. The attitudes towards obesity vary greatly across social and ethnic groups and are related to the economic position of individuals and groups. In many affluent countries women experience social pressures to be thin. Katzmarzyk *et al.* (13) studied the bw and shape of Playboy center-folds from 1978 to 1998 as an ex-

ample of culturally "ideal" women and noted that 70% of them were underweight by WHO standards (BMI <18.5 kg/m²). They speculate that this phenomenon helps to explain the high levels of body dissatisfaction and disordered eating among women. It has been observed that these social pressures towards thinness are greater among women than among men and greater in women with a high educational level compared to those with a low educational level. The prevalence of obesity is also sharply inversely associated with educational level. Black women in the USA are more likely to be obese than white women, even when adjusted for socio-economic status, but they are less likely to perceive themselves as being overweight (14). Such epidemiological data would suggest that the perception of overweight as an undesirable characteristic may play a role in the prevention of overweight particularly in young white women of high socio-economic background in affluent countries. This is undoubtedly an oversimplification but if true it does so against the potential cost of an increased risk of body dissatisfaction and perhaps disordered eating.

The perception of overweight among black women from disadvantaged communities in South Africa, where food insecurity is a continuous concern, is very different (15). A qualitative in-depth survey of overweight women in these communities showed that the concept of an individual voluntarily regulating food intake when food was available was completely unacceptable. Increased BMI was regarded as a token of well-being in that marital harmony was perceived to be reflected in increased bw. Overweight children were regarded as reflecting health as it was associated with sufficient food supply and intake. According to a survey in a urban black population in the Cape Peninsula in South Africa more than half of the women above the age of 35 yr were obese (BMI >30 kg/m²) whereas a considerable proportion of the children was undernourished (16). The Cape Peninsula is an example of a population that has undergone rapid economic transition and which has moved from under-nutrition to extreme over-nutrition. Doak *et al.* (17) have similarly described the coexistence of overweight and underweight within households in Brazil, China and Russia with an underweight child coexisting with an overweight non-elderly adult being the predominant pair combination in all 3 countries. On an international level, Martorell *et al.* (18) have studied the prevalence of obesity in women aged 15-49 yr in different regions of developing countries. The prevalence of obesity was estimated to be about

17% in the Middle-East and North Africa, over 15% in Central Eastern Europe/ Commonwealth of Independent States, about 6% in Latin America and the Caribbean and less than 3% in Sub-Saharan Africa. There was a clear positive association between the gross national product (GNP) and the percentage of obesity up to a level of \$1500 per year GNP. With higher GNPs the relationship was no longer present. In these countries obesity was more prevalent in urban compared to rural areas and among people with high educational level compared to those with low educational level. The relationship between obesity and the indicators of social class sharply diminished with an increase in the countries' GNP.

Such observations illustrate the complexities of the social determinants of obesity. In affluent countries the social pressures to thinness seem to be more intense in women than in men and in developing countries the pressures towards high BMI seem also to be directed mainly to women. In affluent countries the preoccupation of diet is more common in those with high socio-economic status, whereas in developing countries a high BMI is particularly appreciated in those with low socio-economic status. These social pressures may reflect many underlying issues among which food insecurity may be an important and often neglected element (19). In societies where food security is never a problem, obesity is common but not appreciated (particularly in women), whereas in food insecure societies obesity is uncommon in women but regarded as a desirable trait. In countries undergoing an economic transition and in immigrants from developing to developed countries the traditional perceptions of ideal bw in women may be sustained. At the same time, increases in food availability and decreases in energy expenditure promote weight gain. Such a mixture of attitudes and change of socio-economic conditions may, in part, be an explanation for the exceptionally rapid increase in the prevalence of obesity in particularly in women in such populations. The reason why the socio-cultural ideals vary more by socio-economic conditions among women than among men may be explained by the relative importance of energy reserves in women under conditions where the food supply is insecure. The energy reserves required for pregnancy and lactation may provide a biological basis for the cultural perception of an association between obesity and fertility. In situations where food is abundant throughout the year and no strenuous physical activity is required the cultural ideals about body shape seem to disappear.

CONCLUSIONS

The prevalence of obesity is increasing at an alarming rate in many parts of the world. In white populations living in the western and northern Europe, Australia and the USA, the prevalence of obesity is similarly high in men and women. In countries with relatively low GNP such as those in central and eastern Europe, Asia, Latin-America and Africa, the prevalence is 1.5 to 2 times higher among women than among men.

Within affluent societies the rates of obesity seem to be more common among women at older ages (65 yr) and in groups with relatively low socio-economic status.

It can be tentatively concluded that obesity is particularly common in women living in relatively poor conditions.

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