



**French National Institute of Health and
Medical Research**

Obesity

Assessment and the evaluation of obesity prevention and management programs

Collective expert review

2006

This document presents the work of the expert group convened by Inserm in the context of the collective expert procedure to respond to the request from the Parliamentary Office for Evaluation of Health Policies (Opeps) regarding the assessment of the programs for obesity management and prevention in France. The study took account of a document base of 550 articles and documents available as at the first quarter, 2005.

The Inserm collective expert review center coordinated the collective expert review.

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Foreword

Recent French epidemiological data show a marked increase in obesity, particularly childhood obesity. As in other European countries and the United States, the trend concerns the whole population but more frequently families with low incomes. The consequences of that trend with regard to health are becoming worrying and have economic impacts. In order to combat the epidemic, measures were defined a few years ago by international (WHO), European and French organizations.

The combat against obesity has involved the highest political authorities in France. The French Parliamentary Office for Evaluation of Health Policies (Opeps) requested an assessment of obesity and an evaluation of the programs set up in France in the fields of obesity prevention, screening and treatment. Inserm responded to that call by setting up a pluri-disciplinary group of experts under the collective expert review procedure. The group's mission was to respond to the various aspects of the request.

The expert group's proceedings were structured by a set of questions drawn up on the basis of the specifications and addressing the epidemiological situation, economic implications, preventive strategies, healthcare system organization, French and international initiatives and their impact, and the role of research.

The objective of this report is to supply the Parliamentary Office for Evaluation of Health Policies with a review of the scientific arguments and public health strategies on which obesity prevention and treatment operations are based. The following have been analyzed: the context, strengths and weaknesses of the French initiatives in the field, the opportunities and obstacles, the principles of the actions and the priority approaches for the public authorities. Since obesity is a multifactorial disease that is largely dependent on the environment and behaviors, the expert review aimed to position the socioeconomic issues raised by obesity prevention and treatment.

The assessment mainly addresses the design and implementation of various programs, in particular with regard to the time course of the concepts underlying those programs. The orientations, prospects and limitations of the operations implemented at international, European and local level were elucidated in the course of several hearings.

The expert group has submitted, as a final synthesis, the main findings and principles of the operations as defined by the collective review. The review has not attempted to formulate new 'recommendations', which are available elsewhere.

It is to be noted that the evaluation of the impact of those programs on health at the individual and population levels is premature since those programs were only initiated recently (less than 5 years ago).

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Epidemiological data

It is currently firmly established that obesity, i.e. excess body weight, is increasingly frequent in the population. This phenomenon may be clearly demonstrated for both adults and children by the increase in the body weight of our contemporaries for a given gender, age and height. The evidence is so striking that the health authorities became aware of it at the end of the last century (WHO, 1997). Mobilization in most Western countries resulted. However, the in-depth understanding of the causes of the phenomenon and rational assessment of its consequences in terms of individual and collective health are far from perfect. In parallel with the public health measures to be taken to halt the progression, progress in our understanding of the phenomenon is necessary.

The epidemiological context of the combat against obesity is reviewed in this chapter. An attempt is made to indicate the limitations and interpretation difficulties of the reported findings. The prevalence of obesity and, above all, its recent progression are discussed, as are the current data on the public health consequences, particularly with respect to cardiovascular disease and mortality. Special attention is paid to the role of socioeconomic factors as determinants of obesity in the population.

Prevalence of adult overweight and obesity

Individual corpulence measurement is an essential biometric parameter. It is appropriate to distinguish between the overall indices that, for each gender, are only a function of body weight (W), height (H) and possibly age, from the combinations of more specific anthropometric measurements (skinfolds, circumferences, diameters, etc.) designed to characterize certain characteristics of body composition (fat mass, adipose tissue distribution, etc.). The universally used overall index is the Quetelet index or body mass index ($BMI = W/H^2$).

The generalized use of the BMI as a body mass indicator, in particular in epidemiology, is due to its great simplicity of determination together with two properties that have been approximately verified on adult populations. BMI is independent of the subject's height and fairly strongly correlated ($r = 0.6$ to 0.8) with fat mass. However, BMI has a low individual predictive value. It is more appropriate for population studies than for clinical use. The mean BMI of a population and the percentage of subjects with BMI values greater than certain cutoffs enable characterization of corpulence distribution in the population. Thus, by convention, the proportion of subjects considered overweight is the proportion whose BMI exceeds the cutoff of 25 kg/m^2 while those considered obese exceed 30 kg/m^2 . Finer categories have been proposed (Visscher *et al.*, 2001) but incorporate the two cutoffs systematically used today. The two prevalences obviously depend on the population under study and particularly on age and gender. It should be stressed that those definitions, which are based, as will be seen, on epidemiological observation, do not reflect natural subpopulations and are to be treated with caution at individual level.

The prevalence of excess weight and obesity in adults in France has markedly increased over the last ten years.

The ObEpi survey conducted by telephone in 1997, 2000 and 2003 (Charles and Basdevant, 2003) showed that the prevalence of obesity increased from 8.2 to 11.3% while overweight subjects (thus including obese subjects) increased from 36.7 to 41.6% of the French population aged over 15 years. The trend exists for all age groups, but the mean annual rate of increase in the frequency of obesity would appear to be higher in the age groups 25-34 and 35-44 years (of the order of 8% per year).

An annual survey employing similar methodology and conducted on the US population aged over 18 years (Mokdad *et al.*, 1999) showed a comparable rise in reported obesity, but a rise which began much earlier, since, in the period 1991-1998, obesity prevalence increased from 11.7% for men (12.2% for women) to 17.7% (18.1% for women). The prevalence of obesity in France in 2003 was thus the same as that in the United States in 1991. In the United States, the increase also affected all age groups but was relatively more marked for the age group 18-29 years (of the order of 10% per year).

Repeated epidemiological surveys with measurement of the weight and height of subjects in representative national samples are only available for a few countries. The Nhanes series of surveys in the United States showed an increase in the prevalence of overweight and obesity that has been particularly marked since the start of the 1980s (Flegal *et al.*, 1998 and 2002). The frequency of obesity in people aged over 20 years increased from 13.4% in the 1960s (overweight: 43.4%) to 15% in the 1980s (overweight: 46.2%), then to 30.5% in 1999-2000 (overweight: 64.5%).

In contrast, in Europe, a comparable relative increase only emerged in the 1990s: 10.1% obesity in 1998 in The Netherlands vs. 5.9% in 1988 in subjects aged 19 years and older (Hulshof *et al.*, 2003). The regional representative samples of the Monica project showed high levels since they targeted the age group 35-64 years for which the BMI is on average the highest (Seidell *et al.*, 2002). In Western Europe, the mean prevalence of 15% for the first survey (1979-1985) increased to 18% ten years later (1991-1996). For example, 20.2% obese and 61% overweight subjects were observed in Finland in 1992 (Pietinen *et al.*, 1996) vs. 16 and 58.2%, respectively, in 1982. The mean prevalences in the three French regions targeted by the project (Lille, Strasbourg, Toulouse) were 17 and 18%, respectively (Marquès-Vidal *et al.*, 2004) and therefore had not changed substantially between the two periods. This is compatible with a perhaps rather later increase in obesity in France than in other European countries and an even later increase relative to the United States.

A few remarks will be formulated on the interpretation of that particularly consistent set of results.

The increase in the prevalence of obesity in Western populations indicates that an increasing proportion of subjects have a high fat mass. Although the phenomenon is observed at all ages, the trend appears associated with more marked fat mass increases, particularly at the start of adulthood. Few representative data are available for direct confirmation of the trend but it is to be observed that, in the ObEpi survey, the subjects' self-measured waist circumference increased, on average, from 84.6 cm in 1997 to 86.2 cm in 2000 and 87.2 cm in 2003, equivalent to an annual relative increase of 5%.

The increase in the proportion of obese or overweight subjects was accompanied in all cases by an increase in the mean BMI of the corresponding adult population. The increase is thus largely secondary to changes affecting all the population rather than the particular behaviors of subjects with a high BMI (Silventoinen *et al.*, 2004). However, certain fine analyses show that the general effect of increasing corpulence is not the only mechanism (Pietinen *et al.*,

1996), suggesting that the profile of the BMI distribution in the population is changing with an increase in variance and skewing toward high values.

In France, the proportion of military service recruits who were overweight or obese also constantly increased over the period 1987-1996, from 11.5 to 16.5% and from 1.5 to 3.1%, respectively, while height continued to increase (Salem *et al.*, 2000). This suggests that the increase in the body weight of 19-year old recruits, secondary to the secular trend towards an increase in height, was accompanied by a supplementary weight gain that could already be measured at the end of adolescence. It is thus remarkable that the increase in the prevalence of obese and overweight adults was also observed in children and adolescents over the same period (Lobstein *et al.*, 2004).

Prevalence of childhood overweight and obesity

A simple indicator of corpulence associated with excess fat mass is more difficult in children than in adults since, in children of a given age, BMI is positively associated with height. The correlations observed between BMI and direct estimations of fat mass are generally smaller and depend on the age, gender and pubertal status of the children. However, for high values, i.e. for the detection of obesity, the sensitivity and specificity of the BMI are considered satisfactory (Mast *et al.*, 2002). Despite those reservations, it was considered useful to retain the same body mass index for children, in particular at the epidemiological level. A supplementary step in the standardization of the expression of overweight and obesity in children was made in 2000 by the International Obesity Task Force (IOTF) which proposed: first, replacing the BMI cutoffs defined on the basis of distributions specific to each population by those for a population common to a set of countries; secondly, defining the percentiles corresponding to the cutoffs for each age as those yielding an overweight and obesity frequency at age 18 years defined by the cutoffs of 25 and 30 kg/m², respectively. Those are the universal cutoffs for adults (Cole *et al.*, 2000).

The demonstration of a recent increase in the prevalence of childhood obesity in France and in other Western countries (earlier in the United States) has been well documented (Rolland-Cachera *et al.*, 1992; Lehingue *et al.*, 1996) and reported in the Inserm collective expert review 'Obesity, screening and prevention in children' (2000). Table 1.I complements those data without repeating them. The table is restricted to those studies having used the IOTF definitions, enabling better comparisons. In the interest of simplification, the frequencies have been reported for both genders together.

Table 1.I: Prevalence of overweight and obesity in children by age group as per the IOTF definitions (Cole *et al.*, 2000)

Reference	Country	Characteristics	Age (year)	Period	Overweight (%)	Obesity (%)
De Peretti et Castetbon, 2004	France	National survey Measurements	14-15	1990-1993	8.3	2.4
				1999-2000	10.4	3.9
Lioret, 2004	France	National survey Interviews	3-14	1993-1994 ^a	14.2	2.4
				1998-1999 ^b	15.2	3.5
Romon, 2005	France	Lille Measurements	5	1989	9.6	1.8
				2000	16.9	4.9
Heude, 2003	France	Nord France Measurements	5-12	1992	11.4	1.6
				2000	14.3	2.8
Lobstein, 2003b	United Kingdom	National survey Measurements	7-11	1974	6.0	
				1984	8.0	
				1994	12.5	
				1998	20.0	
Magarey, 2001	Australia	National survey Measurements	7-11	1985	10.4	1.7
				1995	14.4	5.0
				1985	9.5	1.6
				1995	17.2	5.2
Kautianen, 2002	Finland	National survey Interviews	12-18	1977	5.6	0.7
				1999	13.3	2.0
Ogden, 2002	United States	National survey Measurements	6-8	1976-1980	12.1	3.1
				1988-1994	20.5	7.7
				1999-2000	30.3	15.2

^a ASPCC study: study by the Association sucre-produits sucrés communication consommation

^b INCA study: National Individual Food Intake study

The results observed in France were particularly consistent and show, over the decade 1990-2000, a systematic increase in prevalence, which was relatively greater for obesity than for overweight. The increase over that period was apparently less marked than in countries such as the United Kingdom and Australia. The difference compared to American children is striking since the French rates in 2000 were approximately the same as those observed in the United States at the start of the 1980s. The 30% overweight prevalence for American children aged 6 to 8 years in 2000 may be compared with the European rates in various surveys conducted on 7- to 11-year olds at the end of the 1990s (Lobstein *et al.*, 2003a). The difference is of the same order for Mediterranean children (31 to 36% in Greece, Spain and Italy) but ranges from 12% (The Netherlands) to 20% (United Kingdom) in Northern Europe and was 19% for France.

Overall, the increase in childhood BMI over the 1990s was observed for all age groups and in both boys and girls. The relative increase in the prevalence of obesity may differ in certain groups but the between-study results are in that respect very variable.

In line with the findings in 19-year old recruits, the secular increase in the height of children was pursued over that decade. In consequence, it may be considered that a small proportion of the increase in corpulence may not be due to an increase in fat mass. However, several studies of the mean adiposity of children of a given age (directly measured) showed that the parameter increased in parallel with their body mass index over the same period. Deheeger *et al.* (2004) showed that the increase in overweight prevalence (97th percentile), children aged over 6 years born in 1985 vs. those at the same age born in the years 1953-1959, was

accompanied by an increase in skinfold thickness and subscapular/tricipital fold ratio indicating both an increase in fat mass and a more android change in its distribution. McCarthy *et al.* (2003) showed a parallel increase in waist measurement and BMI in adolescents aged 11-16 years in two national surveys in the United Kingdom conducted in 1977 (1987 for girls) and 1997.

In short, an increase in overweight and obesity prevalence is known to have occurred in the French population over some 10 years, as was the case in all Western countries, but the onset was much later than in the United States. The current prevalences for children, adolescents and adults may be considered intermediate with respect to those of other countries but markedly lower than those for the US population. Interpreted as essentially reflecting an increase in fat mass, in terms of relative value, the change does not seem exhibit major between-age-group differences and thus does not appear to depend on birth generation. This suggests that the causes largely reside in the time period itself. Numerous population obesity studies have thus particularly addressed the associations between overweight/obesity and the lifestyle, socioeconomic category, cultural habits, and other characteristics of the subjects constituting the population.

Obesity, overweight and socioeconomic factors

In the ObEpi survey, the prevalence of adult obesity differed between regions with the highest prevalence in the North and in the Paris area (Charles and Basdevant, 2003). However, the increase over the period 1997-2003 was more marked in the Paris area and Mediterranean region. The result is to be compared to the distribution of overweight recruits in 1996: overweight recruits had been more frequently from the North and the Mediterranean regions since 1987 (Salem *et al.*, 2000). The overweight frequency also falls with the size of the administrative unit ('*commune*') of residence. This finding was first observed in 1987 and is doubtless associated with differences in corpulence depending on socioeconomic category. Thus, in the ObEpi survey, in 2003, obesity was 2-fold less frequent in managers and the liberal professions (8.5%) than in craftsmen and tradesmen (16.1%). It is remarkable that the increase in the prevalence of obesity over the period 1997-2003 affected all the socioeconomic categories in a similar manner. Parallel results were observed with another indicator of social status: educational level. The frequency of obesity was 20% in subjects with primary education only and 6% in those with higher education. The increase in obesity since 1997 is once again systematic, irrespective of the educational level considered. Socioeconomic category and educational level are associated with obesity prevalence, independently of each other, in the population of Seine Saint-Denis, for which a low income is also associated with obesity (La Rosa *et al.*, 2003). That finding is not, however, systematically encountered in the literature. In the 1996 Health Survey in the United Kingdom, educational level was the most important factor. The social category effect disappeared when educational level was taken into account (Wardle *et al.*, 2002). The marked increase in obesity and overweight in Austrian recruits over the period 1985-2000 was observed irrespective of educational level and educational level was confounded by height, since recruits with a higher educational level were both taller and had a lower BMI (Kirchengast *et al.*, 2004).

Obviously, numerous other socioeconomic indicators have been studied and the results obtained for overweight and obesity systematically point in the same direction in European populations. Comparison of 8 indicators in a population of Helsinki city employees showed that having had economic difficulties in childhood and currently having economic difficulties seems particularly decisive with respect to the risk of obesity after adjusting for

the other more conventional indicators (Laaksonen *et al.*, 2004).

The particular status of the US adult population is noteworthy in this context: the association between a low educational level and the frequency of obesity, very marked in the 1971-1974 Nhanes survey, underwent gradual attenuation and disappeared completely in the 1999-2000 survey (Zhang *et al.*, 2004). Currently, obesity, which is so frequent in the United States (overall adult prevalence: 30% in 2000), appears to be developing in an equivalent manner in the various social classes and over the various ethnic origins suggesting a greater homogenization of living conditions, or at least those that contribute to individual susceptibility to weight gain.

It is remarkable that, over the same periods, the populations of developing countries also experienced, overall, an increase in the frequency of obesity. In contrast, the differences between the population groups with different educational levels increased: those with a low educational level had higher rates than others. This was more marked, the greater the economic development of the country (Monteiro *et al.*, 2004).

It is not surprising that in France, as is the case in many Western countries, the frequency of childhood overweight and obesity differs depending on the parents' socioeconomic levels. In the 1998-1999 INCA survey cited above, the overweight frequency in children aged 3-14 years ranged from 7% in the children of parents who were managers or employed in the liberal professions to 25% in the children of unemployed people. With regard to children aged 10-11 years, a study of primary school children (class: CM2) over the school year 2001-2002 (Labeyrie *et al.*, 2004) demonstrated similar differences (13 vs. 31%). In children aged 14-15 years (class 3 in 2001-2002), overweight prevalence ranged from 11% (managers' children) to 22% (unskilled workers' children), while the obesity rates were 1 to 7%, respectively (De Peretti *et al.*, 2004). A more important role of the mother's educational level than that of the family's financial resources in adolescents aged 12 years has been suggested (Klein-Platat *et al.*, 2003). In children aged 12 to 13 years (class: 5), in the North of France, Romon *et al.* (2005) observed an increase in overweight and obesity prevalence between 1989 and 1999 that affected all socioeconomic parental categories except managers and liberal professions. For the latter, the prevalences did not increase. Those results do not seem to have been confirmed in other populations (Toschke *et al.*, 2005).

Of course, several studies have investigated whether the association between child BMI and parental socioeconomic indicators was independent of the association with one or two overweight parents. The study by Lang-Nase *et al.* (2002) of a sample of German school children aged 5-7 years showed that each of the two factors had its own effect. The specific effect of the child's living conditions may be associated with a more sedentary lifestyle, less physical exercise, inferior diet, etc., pointing to the essential components of the etiology of overweight and obesity at population level. Those components will be analyzed elsewhere in this study.

Public health consequences associated with obesity and overweight

The recent increase in the prevalence of obesity described above concerns all the population irrespective of age, i.e. in France several million men, women and children. The scale of the analysis of the consequences of the trend is thus clearly the public health scale. However, it should not be overlooked that the most severe obesity is associated with individual health problems that require management by specialist physicians. Such cases may therefore be considered morbid obesity. There is thus a medical approach to morbid obesity that aims at reducing, as far as possible, the excess fat mass and managing the most immediate

consequences in the form of visceral, functional and psychological complications. In the context of health policy, the clinical and public health approaches are thus complementary with the latter attempting to restrict the longer term consequences of non-massive obesity, which is much more frequent. Those consequences can only be dealt with at the population level by addressing the health risks they induce. Epidemiological knowledge plays an essential role in that field. The epidemiological findings and their limitations are briefly described below.

Obesity, cardiovascular and diabetic risk factor

While obesity is now considered 'a major contributor to the overall weight of disease' by the World Health Organization (WHO, 1997), it is largely because adults with a high body mass have a greater probability of becoming diabetic, developing ischemic heart disease, and more generally, developing cardiovascular disease. This field remained controversial for a long time. In the last 20 years, however, a large number of epidemiological results derived in particular from cohort studies have become available. Biology has elucidated the fundamental role of adipose tissue in metabolism and its consequences in essential pathophysiological fields such as inflammation.

The risk of developing type 2 diabetes mellitus (maturity-onset diabetes) increases markedly with body mass index since, in two large-scale US cohort studies, the risk was increased 10-fold in women presenting with a BMI greater than 29 kg/m² (greater than 31 kg/m² in men) vs. the basal value (< 20 kg/m²) (Chan *et al.*, 1994; Carey *et al.*, 1997). The risk also increases for more modest increases in BMI. Similarly, weight loss is associated with a decrease in the diabetic risk, particularly in obese and overweight subjects (Tuomilheto *et al.*, 2001; Wannamethee *et al.*, 2005). It has now been clearly shown that it is the excess fat mass and, in particular, its perivisceral or abdominal location, which is involved in the susceptibility to diabetes. Following Reaven (1988), numerous authors now consider that the waist measurement is an indicator that could be more pertinent than BMI with respect to the risk of diabetes: an increase in waist measurement is reported to be the central component of the metabolic syndrome in which the emergence of insulin-resistance accompanies the development of type 2 diabetes.

Obesity or, more generally, excess body mass, is the most important determinant in the three classic fields of vascular risk: increased blood pressure, reduced HDL cholesterol (and/or increased triglycerides) and type 2 diabetes. In the largest US cohort studies, an increase in the risk of ischemic heart disease in overweight and, more markedly, obese subjects was evidenced (Manson *et al.*, 1990; Rimm *et al.*, 1995). However, the association between BMI and cardiovascular risk has sometimes yielded variable results. Explanations may be attempted today, but the variability of the results reflects the complexity of the field.

The risk associated with BMI only clearly emerges after sufficiently long follow-up of the study population: 12 years, for instance, in the Framingham study (Hubert *et al.*, 1983). While this finding helps explain the absence of a significant association in studies with shorter follow-up, it also suggests that a sufficient extent of exposure to excess fat mass may be necessary. This calls into question the preventive efficacy of weight loss that is only of short duration.

The relative risk associated with BMI falls markedly with age (Hubert *et al.*, 1983) and in an approximately equivalent manner for men and women, although differences have been observed for certain complications. In the study by the American Cancer Society, the excess cardiovascular mortality associated with a 1 kg/m² increase in BMI fell regularly from 10% for subjects aged 30-44 years of either gender. There was no excess mortality for subjects

aged over 85 years (Stevens *et al.*, 1998).

In parallel with the findings with respect to the risk of diabetes, excess fat mass and, in particular, its abdominal distribution, are, overall, more strongly associated with cardiovascular risk than is BMI. This was shown in the 1980s by several studies: a Swedish team using the waist/hips circumference ratio (Larsson *et al.*, 1984), the Paris Prospective Study using skinfold thickness distribution (Ducimetière *et al.*, 1986) and studies based on the iliac/thigh circumference ratio (Ducimetière *et al.*, 1989). Since then, the results have been confirmed by several large-scale cohort studies (Rimm *et al.*, 1995; Rexrode *et al.*, 1998).

Obesity and cancer

Various studies have shown a relationship between excess body weight and cancer in man. So far, the question has attracted little interest since the relative risk of cancer in the event of obesity is increased much less than it is with smoking. Moreover, the mechanisms relating excess fat mass to cancer have not been elucidated. The current progression of obesity, in the United States, in particular, has drawn attention to the long-neglected question: the relative risk is undoubtedly small but now applies to a third of the US population. In a recent prospective study of a population of 900,000 adults (about 400,000 men and 500,000 women) first analyzed in 1982 and followed up over 16 years, the relationships between BMI in 1982 and cancer death risk were analyzed overall and by disease site (Calle *et al.*, 2005). A multivariate analysis took into account a series of parameters including smoking. The subjects presenting with morbid obesity, i.e. BMI \geq 40, had a mortality rate that was 52% (men) to 62% (women) higher than that of subjects with a normal BMI. For both genders, BMI was significantly associated with an increased risk of death due to cancer of the esophagus, colon, rectum, liver, bile ducts, pancreas and kidneys. Non-Hodgkin's lymphoma and multiple myeloma were also more frequent in subjects presenting with morbid obesity. In men, cancer of the prostate and stomach were more frequent in the event of obesity. In women, cancer of the breast, uterus, cervix and ovaries were more frequent. The authors reported that overweight and obesity could explain 14% of cancer deaths in men and 20% in women. The highest relative risk was observed for cancer of the uterus, kidneys and cervix and the lowest risk for myeloma and cancer of the colon and rectum. The results confirmed previously published data. The International Agency for Research on Cancer considers that there are now sufficient arguments for including the prevention of weight gain in the preventive measures with respect to cancer of the endometrium, kidneys, esophagus, colon and breast (post-menopausal). What is surprising in the association between corpulence and cancer is the variety of types of cancer, which markedly exceed the neoplasms generally considered hormone-dependent. Mechanistic studies are now needed to generate data additional to the epidemiologic information. Meanwhile, for the clinician, the conclusion is clear: cancer screening is justified for obese subjects as it is for non-obese subjects, but is perhaps even more justified for the obese.

Other complications

The consequences of obesity are not restricted to metabolic and vascular diseases and neoplasms. The consequences affect other organs and involve diseases with important functional implications (respiratory diseases, musculoskeletal diseases, etc.). Table 1.II summarizes the main causes of morbidity in obese subjects.

Table 1.II: Principal complications of obesity

Cardiovascular	Coronary heart disease * Arterial hypertension * Cerebrovascular accidents * Deep vein thrombosis, pulmonary embolism Heart failure Impairment of hemostasis: fibrinolysis, PAI1 Autonomic dysfunction
Respiratory	Sleep apnea syndrome * Alveolar hypoventilation * Respiratory insufficiency * Pulmonary hypertension
Osteoarticular	Osteoarthritis of the knees, low-back pain, postural disorders
Gastrointestinal	Gall stone, hepatic steatosis, gastroesophageal reflux
Cancer	Men: prostate, colorectum, bile ducts Women: endometrium, bile ducts, cervix, ovaries, breast, colorectum
Metabolic	Insulin resistance *, type 2 diabetes mellitus * Dyslipidemia *, hyperuricemia *, gout
Endocrine	Infertility, ovulation disorders * Hypogonadism (men, massive obesity) Proteinuria, glomerular sclerosis
Renal	Excessive sweating, skin fold mycoses, lymphedema
Other	Leg edema Intracranial hypertension Obstetric complications, operative risk

* Complications related to abdominal adiposity

Corpulence and mortality in the adult population

Although the results observed are sometimes variable and the mechanisms have yet to be elucidated, obesity seems associated with a one third increase in the overall cancer mortality rate (for men) and a one half increase (for women) (Garfinkel, 1986). Once again, it would appear that the excess fat mass and its distribution are causally involved. However, associations between cancer mortality (particularly that associated with alcohol and smoking) and a low body mass index ($< 20 \text{ kg/m}^2$) have also been reported, suggesting a possible role of lean mass in the development of certain forms of cancer (Oppert *et al.*, 2002).

In most of the cohort studies published to date, the overall adult mortality of men and women is a convex function of the corpulence determined by BMI, confirming the relationship initially observed in populations consisting of insurance company customers (Troiano *et al.*, 1996). The J or U shape of the function varies depending on numerous characteristics of the populations studied. The excess mortality observed with a low BMI (e.g. less than 21 kg/m^2) is greater (U form) for subjects aged over 50 years, smokers and ex-smokers, with a history of diseases, than in other subjects, for which the function has a J profile (Calle *et al.*, 1999).

In all cases, the overall mortality rate rises with BMI when the latter has exceeded an approximate cutoff of 28 kg/m^2 . The very elderly (over 85 years) would appear to constitute the only segment of the population for which the relationship has an L form (Stevens *et al.* 1998).

By way of an example, figure 1.1 shows the mortality plot for the Norwegian population,

men and women aged 50 to 64 years, in 1960-80 (Waalder, 1984).

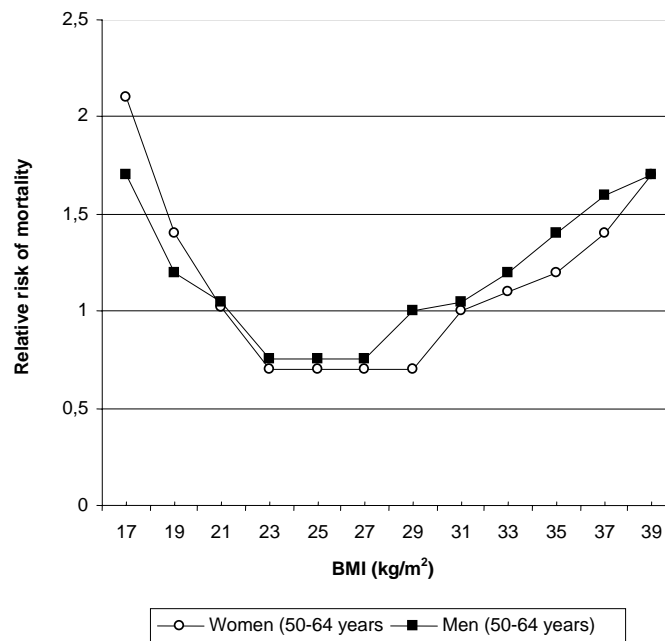


Figure 1.1: Relative risk of total mortality for women and men aged 50-64 years in the Norwegian cohort as a function of body mass index. The reference group was the corresponding whole population (after Waalder, 1984)

For each age, there is thus a very wide range of BMI values associated with low overall mortality. The overweight cutoff conventionally defined as 25 kg/m² is only the limit of the range for young subjects (less than 30 years). The cutoff is rather 28 kg/m² for subjects aged over 50 years. In contrast, an increase in overall mortality for a BMI greater than 30 kg/m² (conventional obesity cutoff) and for a BMI less than 20 kg/m² was observed overall in all the studies.

The interpretation of the excess mortality systematically observed in subjects with a low BMI has been the subject of considerable speculation and at least partially reflects confounders induced by unfavorable factors frequently experienced by low-weight adults at some time in their lives: poorer general health, intercurrent diseases, smoking, etc. However, taking those factors into account does not appear to totally explain the excess mortality (Mikkelsen *et al.*, 1999). For example, excluding from the analysis deaths occurring very early relative to BMI determination (e.g. within 5 years) only slightly modifies the relative risk estimates.

The limitations of BMI as an indicator of obesity or thinness are thus clear. In order to advance further, it is undoubtedly necessary to take individual body composition into account.

The Paris Prospective Study (PPS) showed that overall mortality in man increased regularly with the iliac/thigh circumference ratio. It does not with BMI (Cloarec-Blanchard *et al.*, 1990). The mortality risk may therefore be expressed in terms of fat mass and lean mass (Oppert *et al.*, 2002). Similar results have since been obtained, in particular in women, with the waist/hip circumference ratio (Folsom *et al.*, 1993). This is shown by the relative risks displayed in table 1.III.

Table 1.III: Relative risks of total mortality as a function of body mass index distribution quintile and a body composition index in the male population (43-52 years) of the Paris Prospective Study (PPS) (Cloarec-Blanchard *et al.*, 1990) and in the female population (55-69 years) of the Iowa Women's Health Study (IWHS) (Folsom *et al.*, 1993) (reference first quintile)

	Relative risks of total mortality				
Body mass index quintiles	1	2	3	4	5
PPS*	1.00	0.74	0.74	0.61	0.92
IWHS*					
Non-smokers	1.00	0.92	0.79	0.82	1.23
Smokers	1.00	0.73	0.82	0.88	0.96
Body composition index quintiles	1	2	3	4	5
PPS**	1.00	1.35	1.63	1.83	2.61
IWHS**					
Non-smokers	1.00	1.36	1.44	1.83	2.19
Smokers	1.00	1.53	1.62	1.91	2.49

* quintile limits: PPS: 23.2-25.0-26.6-28.4 kg/m²; IWHS: 22.9-25.0-27.4-30.7 kg/m²

** quintile limits: PPS (iliac/thigh circumference): 1.65-1.72-1.79-1.87; IWHS (waist/hips circumference): 0.76-0.81-0.85-0.90

Mortality and weight change

In the cohort studies, the observation of a relationship between body weight change in adulthood and cardiovascular risk, at first important for prevention, is in fact controversial.

Generally speaking, weight gain is positively associated with cardiovascular risk (Galanis *et al.*, 1998), but weight loss, particularly when it is late, does not seem to be associated with a risk lower than that of subjects having kept a stable weight (Wannamethee *et al.*, 2005) or sometimes a higher weight (Williamson *et al.*, 1993).

Weight loss during adulthood may have numerous causes, depending on whether or not weight loss is deliberate. That information is rarely available in cohort studies. Non-intentional weight loss is known to be a marker of a set of factors characterizing subjects at high risk: intercurrent disease, poor general health, and smoking (Wannamethee *et al.*, 2000; Meltzer *et al.*, 2005). It now seems certain that those characteristics play the role of confounding factors in the relationship between cardiovascular risk (and more generally the risk of mortality) and the reduction in individual body weight in the same way as for the relationship between mortality and low BMI. In the Cancer Prevention Study, the mortality of women never having smoked was only high for those reporting a non-intentional weight loss vs. those reporting a stable body weight (Williamson *et al.*, 1995). It would appear, however, that despite the multiplicity of adjustments, the confounders cannot be totally eliminated (Mikkelsen *et al.*, 1999). Outside of the reasons that led to weight loss, the period at which it occurred relative to the follow-up period and the duration and repetition of weight loss are likely to be important cofactors (Wannamethee *et al.*, 2005), as shown by the specific study of weight oscillations in relation with cardiovascular risk and death. Several studies have shown that repeated weight fluctuations are associated with increased risks. In particular, this was shown in the Framingham study (Lissner *et al.*, 1991). However, the risks are reduced when other potentially harmful factors associated with the weight oscillations are taken into account such as smoking or the presence of intercurrent diseases (Iribarren *et al.*, 1995). Nonetheless, residual risks cannot be formally ruled out. Obviously, in this particular context, it would be of value to have data on the changes in individuals' body

composition and not just on their weight in order to formulate definitive responses.

In conclusion, the epidemiological evidence justifies the efforts made in most industrialized countries, including France, to combat the current spread of the obesity epidemic. The global nature of the increase in obesity prevalence suggests that, in addition to individual approaches, a general prevention policy is needed. The policy is to be implemented taking into account numerous societal questions. However, gaps persist in our knowledge and, in themselves, constitute an obstacle to the scientific consensus that would enable the launching of ambitious prevention. New scientific studies are therefore necessary. At epidemiological level, observational and interventional studies based on finer measurements than the body mass index are needed.

Predicting the consequences, in epidemiological terms, of the current trend is a particularly difficult exercise as is clearly shown by the great variability in the estimates relating to the present situation. Recently, an estimation of the number of obesity-related deaths in the United States was estimated (Flegal *et al.*, 2005). Estimation took into account all the Nhanes data available. Obesity was reported to be responsible for 112,000 deaths per year, inadequate body mass (< 18.5 kg/m²) for 33,000 and overweight not to induce excess mortality. In 1999, a similar estimation yielded 300,000 obesity-related deaths in the US (Allison *et al.*, 1999). The attributable mortality fractions generated by the last Nhanes study (1999-2000) are smaller than those reported in 1999. Does such a great difference cover a real fact?

One possible reason is as follows: in the recent period, the level of cardiovascular risk factors other than obesity was much lower in the United States. The strength of the association between excess body mass and those factors may have weakened (Gregg *et al.*, 2005) inducing lower relative risks and attributable fractions. In addition, the much shorter follow-up duration for the recent Nhanes cohort, compared to previous cohorts, means that the extent of exposure to potential obesity was shorter and thus the risk was potentially decreased. Such findings, if they were confirmed, would contribute to interpreting the fact that, in recent years, no increase in cardiovascular mortality incidence or overall mortality has been observed in the United States or in most industrialized countries despite the markedly increased prevalence of obesity. Conversely, the findings would mean that young generations which become overweight in childhood will, in adulthood, be exposed to higher risks than they would be today. This has led to speculation that life expectancy will decrease over the century that has just begun (Olshansky *et al.*, 2005).

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2

Biological and behavioral determinants

The role of environmental factors in the development of obesity, the only factors that can explain the rapid increase in prevalence over recent decades, has been clearly established. Obesity is explained by relative overeating, i.e. a food intake greater than the energy expenditures. In that context, the generalization of sedentary behavior appears as important as a determinant of the increase in obesity incidence as changed eating habits. The ability to store the energy surplus may be modulated by genetic or acquired factors. Genetics determine susceptibility to obesity. Some subjects may be more susceptible to the effects of a sedentary lifestyle due to their genotype. Others may be more susceptible to overeating. Recent data suggest that the predisposition may also be derived from imprinting by intrauterine or post-natal conditions on the regulation of the energy balance or storage capacity. Analysis of the determinants of obesity thus addresses the genetic aspects, intrauterine and post-natal early determinants, eating behavior and physical exercise.

Genetic determinants

Genetic susceptibility was demonstrated in studies conducted on monozygous twins who showed a great similarity in weight gain when breast-fed in the course of overnutrition studies (Bouchard and Tremblay, 1997). However, the familial nature of obesity is the reflection of combined factors that are genetic, but also intra-familial environmental factors (including intrauterine factors, breast-feeding, etc.). Those factors intervene in addition to the extra-familial environmental factors specific to each individual. It is difficult to determine the specific contribution of each factor. On the basis of some fifty studies of the families of twins concordant or non-concordant for obesity, Bouchard *et al.* (2003) concluded that genetic factors contributed 25 to 40% of the variations in the subjects' weight and fat mass. Intensive research on obesity genes has been conducted in recent years. Over 400 genes, markers or chromosomal regions have been shown to be related to obesity (Snyder *et al.*, 2004). However, only 6 monogenic mutations have been shown to be responsible for obesity in less than 150 subjects. Those discoveries (Clément *et al.*, 1998; O'Rahilly *et al.*, 2003) furthered our knowledge of the mechanisms of obesity but, outside of those exceptional cases, obesity appears to be a complex genetic trait. However, there is an increase in the risk of obesity in children whose parents are overweight, particularly if both parents are overweight (Magarey *et al.*, 2003). However, it is clear that the current increase in obesity incidence is not due to a change in the genetic characteristics of the populations considered but rather consists in an interaction between predisposing genotypes and behavioral and environmental changes.

Early determinants

Recently, it was suggested that early environmental factors ranging from fetal life to the first years of extrauterine life could influence health in adulthood. With regard to obesity, a relationship between birth weight and adult BMI was evidenced. Several studies have shown a relationship between high birth weight and obesity in adulthood (Whitaker, 2004). Similarly, obesity is found in children whose mothers had gestational diabetes (Silverman, 1998). It would appear that the fetal hyperinsulinism encountered in those contexts is responsible for changes in body composition and even adaptation of pancreatic function, generating hyperinsulinism. Relationships have also been evidenced between low birth weight and central obesity and hyperinsulinism in adulthood. It would appear that fetal malnutrition during the 2nd and 3rd trimesters of pregnancy may modify gene expression by an epigenetic process and result in a saving phenotype with harmful effects in adulthood and emergence of a metabolic syndrome (Gallou-Kabani and Junien, 2005). New studies are required to confirm those hypotheses. Data from animal studies and epidemiological studies such as the Eden¹ study, currently ongoing, should enable elucidation in that field (Charles, 2005). The aim of the Eden is to identify pre- and early post-natal factors (exposure and maternal health during pregnancy factors, intrauterine fetal development, infant's status at birth and in the first few months of life) influencing the child's subsequent development and health. A further aim is to elucidate the mechanisms of those relationships. The study should enable a clearer understanding of the importance of early determinants with respect to individual health, in particular with regard to the numerous environmental factors that influence health during childhood and adulthood.

Diet during the neonatal period also seems to be involved in the subsequent time course of body weight. The protective effect of breast-feeding with respect to childhood obesity was first reported by Kramer in 1981. Since then, a number of studies have been published and reviews have been conducted. In the meta-analysis by Arenz *et al.* (2004), 954 studies were identified. Only 9 were selected after ruling out confounding factors (birth weight, parenteral weights, socioeconomic factors, etc.). The meta-analysis enabled comparison of infants breast-fed for more than 6 months and non-breast-fed infants. It showed a weak but certain protective effect of breast-feeding with respect to childhood obesity. Four studies showed a dose-response effect of the duration of breast-feeding on the prevention of obesity. Multiple factors would appear to be involved in the protective effect and are still under discussion: enhanced learning of satiety by breast-feeding, role of the composition of breast-milk (protein content, type of fatty acids, leptin), less insulin secretion post-breast-feeding, etc.

Recently, the role of the type of fatty acids in adipose tissue development was demonstrated. Fatty acids of the n-6 series are potent promoters of adipogenesis *in vitro* and adipose tissue development *in vivo* (Ailhaud and Guesnet, 2004). Fatty acids of the n-3 series such as EPA, DHA and conjugated linoleic acids (CLA) decrease pre-adipocyte proliferation and adiposity in rodent models (Azain, 2004). These factors thus appear to be important determinants of obesity development. However, the nature of breast-milk fatty acids depends on the maternal diet and the fatty acid composition of milk formulas has evolved over time. It is therefore difficult to determine the influence of those changes but they are probably parameters that will need to be taken into account in the future.

Weight during childhood is a predictor of weight during adulthood. The BMI at age 6 years appears in particular predictive of the BMI at 20 years. BMI at 6 years has more influence

¹ Study of the pre- and post-natal determinants of infantile development and health

than parental BMI, although the overweight risk increases with parental weight (Magarey *et al.*, 2003). It is noteworthy that the father's and mother's weights seem to have a different influence on the child's weight. Maternal BMI is a stronger determinant with respect to childhood and adolescent BMI while paternal BMI has a greater influence on adipose mass distribution (Heude *et al.*, 2005). The time course of BMI over childhood also has a predictive value. BMI re-increases in a physiological manner after a nadir between age 4 and 7 years. This is known as the adiposity rebound. Rolland-Cachera *et al.* (1984) showed that an early rebound was associated with an increased risk of obesity. This finding has been contested by certain authors who have shown that crossing the BMI percentile plot is associated with an enhanced risk of obesity irrespective of age (Cole, 2004). The data show the value of monitoring weight gain and height over childhood. It would appear that a risk profile may emerge during that period of life. The profile associates an extreme birth weight, absence of breast-feeding, an unfavorable course of body mass index and parental obesity. The conjunction of several of those factors is to be taken into account in defining targets for action.

Food intake and dietary behavior

Food intake is one of the fundamental determinants of obesity. Irrespective of genetic susceptibility, weight gain can only occur if there first exists a sustained unbalance of the energy balance and hence an excess of food intake relative to energy expenditure. However, in addition to meeting the subject's energy requirements, eating involves social, cultural and emotional aspects of everyday life. Adults and children eat, in part, because they are hungry, but also because drinking and eating are pleasant and an integral part of family life, celebrations and various social events. Food is for many people an important component of their well-being and a compensation for psychological aggression. It is thus completely unrealistic and would be a total failure to base obesity prevention operations on food energy composition considerations only, without taking into account the social, economic and affective dimensions of eating. Moreover, while the toxic nature of cigarettes and alcohol is not open to debate, the concept of good or bad foods is not the subject of a consensus, even in purely nutritional terms.

In reality, the nutritional qualities of a food largely depend on the quantities eaten, the mode of consumption and the other foods eaten at the same time. The whole diet conditions the quality of the diet with respect to its energy content and the macronutrient distribution. Nonetheless, some recommendations may be formulated with regard to the quality of the diet as has been done in France in the 'Recommended dietary intakes for the French population' (table 2.I) (Martin, 2001). The energy density of foods is also to be taken into account (Simon, 2003). Subjects adjust their ingestates more on the food volume than on the calorie intake. It will thus be understood that a diet with a high energy density results in high energy intakes while a diet with a low energy density procuring few calories in a large volume induces satiety and results in a lower energy intake. The energy density of foods largely depends on their lipid content. Lipids procure 9 kcal/g while carbohydrates and proteins only procure 4 kcal/g. Water, by increasing the weight and volume without changing the calorie content, and fiber content also enable a reduction in the energy density of foods. The quantity of foods eaten also depends on their palatability. The palatability of a food is its pleasantness. It depends on the sensory characteristics of the food: appearance, taste, odor, texture, etc. Palatability promotes excess energy intake, particularly since palatability and high energy density are frequently associated. It is noteworthy that the attraction for fat and sugar and the intensity of the pleasure experienced when palatable

foods are eaten varies between individuals and are in part genetically determined.

Table 2.I: Frequency of food intakes enabling adequate macronutrient intakes, particularly with respect to folic acid (1), calcium (2), iodine (3), iron (4) and vitamin C (5) (after Martin, 2001)

Food intake	Intake frequency
Dairy product (varying fresh dairy products and cheeses) (1, 2, 3)	at each of the 3 main meals
Meat or ham (4), fish or seafood (3, 4) and/or, from time to time, egg (1, 3), hot delicatessen meats, liver pate or liver, not more than once per week (1, 4)	once daily
Cooked vegetables (1) (fresh, frozen or canned) or potatoes, rice, pasta or dried pulses (1, 4) with green salad or raw vegetables or vegetable soup (1, 5)	twice daily
1 fruit, 1 citrus fruit (1, 5) or possibly dried fruits (1, 4)	once daily for each
Sweet dessert or Viennese pastry	not more than once daily
Bread	with all meals
Various fats (various oils, butter, fresh cream, margarine)	preferably raw
Water	<i>ad libitum</i>
Use an iodized salt (3)	

An increase in the consumption of sweet beverages is undoubtedly an important change in the modern diet. Beverage intake is subject more to fluids regulation than to energy regulation. The speed of ingestion and the absence of chewing are factors that do not promote satiety. In that context, the current sweet beverage consumption increase, particularly by adolescents, is worrying with respect to the development of obesity. The role of fat foods vs. carbohydrate foods in the genesis of obesity has been greatly discussed in the literature (Willett, 1999). Foods with a high lipid content due to their high calorie density, generally good palatability and low energy storage cost are potentially the foods that most generate obesity. However, a decrease in fat intake has been reported in various countries (United States, Finland, Great Britain) although the prevalence of obesity is increasing (Prentice and Jebb, 1995; Fogelholm *et al.*, 1996). Those data nonetheless need to be tempered by the fact that populations have become sedentary, reducing their energy requirements. Few studies have concomitantly addressed the amount of physical exercise and food intake. It is noteworthy that despite the increasing availability of low-fat products and the recommendations with respect to decreasing the fat content of the diet, energy intakes remain high. It cannot be excluded that the campaigns stigmatizing fats have led some people to consume low-fat products without restriction. Some of those products have a high energy density and palatability (Simon, 2003). This draws attention to the potential danger of campaigns stigmatizing one type of food when obesity has multiple determinants. It is the total dietary calorie intake that is important, not the nature of the foods. Excessive carbohydrate intake can also be harmful, particularly when the carbohydrates are added sugars which increase the energy density of foods. A sweet taste contributes to a hedonic quality of foods, particularly when the sugar is associated with fats. Passive over-consumption may result. Afssa thus recommends (2004) decreasing the consumption of added simple sugars. The report also stresses that it is preferable for carbohydrates to be eaten in solid rather than liquid form and in the context of structured meals rather than between meals. The change in eating habits plays an indubitable role in the development of obesity. The ubiquity of food offer and particularly the availability of ready-to-eat foods

compromise the structure of eating behavior and the ritual aspects of meals. The Inca study² (Afssa, 1999) shows that France has not been spared from this disintegration of the traditional model. In addition, the role of increasing portion size in the inflation of individual energy intakes should not be overlooked.

Adipose tissue storage capacity

Adipose tissue is responsible for the storage of energy reserves. The inflation of adipose reserves which characterizes obesity initially results from an unbalance between energy intake and output. This unbalance may also be promoted by primary anomalies of adipose tissue, which has become particularly 'gifted' at storage due to cell anomalies. Adipose tissue is of an exceptional plasticity. Throughout life it remains capable of growth. The number of adipocytes can thus markedly increase. The increase in the number of adipocytes results from the adipogenesis process, which involves a process of stem cell proliferation and differentiation into adipocytes. Numerous intrinsic or extrinsic molecular and cellular factors are involved in the proliferation of adipose tissue. The complex process is controlled by various signals modifying the activity of the transcription factors identified by molecular biology. According to the 'critical size' hypothesis, there is a maximum cell size. Thus, the differentiated adipocyte takes up triglycerides until it reaches the critical size. It then 'recruits' a new pre-adipocyte. An increase in the number of adipocytes, in other words, hyperplasia, may thus occur. The number of adipose cells continues to increase if energy storage is necessary because of a positive energy balance. The cells remain available for *de novo* storage. The hyperplasia seems to be irreversible. This explains why, after a certain amplitude and duration, return to the initial weight is not possible. It is impossible to maintain adipocyte size below a certain value without triggering all the mechanisms which reconstitute fat mass. The minimum fat mass that it is possible to achieve is limited by the number of adipocytes. If the number is high, either constitutionally or subsequent to recruitment of new cells during weight gain, it is difficult to reduce the volume of the fat mass below a certain threshold (except by permanent dieting). In other words, obesity may result from or be promoted by primary anomalies of adipose tissue, of genetic origin or acquired (questions are being asked with regard to the substances in the body, diet or environment that may promote obesity independently of calories, in particular during the perinatal period). The pathophysiology of obesity is proving increasingly complex and heterogeneous, varying markedly between individuals.

Physical activity

The other important part of the energy balance is energy expenditure. Although physical activity is not the most important component of total energy expenditure (the most important component is resting metabolism, which essentially depends on body weight, height, age and gender), it is the part most subject to modulation. Each individual's level of physical activity depends on various parameters related to his/her personal, environmental and also genetic characteristics (Wolfarth *et al.*, 2005). It should also be understood that the energy balance is an integration over a very long interval. A minor dysequilibrium in the balance of the order of 100 kcal/d results in annual weight gain of 5 kg and can thus engender obesity over time (Jéquier, 2002). In addition to the energy consequences, it is now recognized that a low level of physical activity is associated with an increase in the overall

² National study of individual food intakes

mortality risk, cardiovascular morbidity and mortality, and an increase in the risk of hypertension, an increase in the risk of type 2 diabetes mellitus and an increase in the risk of certain forms of cancer, together with an increase in states of anxiety and depression (Oppert, 2003). The current recommendations for physical activity are 30 minutes of physical exercise, such as fast walking, daily. Those recommendations target overall health and particularly the cardiovascular risk. They are not however specifically adapted to the prevention of weight gain and obesity. In France, few data on the degree of physical activity of the population and its time course are available. The Suvimax study showed that 10% of men and 12% of women take no physical exercise and almost half the population does not achieve the recommended level of exercise. Changes in lifestyle and particularly technological progress have decreased the energy expenditures related to work, housework and traveling. Despite the increase in leisure time, the overall tendency is toward a reduction in physical exercise making physical inactivity a veritable public health problem (Prentice and Jebb, 1995; High committee of public health, 2000). It is noteworthy that the time spent on inactive occupations such as watching television and playing video games is markedly increasing. The calculations necessary to determine the level of physical exercise required to prevent weight gain show that that level is 1.5- to 2-fold higher than the above recommendations (Fogelhom and Kukkonen-Harjula, 2000; Oppert, 2003). The type of physical exercise able to have an effect with respect to preventing obesity is still under discussion. In particular, should the total energy expenditure through exercise or the intensity of the exercise be addressed? In addition to promoting physical exercise to combat obesity, it would appear of value to add measures relating to the reduction of the sedentary lifestyle. This will necessitate developing new markers of sedentary lifestyle, which cannot simply be considered the time spent in front of the television. It is important to take into account not only behavior with respect to physical exercise but also dietary behavior and other behavioral patterns such as alcohol consumption and smoking. Enhanced understanding of the groupings of those various types of behavior and particularly their determinants at both individual and collective level is a major issue with regard to defining strategies to combat obesity (Oppert, 2003).

Psychological and social factors

Eating is at the center of decisive processes in the psychological development of the child. It is therefore not surprising that psychological factors play a decisive role in the genesis of certain forms of obesity associated with dietary behavior disorders. The psychological factors influence eating behavior, which is very sensitive to emotions and stress. Anxiety and/or depression may also induce compulsive eating.

The nutritional, familial and social environment and economic changes are all decisive factors. The role of the evolution of the food industry at all levels needs to be stressed: intensive production, facilitated distribution, simplified preparation, disordered consumption. The current nutritional situation is unprecedented. We must learn how to adapt to plethora when we are programmed to withstand famine.

At the source of the reduction in energy expenditures lie the change in clothing, heating, transport, manual work, food-obtaining behavior, development of services, reduction in the 'energetic cost' of consumption activities and progress in communication. While leisure occupies more of our time, relaxing physical exercise remains unpopular. Passive leisure activities (television and others) predominate, in particular due to urbanization and its material, psychological and social consequences. There is, in fact, a close relationship between the number of hours spent in front of the television and the prevalence of obesity.

Prospects and orientations

In the light of those determinants, targets for obesity prevention may be singled out.

We clearly cannot change the genetic aspects although they intervene at various levels not only on the energy aspects but also on behavior with regard to eating and physical exercise. With regard to early determinants, more research is needed to elucidate their real importance. It would appear that the mother's nutritional status during pregnancy influences the outcome for the future child and its state of health. Close nutritional monitoring of the pregnant women is thus essential. Breast-feeding would seem to play a positive role justifying promotion of breast-feeding, not that breast-feeding alone will have an important impact on body weight on the population scale. In that context of early diet, it is important to monitor the time course of milk fatty acids, be the milk breast-milk or an infant formula, since fatty acid type seems to be important with respect to adipogenesis. Lastly, regular monitoring of children's weight and height should enable detection of risk situations for which early interventions are justified.

The campaigns intended to modify dietary behavior should not overlook the social, affective and cultural components of eating. Campaigns should be more targeted on the overall mode of eating with a view to restructuring meals and restoring their ritual nature rather than stigmatizing a food or nutrient. The food industry's efforts should target reducing portion size and developing low-energy density foods. The challenge will be to retain the palatability of such foods and market them effectively. Only such changes in the food offer will enable the population to be 'passively' oriented toward a healthier diet. The changes in the modes of consumption will not, in themselves, be effective. Global strategies incorporating combating the sedentary lifestyle and promoting physical exercise are also to be implemented. Further studies are required to optimally define the type of physical exercise (duration, intensity) that is most effective in combating weight gain. Nonetheless, the population's adoption of the current recommendations would already be a considerable step forward. Once again, it is necessary to privilege environmental changes which make access to physical exercise easier or access to inactivity more difficult...

In conclusion, the determinations of the development of obesity are increasingly well known and are complex and mutually interact. It would be a mistake to believe that a single factor is causal or predominant. Strategies enabling changes in the environment and leading to easy adoption of 'health' behaviors may be successful. However, they necessitate the involvement of a large number of societal players: politicians, town planners, economists, food-industry professionals, food-distribution professionals, restaurant managers, teachers, trainers, physicians, etc.

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Economic determinants and prevention issues

The development of obesity is a public health issue in which the economic dimension is omnipresent both with respect to the causes and with respect to the consequences. Moreover, the economic weight of the food industry ups the stakes for preventive action. This explains the liveliness of the debate on policies for preventing and combating obesity.

Political success will very probably depend on the degree of cooperation between all the players involved. For that reason, it is important to understand the arguments and concepts advanced by the various parties.

The economic approach can contribute to enhanced understanding in three ways. First, it enables identification and measurement of the environmental factors that, in industrialized economies, act directly on weight gain in an increasing proportion of the population. Secondly, the economic approach supplies a conceptual framework which enables clarification of the issues and points of view in the debate on the justification of public intervention. Lastly, applied studies to quantify the effects of the existing measures (nutritional labeling of products) or to simulate the effects of measures under debate (taxes and subsidies, nutritional information in restaurants, etc.) are increasing. The three contributions of the economic approach will be reviewed in turn.

Economic analysis of the development of overweight and obesity

The conceptual framework of the economic analysis is particularly suited to analysis of the effects of environmental changes (and particularly costs) on individual behaviors. For some years, studies using economic concepts have been implemented with a view to understanding the development of obesity and structuring the interventional actions.

Conceptual framework

The economist approaches individuals' choices by looking at the constraints imposed by material resources and the time available to those choosing. Microeconomic analysis interprets the development of overweight and obesity as the result of individual choices on the nature and quantity of foods consumed and on the duration and intensity of usual physical exercise. The choices are made by allocating a limited revenue and time budget to competing activities and consumptions in order to achieve specific objectives. Health may be one of the objectives pursued, but it is not the only objective. Due to limited resources and time, individual arbitrations may deliberately be made to the disadvantage of health. Economic analysis thus constitutes a framework for understanding behaviors which do not appear optimal from the public health point of view (Cawley, 2004; Philipson *et al.*, 2004). This is a fundamental point to be taken into account in the debate on preventive actions.

Several studies have shown the main economic factors in the development of obesity in the United States. The data are American, but the mechanisms defined (role of technological

change, fall in the real cost of foods, increase in the opportunity cost of time, etc.) have a very general nature and are also valid for Europe and for France. The development of overweight and obesity in developing countries has additional specific features related, in particular, to the speed of the nutritional transition (Popkin, 2002) which will not be addressed herein.

Role of technological change

The role of technological change is fundamental for economists since it acts directly on the two components of the energy balance: technological change decreases the cost of calorie consumption and increases the cost of energy expenditure (Philipson and Posner, 1999). Technological changes in agriculture and other productive sectors have induced a regular fall in the relative cost of foods, which stimulates calorie consumption. In parallel, the development of sedentary work has decreased the energy expenditure related to physical exercise and rendered that exercise costly in that taking exercise now means giving up leisure.

More generally, increased participation in the labor market and the multiplication of physically passive recreational activities have increased the opportunity cost of physical exercise (measured by the value of the preferred alternative activity plus the cost of the activity itself if particular equipment or joining a club, for example, is necessary). A quantification based on the combination of individual data from various sources covering the period 1976-1994 attributes 40% of the increase in body weight to the reduction in food prices and 60% to the reduction in physical exercise at work, at home and in leisure activities (Lakdawalla and Philipson, 2002).

Reduction in the overall price of foods and self-control

For Cutler *et al.* (2003), on the contrary, the increase in calorie intake rather than the reduction in physical exercise is responsible for the development of obesity in the United States. Of course, for those authors also, technological innovation is the motor of increased consumption. Technological innovation has enabled a reduction in the direct cost of foods and a decrease in the time necessary to prepare them. The result is a considerable decrease in the overall cost borne by individuals when they access ready-to-eat foods.

The consequences of that reduction in the overall price of foods are clear. Food intakes have multiplied and the increase in the calories ingested is only due to food intakes outside of meals since the quantities consumed during meals have not increased. Ready-to-eat food sales have increased most and the individuals who most benefit from the reduction in the overall price of foods are those who have gained the most weight, in particular married women (Cutler *et al.*, 2003).

The environmental omnipresence of consumers of an increasing number of ready-to-eat products affects consumption in two ways. The first mechanism is a classic price effect which gives rise to an increase in consumer well-being. The second factor to be taken into account is the degree of self-control, which explains why not all individuals react in a similar way to the food-saturated environment. For individuals who have difficulty controlling themselves, the reduction in the complete price of foods may give rise to a decrease in well-being if excessive consumption is accompanied by undesired weight gain (Cutler *et al.*, 2003).

Development of the food offer outside the home and anti-smoking legislation

Chou *et al.* (2004) expanded the economic model by incorporating an increased number of environmental variables in order to take into account more of the changes in relative prices

with which individuals are confronted. The analysis of the time course of body mass index (BMI) and obesity in the United States between 1984 and 1999, based on the individual data generated by the Behavioral Risk Factor Surveillance System (over 1,110,000 observations in all), was designed to evidence the evolutions while controlling the individual characteristics of the respondents. Three main results were observed. In the first place, the number of restaurants per person (conventional restaurants and fast-food) in the state of residence has an important and very significant effect on BMI and the prevalence of obesity. Secondly, the role of the reduction in food prices was confirmed. Lastly, the effect of the price of cigarettes was positive and significant, drawing attention to an unexpected effect of the anti-smoking policy.

Strength of economic incitements

All the analyses conducted by economists confirm the idea that any change in the price of a product or in the time required for an activity has an impact on individual behaviors. The analyses also show that the recent changes in economic variables are all conducive to weight gain: the cost of food is falling, preparation time is becoming shorter, the cost of physical exercise is increasing and the value of time is increasing (particularly for women).

The power of the economic factors involved in behavioral change explains why the probability of purely informative political measures being successful is low. A more effective strategy would consist in channeling the economic forces which determine food selection and physical exercise in order to induce behavioral changes through ongoing incitement mechanisms (Hill *et al.*, 2004). Such mechanisms exist, but before reviewing them, the question of the legitimacy of intervening needs to be raised. In particular, we need to know whether the current trend results from deliberate arbitration by an increasing fraction of consumers who have decided to prefer immediate satisfaction to long-term health.

Economic criteria for public intervention

The state's role in ensuring the safety of food supplies and the health safety of foods is rarely called into question. In contrast, state intervention at individual dietary choice level may be questionable. The increasing demand for public intervention to combat the development of obesity has thus given rise to a debate on its economic justification.

For the economist, public intervention is justified when the market is inefficient or distorted. In the case of food choices, asymmetric information and negative externalities are two obvious reasons for intervening. There are two further reasons, which are not only economic: the defects of rationality and equity.

Asymmetric and deficient information

Firstly, consumers may be poorly informed on the characteristics of their foods and the effects of their choices on their health. In that case, public intervention is justified either because the information is asymmetric (manufacturers are aware of the characteristics of their products but do not totally disclose them), or because there is a deficiency in generic information (like all public goods, generic information tends to be supplied in inadequate quantities by the private markets). Asymmetric information is an unquestionable cause of poor market operation. How can we take the right decision when we have not been informed about the characteristics of a product or the consequences of a behavior? The public authorities' intervention then consists, first, in forcing manufacturers to reveal private

information, for example through mandatory standardized labeling, and, secondly, by ensuring the supply of public information via specific campaigns. In the latter case, it is still necessary to ensure that the public information is not drowned out by the commercial information and to ensure that the public information can be readily and easily used by consumers (Cawley, 2004).

In Europe, the regulations provide for non-mandatory voluntary labeling. Thus, numerous asymmetries persist with regard to information on food markets, not to mention eating outside the home, for which nutritional information is non-existent in both Europe and the United States (Variyam, 2005). Deceptive information of course constitutes a case where intervention is legitimate irrespective of whether the deception applies to claims for foods or claims for weigh-loss diets.

Negative externalities

A well informed consumer has the right to make choices that are not compliant with the nutritional recommendations without his/her so doing justifying public intervention for as long as the consumer bears all the consequences of his/her choices. However, if those choices impose costs on others, there are negative externalities and public intervention to correct them is justified. In the case of overweight and obesity, the excess health costs impose negative externalities on those with health insurance coverage, but the obese may also generate positive externalities for those belonging to pension schemes if the life expectancy of the obese is shorter (Cawley, 2004). In the United States, various evaluations for the years 1996-1998 (Sturm, 2002; Finkelstein *et al.*, 2003) show that the annual medical expenditures of the obese exceed those of the non-obese by about 36%. Finkelstein *et al.* (2003) consider that about half the excess costs attributable to overweight and obesity are covered by public financing (Medicare and Medicaid). Even though a complete assessment of the externalities has not been made, the orders of magnitude justify public intervention, particularly since the time course of healthcare costs suggests that the essential consequences of the spread of obesity are not yet visible (Sturm, 2002).

Defects of rationality and 'asymmetric' paternalism

Even when totally informed of the consequences of the alternative choices, some consumers (or the majority of consumers in certain circumstances) may make decisions that they will regret later, thus demonstrating the classic difficulties of self-control related to temporally inconsistent preferences. In those cases and even in the absence of negative externalities, intervention may improve the status of individuals who do not act 'in their own best interest'. Those individuals may subsequently recognize the benefits of taxation forcing them to adopt behaviors that they are unable to adopt at lower prices (Cawley, 2004) as a study of Canadian and American data showed for smokers (Gruber and Mullainathan, 2002). Further application of that type of intervention nonetheless presupposes the availability of results clearly showing the inconsistencies of temporal preferences as a function of the characteristics of the choices. Numerous results are beginning to become available in that field (Frederick *et al.*, 2002). Their development in the field of dietary choices will shed light on the problems of self-control.

Outside of children who are generally considered not to take into account the future consequences of their actions, the economic rationale for paternalist interventions is the subject of debate by economists. With the concept of 'asymmetric paternalism', Camerer *et al.* (2003) hope to advance the debate on the basis of examples of interventions in the fields of health and nutrition. For those authors, an asymmetric paternalist policy is a policy which

helps those who need to avoid costly errors without making those who have no need bear an excessive cost. Mandatory nutritional information is an example of an intervention exactly fulfilling that criterion (Variyam, 2005).

Smith adopts a more radical position (2004). Smith considers that by manipulating sensory signals, food designers deceive the biological regulatory mechanisms inherited during our evolution. The regulatory mechanisms which optimize food finding are inappropriate in an environment saturated with food signals. Individual choices can thus no longer be considered to lead to an optimum, providing the rationale for restrictions on advertising, increased product calorie density or increased portion size, for example.

Equity

In so far as obesity is not randomly distributed through the population but mainly affects the least wealthy and least educated social groups (Drewnowski and Specter, 2004), intervention by the public authority may be justified by considerations of social justice (Cawley, 2004). One of the important questions raised by intervention in favor of less fortunate populations is to determine whether the most limiting factor is the level of nutritional knowledge or the cost of diets compliant with nutritional recommendations.

Kennedy and Ling (1997) insist on the fact that lack of nutritional knowledge is not the factor which inhibit change in behavior. Familial pressure to comply with social standards is a much more important resistance force, immediately followed by financial constraints which are of direct interest herein.

Drewnowski and Specter (2004) observe that the foods with the highest energy density are those that supply the cheapest calories (refined cereals, sugar, fat). Various studies (e.g. Prentice and Jebb, 2003) have shown that the energy density and palatability associated with sugars and fats increase calorie intake. The development of obesity in underprivileged environments thus results from the effect of economic constraints orienting food selection towards a diet with a high energy density and that is attractive at sensory level, supplying the maximum calorie intake in a small volume and for the lowest cost. Darmon *et al.* (2004) showed that the French data on energy-dense diets are indeed associated with the highest calorie intakes. The diets have a high fat and sugar content. Above all, they are less expensive irrespective of the level of energy intake.

The cost of diets compliant with the nutritional recommendations is thus clearly an obstacle to their adoption by households with limited means. It could, of course, be shown that it is possible to eat cheaply while complying with nutritional recommendations. Thus, for example, an interventional study on the families of obese children was conducted in the United States by Raynor *et al.* (2002). The study concluded that long-duration intervention was effective in modifying the diet without increasing the budget. There is thus a debate on the effective cost of diets enabling obesity prevention. It should be noted that the data generated by Raynor *et al.* (2002) are longitudinal and on a limited number of families (31 at baseline, 20 complete cases) who agreed to the rather demanding follow-up. The data reported by Darmon *et al.* (2004) were generated by a cross-sectional observational study with no intervention. There is not really any contradiction between the results insofar as the studies were very different: one descriptive of the effective cost of diets as a function of energy density; the other on the possibility of modifying excessively energy-dense diets for the same budget. Both authors agree that the costs of a healthier diet may also include the higher supply and preparation costs. It should be noted in passing that participation in a food behavior modification program constitutes a marked investment and hence a cost that must be taken into account.

The low level and constant decrease in the cost of the energy derived from sugar and fats has undoubtedly increased the offer and demand for sweet and fat products. Conversely, the very high energy cost of fruits and vegetables appears a factor limiting the spread of their consumption. This is a very concrete illustration of the role of economic determinants in the development of obesity. Would setup of a nutritional taxation system enable those trends to be controlled? Would other economic measures be more appropriate? These considerations will now be addressed.

Economic measures in the prevention of obesity

It is important to clearly distinguish the analysis of economic obesity prevention measures and the economic justification of those interventions. The latter, as indicated above, stresses the formal criteria for intervention (asymmetric information, negative externalities, defective rationality). It does not take into account the content of the choices nor the objectives pursued by those who make them. In the economic analysis of preventive measures, the objective of improving public health, or equity, is taken as a given and the costs and effectiveness of the various actions considered are addressed.

Economic obesity prevention measures are based on modifying the incitement mechanisms enabling individuals to make their choices. In order to do so, the economist has two levers: price and information.

Intervention on pricing

Acting on pricing via taxes or subsidies is one of the most direct economic action mechanisms used to decrease or increase demand. Fat tax policies have at the present time undergone more analyses than subsidy policies although the latter could prove effective and encounter less opposition. In addition, experiments in restaurants show that nutritional tariffs may be effective and not require public financing.

Taxation

Various taxation systems have been envisaged or are being implemented with a view to decreasing the consumption of excessively high energy density products. In the United States, 18 states have already set up various forms of nutritional taxation. In Europe, no such taxes exist, but the possibility of using value-added tax for that purpose is under debate, particularly in Great Britain.

Nutritional taxation may be applied to agricultural production and thus impact the price of food raw materials or at final consumption level. Given the low weight of agricultural raw materials in the market price of prepared foods, taxation on agricultural produce would have little impact on final demand, at least in developed countries (Schmidhuber, 2004).

Taxation directly impacting the retail price of high energy density foods would doubtless be more appropriate. The main question relates to the sensitivity of demand to variations in the prices of products taxed (price elasticity of demand). If the sensitivity is low, which is the case for snacks for example, taxation will only have a weak impact on consumption (Kuchler *et al.*, 2005). It is, however, possible that use of mean price elasticity does not give a very accurate idea of the impact of taxation. The distribution of consumption levels and reactions to taxation are at least as important as the mean. A Norwegian study on the consumption of carbonated soft drinks showed, for instance, that subjects who have the highest intakes (and are thus the target of taxation) are also the most sensitive to price variations (Gustavsen, 2004).

Taxation could simply consist in applying different value-added tax (VAT) rates by product category or, on the contrary, address specific ingredients (saturated fats, sugar and salt, for instance). In general, targeted taxation systems are more effective insofar as they strongly incite manufacturers to reduce their use of the taxed ingredients, but are more costly to implement than modulation of VAT. In addition, it should not be overlooked that if taxation induces a reduction in the consumption of, for instance, foods rich in saturated fats, the fat will obligatorily reappear elsewhere in the food chain, in other products or other countries (Schmidhuber, 2004).

Nutritional taxation raises the problems of equity and efficacy. The taxation is regressive insofar as it affects families with the lowest incomes who spend more on the taxed foods than households with greater means. Taxation also affects more individuals who, through their work, domestic activities or leisure activities, have high energy expenditures. A taxation on energy-dense foods is not asymmetric insofar as it imposes costs on a large section of the population which consumes moderately or has excess weight problem. It is liable to have a limited positive effect on the target households if the latter cannot find acceptable and cheap replacement products.

Lastly, it is difficult to evaluate all the potential effects given the large number of replacement products available to consumers and, for the same reason, it is probable that taxation on a limited number of products would have limited effects on the prevalence of obesity (Finkelstein *et al.*, 2004).

Subsidies

Subsidizing low-energy density foods has been the subject of very few studies. Subsidies could constitute an interesting alternative to taxation.

A simulation was conducted on American data (Cash *et al.*, 2005) to study the impact of a permanent 1% subsidy on the overall consumption of fruits and vegetables with respect to the incidence of various heart diseases. The estimates yielded a cost per life saved that was markedly lower than many other public health programs. Moreover, the cost per life saved was very significantly lower (about 30%) for consumers with the lowest incomes, compared to those with the highest incomes.

More generally, studies on nutritional taxation insist on the progressive nature of subsidies for low energy density foods which, unlike taxes, procure the greatest benefits for low-income consumers.

In addition, actions may be oriented directly toward sensitive groups, children for instance, through subsidies to school canteens or through support for programs distributing free or low-price fruit in schools. Pursuant to a fruit distribution program set up in Norwegian primary schools, a Danish interventional study demonstrated the efficacy of that type of action and its effect on overall fruit consumption (Eriksen *et al.*, 2003). Lastly, setup of targeted subsidies would no doubt be the subject of a larger consensus than new taxes, both from the point of view of manufacturers and consumers.

In all cases of intervention on prices (taxation and subsidies), the studies stress the potential unexpected effects and, in particular, the scope for manufacturers and distributors to adapt their strategies. Depending on the forces in play, it is not certain that the effect of the tax or subsidy would totally impact the final consumer.

However, it may be imagined that the setup of such a type of taxation would have the effect of a positive signal attracting the attention of manufacturers and consumers to both the effects of the composition of their diet on their health and to the public authorities' determination to implement a committed policy in the field. Lastly, even if nutritional

taxation had little direct effect on diet, it may be considered an instrument for redistribution: using the taxes to finance subsidies and, more generally, information programs, whose effectiveness would also require evaluation (Kuchler *et al.*, 2005).

Nutritional tariffs: studies of canteens

The difficulty of calculating price elasticity and the uncertainties with regard to replacement products and the consumer shifts induced by nutritional taxation are, as indicated above, an important obstacle to the evaluation and perhaps setup of nutritional taxation. Actions on prices are not, however, necessarily ineffective, particularly as a means of pricing in selected environments where the choice of replacement products is limited.

Several interventional studies have demonstrated the potential efficacy of nutritional tariffs. A study conducted in the cafeteria of the administrative building of an American university showed that an increase in the offer of salads and fruits together with a 50% price cut induced a 3-fold increase in demand over the three weeks of intervention (Jeffrey *et al.*, 1994). A similar study conducted in two schools located in very different ethnic and socioeconomic environments showed that halving the price of fresh fruits and baby carrots for 3 weeks induced a 4-fold increase in fruit consumption and a 2-fold increase in carrot consumption (French *et al.*, 1997). Those studies raise the question of the possibility of maintaining, over time, a tariff system which promotes a consumption shift towards low-energy density products without decreasing the revenues of the restaurant. A pilot study in a secondary school cafeteria (Hannan *et al.*, 2002) showed that nutritional pricing that increases the price of fat products and decreases the price of fruit and low-fat products enabled maintenance of constant revenues through the school year.

Even though more in-depth studies are required, in particular in order to analyze the long-term effects of pricing, the above studies are clearly of interest. They demonstrate the efficacy of measures which could be applied fairly broadly in catering environments. They also point the way to other studies to test the efficacy of measures not simply impacting prices but also nutritional information and the sensory characteristics of foods.

Actions on information

In order to evaluate the costs and benefits associated with their choices, consumers need to be informed about the nutritional value of foods and the desirable consumption levels. In the United States, food labeling was made mandatory by the Nutrition Labeling and Education Act (NLEA). All foods must now bear a standardized label (nutrition facts) stating the essential information. But foods intended for immediate consumption (in restaurants, canteens, etc.) are not subject to nutritional labeling for the time being, although eating outside the home accounts for an increasing share of consumption (46% of the food budget in the United States in 2002). The nutritional quality of food eaten outside the home is inferior to that of foods prepared at home. The assessment of the mandatory nutritional labeling of food products and the discussions on whether or not it would be opportune to extend the nutrition facts obligation to foods eaten outside the home have generated interesting information on the efficacy of those measures and on the related issues.

Effects of mandatory nutritional labeling

Prior to application of the 1990 NLEA in the 1994, nutritional labeling was voluntary. Manufacturers were free to communicate on the nutritional composition of their products provided that they stated the necessary information. Voluntary nutritional labeling was based on the idea that if there was consumer demand for information on the nutritional composition of products, manufacturers would be incited to supply the information since the

signal would impart a competitive advantage. Products stating their composition would be perceived as of superior nutritional quality to those that did not.

A number of lessons were drawn from the economic analysis of the efficacy of those incitements. On the basis of an analysis of the nutritional information shown on the packaging of products in 53 different categories, Mojdzuszka and Caswell (2000) concluded that voluntary labeling did not provide consistent and reliable nutritional information to consumers for all categories of food. With regard to salad dressings, for example, voluntary nutritional labeling was only used for low-fat products. Other products, accounting for most of the market, did not supply any information. The advent of mandatory labeling put an end to that situation and was accompanied by a fall in the sales of salad dressings with the highest fat content (Mathios, 2000). The voluntary disclosure mechanism is thus not sufficient, particularly when the primary characteristic of a product (in this case the fat content) has a negative value on the market.

By making product composition information systematic through mandatory labeling, two main effects were expected: first, an improvement in consumers' diet, and, secondly, an improvement in the composition of the products offered on the market due to enhanced competition between manufacturers.

Using individual data generated by American surveys of food consumption and nutritional knowledge from 1994 to 1996, Pérez-Escamilla and Haldeman (2002) showed that use of nutritional information on packagings was significantly associated with a superior diet (measured by the Healthy Eating Index). The interaction with income was particularly striking: people with low incomes who used the nutrition facts had a better diet than those with high incomes but not using the facts. Causality has not, however, been clearly established, since the data were sectional and do not enable the sequence of events to be determined.

The effects on manufacturers' strategies were more complex. Moorman (1998) showed that manufacturers reacted strategically by modifying the quality of their products as a function of their initial position in the nutritional field. For basic brands not positioned in the nutritional field, there was an improvement in nutritional quality through an increase in positive attributes rather than through a decrease in negative attributes. For range extensions positioned on the nutritional segment, however, the improvement in nutritional quality mainly consisted in a reduction in the negative characteristics rather than development of products incorporating additional nutrients. In addition, Moorman observed that brands that had no nutritional comparative advantage reacted to mandatory labeling by competing more at price level. The latter point particularly clearly illustrates the way in which manufacturers' strategic reactions may undo the legislator's initial intentions.

Nutritional information and diet outside the home

Extending mandatory nutritional information to eating outside of the home is currently under discussion in the United States. The rare studies of the effects of nutritional information in restaurants have generated uneven results in terms of changing consumers' behavior (Stubenitsky *et al.*, 2000; Kral *et al.*, 2002; Variyam, 2005). The requirement of providing information on the nutritional composition of the dishes served may, however, improve the situation by regulating manufacturers' behavior. However, as was the case for mandatory labeling, strategies based on price reductions may interfere with achievement of the stated objective (Variyam, 2005).

Who uses the information?

The most frequent criticism of information actions is that they target as a priority consumers who do not need them, in other words the better educated and more informed who in general have already adopted a healthy diet. Many authors thus insist on the need to find new modalities for information enabling the populations at risk to be targeted and broadening the audience of the recommendations by making them more simple and easier to implement.

In conclusion, it will be observed that while the economic factors associated with the development of obesity are beginning to be well understood, the justification for, and evaluation of, preventive measures remain under debate. The economic studies reviewed show a fairly broad agreement with public intervention on the basis of three arguments: the increasing negative externalities related to healthcare costs; asymmetric information on product characteristics; the need to protect children. The question of intervention related to problems of self-control in the adult population remains more open. Intervention may be justified on the basis of asymmetric paternalism: high gains for subjects with self-control difficulties; low costs for the others.

The analysis of the economic measures possible show that nutritional taxation would act directly on the food choice environment, but is liable to be found unjust and ineffective. Subsidizing foods such as fruit and vegetables would doubtless be the most practical approach. No argument of principle can be opposed to implementation of mandatory nutritional information insofar as the information is a necessary condition for the exercise of free choice and a stimulant to improving the nutritional quality of food offer.

Generally speaking, understanding the role of incitements enabling lasting changes in behavior would seem to be gaining ground. Much remains to be done however, particularly in Europe and France, in order to develop cost effectiveness analyses of the main potential measures and in order to analyze in detail the indirect consequences of such measures. Lastly, the mechanisms underlying the formation and time course of food preferences are still poorly understood. Economists increasingly recognize that biological and cognitive factors may explain behavior which to them is irrational. Further research is necessary in order to better incorporate the biological and behavioral bases in the economic analysis of food decision making. Such studies would enable a more consensus-oriented approach to public and private interventional strategies.

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4

Cost of the disease

Health economics is taking an increasing interest in obesity as shown by the programming in the 5th world congress of the International Health Economics Association (July 2005) of several sessions devoted to obesity. Volume 17 of the collection *Advances in Health Economics and Health Services Research* (publication: 2006) addresses the economic approach to obesity. However, the information available remains very fragmentary and the articles published in the field so limited that there are only three literature reviews. Moreover, examination of those reviews shows disproportionate development of the issues (Martin *et al.*, 2000; Avenell *et al.*, 2004). Health economists propose a 'disease cost' approach that measures the economic impact of a risk factor or disease on the healthcare system and society. That type of approach is generally the first employed since it yields an economic translation of the amplitude of the problems generated by a specific disease. For obesity, that type of study predominates in the various countries. But health economics can also be used to shed light on therapeutic choices with a view to optimizing efficiency. An economic evaluation approach, frequently of the cost-effectiveness type, is then used to compare the costs and results of alternative therapeutic strategies. That approach has been less used for obesity.

Economic approach to the impact of the disease

The economic approach to the disease focuses on the financial or economic impact of a disease by estimating its cost. The difficulties encountered in that approach are, first of all, data availability and, secondly, the need to make pertinent choices with regard to the various parameters that define the perimeters of the costs considered. The cost perimeter depends first on the nature of the costs included in the estimate (medical direct costs, non-medical direct costs and even indirect costs generated by loss of production). Other parameters introduce additional variability, making comparison delicate: the perspective adopted (society, health insurance, etc.), the BMI cutoff used to define overweight and obesity, the time scale selected (from 1 year to the patient's lifetime), the choice between a prevalence or incidence approach, an estimate of the top-down or bottom-up type. With regard to the latter types of estimate, the former gradually reduces all the set of healthcare expenditures to the part attributable to a disease while the second first measures the individual cost by patient type before extending the measurement to the group involved on the basis of epidemiological data.

In France, two studies of that type are available (Levy *et al.*, 1995; Detournay *et al.*, 2000). Both refer to the prevalence of obesity in 1992, defined as a BMI ≥ 30 . The annual direct costs from the point of view of society were calculated.

The first study (Levy *et al.*, 1995) adopted a top-down approach and restricted the cost perimeter to a limited list of diseases partially attributable to obesity. The total annual cost of those diseases was estimated before selecting the proportion of cases attributable (PCA) to

obesity as a function of relative risk (RR) (table 4.I). For a total direct cost of all the diseases of FRF 66.1 billion in 1992 (11% of healthcare expenditures), the part attributable to obesity was reported to be FRF 5.8 billion (BMI \geq 30), or even FRF 12.1 billion (BMI \geq 27). Caution is required with respect to the results due to the heterogeneity of the data sources and other limitations related to the difficulty of estimating pertinent parameters for France (public hospital costs based on the price of a day with the Paris Public Hospital Authority (AP-HP), RR based on international data). The total cost is probably an underestimate given the PCA indicated by WHO in its report on industrialized countries in 2002.

Table 4.I: Diseases attributable to obesity after Levy *et al.*, 1995)

Disease name	WHO code CIM-9	Relative risk	PCA* (%)
Obesity	278	//	100
Hypertensive diseases	401-405	2.9	24.09
Ischemic heart disease	410-414	1.97	13.94
Heart failure	428	2.55	20.56
Cerebral occlusions	433-434	3.09	25.87
CVA** and atherosclerosis	436-437	3.09	25.87
Phlebitis and thrombosis	451-453	1.5	7.71
Non-insulin-dependent diabetes mellitus		2.9	24.09
Hyperlipidemia	272	1.5	7.71
Gout	274	2.5	20.03
Osteoarthritis of the knees	715	1.8	11.79
Gall stone	574	2	14.31
Colorectal cancer	153-154	1.3	4.77
Breast cancer	174	1.2	3.23
Genitourinary cancers	179-189	1.6	9.11

* PCA: proportion of cases attributable

** CVA: cerebrovascular accident

The second study used the bottom-up method to generate an alternative estimate of the cost of obesity in France (Detournay *et al.*, 2000). Using the data generated by the Insee 'Households' survey, the study addressed a representative sample of French adults. The cost of obesity was estimated at the individual level by the excess cost method by comparing the healthcare expenditures of the obese population with that of the normal population ($18.5 \leq \text{BMI} \leq 25$). The excess cost was then extrapolated to French national level as a function of the ratio between the sample size and size of the French population. The study estimated the mean annual net excess cost to be FRF 911 per obese patient. The excess cost consisted in the gross excess cost related to diseases attributable to obesity (FRF +1.183) from which the lesser cost of other diseases (FRF -972) related to an unexplained lesser recourse to healthcare was deducted. For France as a whole, the net excess cost was thus FRF 4.2 billion (0.7% of healthcare expenditures) and the gross excess cost FRF 8.7 billion (1.5% of healthcare expenditures). Using the reported medical consumption data, known to be very little reliable, on hospital costs, the authors were forced to conduct an adjustment to take into account the obvious under-evaluation of the annual expenditures of the sample population vs. the French population (adjustment coefficient: 1.66).

The French results suggest that the medical cost of obesity accounts for about 1 to 2% of total healthcare expenditures. The results are nonetheless fragile and old and are less than those for other countries. The generally accepted range is from 2 to 7% (2 to 2.5% for Australia, Canada and New Zealand; 3.5% for Portugal; 5 to 7% for the United States). Moreover, the scope and interpretation of the results are far from obvious. What information can be drawn from a comparison with the cost of other diseases? Is the cost that of the treated disease or that of the untreated disease? Can the cost be avoided and if so at what price?

The type of questions raised by disease cost studies explains why numerous health economists are not in favor and prefer to refer to the issue of efficiency. If we nonetheless wish to estimate the burden associated with the disease, an alternative approach consists in the mortality and disability-adjusted life years (DALY) attributable to overweight and obesity. The latter measurement adds the equivalent of the years lost through degradation of quality of life to the years lost by premature death (Gold *et al.*, 2002).

Economic evaluation studies

Economic evaluation studies have very little addressed obesity since the only review is to be found in one synthesis and no article addresses France (Avenell *et al.*, 2004). There are, of course, objective reasons for that, particularly the limited number of therapeutic strategies (medicinal) available and the difficulties inherent in chronic diseases in which long-term effects cannot be neglected. The objective of the approach is to estimate the cost per year of life gained (cost-effectiveness study) or the cost per QALY³ gained (cost-utility study) for a given strategy vs. another. The approach is two-phase: beginning with the data generated by a randomized, controlled trial, one attempts to evaluate both the costs associated with each therapeutic strategy and its effects measured using an interim result indicator (weight loss, percent reduction in BMI). Secondly, the long-term outcome for the patients are modeled using a final indicator (years of life saved, QALYs).

Several studies have recently been undertaken with a view to short-term evaluation in the context of a clinical trial or care program (Wylie-Rosett *et al.*, 2001; Dzator *et al.*, 2004) or for a surgical strategy (Avenell *et al.*, 2004). An interesting study focused on the second phase of the approach by modeling the cost and effectiveness of a 10% permanent reduction in BMI vs. baseline (Oster *et al.*, 1999). The study estimated that the reduction in the medical costs over the patient's lifetime was between USD 2,200 and 5,300. The reduction in the incidence of strokes was between 1 and 3°/∞ and the reduction in coronary heart disease between 12 and 38°/∞. Life expectancy increased by between 2 and 7 months.

Combining both components, certain studies have reported a cost per year of life saved or QALY saved whose results are shown in a League Table in the most recent review (Avenell *et al.*, 2004). Differentiation of the patients appears to be of fundamental importance since the cost per year of life or QALY gained was less than GBP 13,000 for numerous strategies (including Orlistat®) for obese patients at high risk while the ratio increased to almost GBP 46,000 for obesity alone with Orlistat®. These results are, however, to be considered with caution due to the hypotheses, which may sometimes be heroic, necessary to model the long-term outcome for the patients.

Lastly, the Who-choice model is worthy of mention (WHO, 2002). Who-choice does not specifically consider obesity but estimates the cost of the DALY avoided by various strategies designed to combat physical inactivity and dietary risk factors (table 4.II). By considering the

³ A quality-adjusted life year (QALY) is the equivalent of a year of life gained, in good health, taking into account the quality of life experienced. A QALY gained thus reduces the DALYs lost due to the disease (Gold *et al.*, 2002).

marginal cost-effectiveness ratio which enables estimation of the additional cost per DALY prevented, it was observed that few of the strategies are of interest. More precisely, all strategies combining nutritional education (and lifestyle education) with other interventions are dominated by other strategies. In other words, they are both more expensive and less effective. Conversely, health education via the media with a view to reducing cholesterol appears a more efficient strategy (lowest ratio value) alone or in combination with legislation to reduce salt intake, possibly together with tritherapy for patients at high cardiovascular risk.

In conclusion, the economic costs of overweight and obesity are important criteria for health policy deciders. On the basis of the international studies, the minimum estimate for those costs would be 2 to 7% of healthcare costs. The studies quantifying the economic weight of obesity-related morbidity and mortality, although imperfect, clearly confirm that the condition constitutes an important public healthcare issue and is continuing to increase. The economic approach (cost-effectiveness, cost-benefit studies, etc.) also constitutes an essential instrument for the selection of treatment and prevention regimens for the management of obesity. The latter type of study has still not been widely applied in the field of obesity.

Table 4.II: Cost-effectiveness analysis of various programs addressing dietary risk factors and physical inactivity in the WHO-choice model *

Intervention	International annual total cost (dollar)	Efficacy DALYs avoided (mean per year)	Mean cost-effectiveness ratio	Marginal cost effectiveness ratio
Cholesterol-lowering treatment (Statin) and nutritional education given individually by the physician to the patients whose cholesterol level exceeds 220 mg/dL (5.7 mmol/L)	27,142,301,153	6,901,683	3,933	Dominated
Antihypertensive treatment and education when systolic blood pressure >160 mm Hg	37,384,697,844	8,241,749	4,536	Dominated
Statin treatment and education with antihypertensive treatment for subjects whose SBP > 140 mm Hg and/or cholesterol > 240 mg/dL (> 6.2 mmol/L)	56,571,928,061	10,961,132	5,161	Dominated
Health education through the mass media with a view to cholesterol lowering	201,952,335	1,225,913	165	164.74
Antihypertensive treatment and nutritional education given individually by the physician to patients whose SBP > 140 mm Hg	14,776,782,002	7,270,226	2,033	Dominated
Legislation to reduce the salt content of prepared foods, reinforcement and adaptation of labeling and education	499,260,742	2,432,798	205	246.34
Legislation, education and triple treatment (hypertensive treatment with a β -blocker, Statin and aspirin) for subjects at a 15% risk of a cardiovascular event over 10 years	21,611,530,014	10,639,576	2,031	7,812.01
Legislation, education and triple treatment (hypertensive treatment with a β -blocker, Statin and aspirin) for subjects at a 25% risk of a cardiovascular event over 10 years	15,473,791,235	9,853,897	1,570	6,163.71
Legislation, education and triple treatment (hypertensive treatment with a β -blocker, Statin and aspirin) for subjects at a 35% risk of a cardiovascular event over 10 years	11,045,338,034	9,135,424	1,209	1,573.42
Legislation, education and triple treatment (hypertensive treatment with a β -blocker, Statin and aspirin) for subjects at a 5% risk of a cardiovascular event over 10 years	35,095,347,271	11,608,012	3,023	13,923.30
Legislation to reduce the salt content of prepared foods, reinforcement and adaptation of labeling	297,308,407	1,309,796	227	Dominated
Treatment (Statin) and education when cholesterol > 240 mg/dL (> 6.2 mmol/L)	19,187,230,217	6,466,856	2,967	Dominated
Triple treatment (antihypertensive treatment with a β -blocker, Statin and aspirin) of subjects with a 5% risk of a cardiovascular event in 10 years	35,750,072,283	11,369,595	3,144	Dominated
Triple treatment (antihypertensive treatment with a β -blocker, Statin and aspirin) of subjects with a 15% risk of a cardiovascular event in 10 years	22,226,384,854	10,352,919	2,147	Dominated
Triple treatment (antihypertensive treatment with a β -blocker, Statin and aspirin) of subjects with a 25% risk of a cardiovascular event in 10 years	16,015,123,762	9,505,930	1,685	Dominated
Triple treatment (antihypertensive treatment with a β -blocker, Statin and aspirin) of subjects with a 35% risk of a cardiovascular event in 10 years	11,554,841,778	8,726,599	1,324	Dominated
Partnership between the food industry and government to decrease the salt content of prepared foods and appropriate labeling	297,077,225	678,711	438	Dominated

SBP : Systolic blood pressure

* Source: <http://www3.who.int/whosis/cea>

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5

International prevention programs and operations

As with any public health operation, obesity prevention, whose imperative necessity no one contests, requires an approach based on evidence. This is the only means of ensuring that the recommended strategies and envisaged operations will procure the expected effects. Evidence is usually based on studies, ideally randomized. Data of that type taking into account the complexity of obesity and particularly the decisive role of environmental and societal changes over recent decades are, however, not very numerous. An understanding of the contexts, potential for change and manner in which they can facilitate, or, on the contrary, prevent the implementation of effective strategies nonetheless appears essential for development of a plan of action for the prevention of obesity. In order to enhance the biological, psychosocial and environmental pertinence of the information and recommendations, the evidence available in various categories of information and studies have been drawn on in this chapter.

Data sources

Two recent reviews, one addressing randomized obesity prevention trials in children and adolescents (Campbell *et al.*, 2005) and the other the promotion of physical exercise in children and adults (Kahn *et al.*, 2002) are available. Few probative interventional studies, most of which are summarized in the two reviews, have been published with respect to either the prevention of obesity or the promotion of physical exercise and healthy eating habits. But the absence of evidence is not equivalent to inefficacy: high-quality studies are not very numerous (22 randomized studies on obesity prevention of which only 10 aged less than one year) and it is frequently not possible to determine whether the absence of observable effect in certain studies is related to the real inefficacy of the projected operation, to the fact that the operation was not implemented as scheduled, to an excessively short duration of the interventions or to a lack of statistical power due to the small population included or a high lost to follow-up rate (NHS, 2002). Moreover, despite the increasing recognition of the influence of the environment and society on behavior, few interventions have taken that contextual complexity into account.

While randomized, controlled studies are the gold standard for testing clinical and research interventions, the approach is not always feasible, appropriate or ethical on a population scale. In addition, for numerous environmental, political, legislative and societal variables, attentive evaluation of large-scale, rigorous observational studies and ongoing preventive programs and policies enable a number of key questions to be answered. For those reasons, an integral and wider review of the evidence available in the field was implemented with a view to enhancing the pertinence of the information and identifying promising approaches.

In addition to that information, data drawn from the experience generated with other preventive strategies for other public health problems (IOM, 2002 and 2005) such as smoking (CDC, 1999; Yach *et al.*, 2005), road safety (IOM, 2002; Gielen and Sleet, 2003) and the

prevention of cardiovascular diseases were used. In the latter field, the cardiovascular disease prevention programs implemented in Finland over the last 20 years (Puska *et al.*, 1998; Puska, 2002) reflect a real public health policy yielding results that have been published in scientific journals.

Various reports and expert reviews have been published by the international organizations, particularly the World Health Organization for the world (WHO, 2003a and b) or for Europe (WHO, 2001 and 2003c). The latter report briefly summarizes the operations or programs implemented in the various European Union Member States. The European guidelines for a healthy diet published by WHO (2000) and various reports funded by the European Union (Eurodiet, 2000; Brettschneider and Naul, 2004) are also available.

Reports and proposals have been compiled by learned societies or associations such as the European Association for the Study of Obesity, which published a report with proposals, in cooperation with the International Obesity Task Force (EASO, 2002). The European Federation of Cardiology Societies made the prevention of childhood obesity a major component of its communication in 2005 and published a report on the 'Marketing of nutritionally incorrect foods' in Europe (EHN, 2005).

Reports and plans of action have been published by various countries, particularly the United States (IOM, 2005), Canada (CIHR/CPHI, 2003), Denmark (National Board of Health, 2003), the United Kingdom (NAO, 2001) and more recently Sweden (National Food Administration, 2005). A document published by the University of Sidney in support of the nutritional policy in Australia and New Zealand is of interest in that it classifies the various potential actions on the basis of their probable efficiency (University of Sidney, 2005).

Taking into account the above sets of data, justified by the fact that the obesity epidemic is a public health problem requiring immediate and rapid action, obviously necessitates developing, in parallel, an action strategy based on the information and the appropriate evidence that continues to be generated and accumulated. This is indispensable not only to ensure that the operations implemented elicit significant effects and justify their pursuit, but also to check that the effects are sustainable and applicable on a larger scale or to other populations. It is also necessary to identify the related effects (on the population scale and on the society scale) and to estimate the cost/benefit ratio. For that reason, evaluation is to be a major constituent of any intervention in the field.

Context and conceptual bases

The definition of a preventive program necessitates an analysis of the context with regard to the life of the population addressed. The preventive strategy will also differ depending on the target: all the population, group at risk or subjects already overweight.

Environment, society, lifestyle and obesity

The influence of the social, cultural, physical and political environment on the individual's lifestyle and, in consequence, on the individual's state of health has now been firmly established (Booth *et al.*, 2001; Davison and Birch, 2001; Lobstein *et al.*, 2004). Society has considerably evolved over a few decades and numerous changes - industrialization, mechanization, urbanization, increase in the number of meals eaten outside the home, modification of food offer - have profoundly influenced our dietary habits and our energy requirements. Other changes such as the increasing diversity of populations influence the cultural aspects, methods of food distribution and marketing strategies.

Currently, our society is structured in such a way that individuals frequently do not need to be physically active during a usual day. Not only does urbanization promote reliance on cars but it discourages the use of active means of transport. Access to hiking or cycling trails, parks and leisure areas is frequently made difficult by extensive urbanization and the distances between home and those facilities. For many, it is not possible to remain physically active without strong motivation and marked effort. Concomitantly, the evolving leisure offer (television, video games, etc.) promotes inactive behavior and increases individual vulnerability to weight gain.

In addition, we live in a context of abundant food. Certain characteristics of the 'modern' diet - high energy density and nutritional composition, portion size, physical properties, palatability, overabundance and diversity - promote passive over-consumption. The same is true for energy-rich drinks and the commercial trend toward promoting food on quantity rather than on quality. The availability of ready-to-eat, palatable and relative inexpensive foods in all places and at all times encourages food intake in response to determinants other than energy requirements. Moving beyond the characteristics of foods, the growth of eating outside of home, the compromised structure of eating, the simplification of meals and loss of their 'ritual' aspects (less time devoted to meals, television during meals) also promote excessive energy intakes. Moreover, due the current commercial offer, food intakes outside of meals and fast food frequently consist in ready-to-eat products with a high energy content or sweet beverages.

Without passing over the contribution of that change in the food system to improvement of certain aspects of health on the population scale (decrease in under-nutrition, infantile mortality and increased life expectancy, for example), it must nonetheless be admitted that the new food availability promotes new public health issues, of which obesity is a prime example.

WHO (2003b) recently classified the factors associated with an increased or decreased risk of obesity on the basis of the quality of the empirical and epidemiological arguments underlying the relationships (table 5.1). It will be noted that, since the table was compiled, studies on portion size have generated results that call for classifying portion size in the probable factor category (Ledikwe *et al.*, 2005).

Table 5.I: Factors liable to increase or decrease the risk of weight gain (WHO, 2003b)

Argument	Reduced risk	No relationship	Increased risk
Convincing	Regular physical exercise High dietary fiber intake		Sedentary lifestyle High intake of low-nutrient high-energy foods
Probable	Familial and school environments which encourage children to eat healthy foods Breast-feeding		Intensive promotion of high-energy foods and fast-food sales points High consumption of carbonated beverages and sodas sweetened with sugar and fruit juices Poor socioeconomic conditions (in developing countries, particularly for women)
Possible	Low glycemic index foods	Protein content of the diet	Large portions High proportion of foods prepared outside of the home (developed countries) Dietary habits: 'rigid restriction/periodic binges'
Insufficient	More frequent food intakes		Alcohol

The ecological niche concept

A large number of the social, cultural and environmental characteristics of industrialized countries that populations now consider 'normal' also contribute collectively to the increase in obesity. It is now patent that the intrapersonal factors (genetic, biological and psychological) which condition physical exercise and food choices can no longer be considered in isolation but must be incorporated in a complex network of individual, interpersonal and environmental factors (Booth *et al.*, 2001; Kumanyika *et al.*, 2002; Swinburn *et al.*, 2004; Swinburn *et al.*, 2005). More specifically, understanding what makes a subject at risk of gaining weight (and in consequence, the setup of effective preventive strategies) necessitates taking into consideration the context, the 'ecological niche' in which the subject lives: familial environment, school and professional environment, but also in a wider sense the housing estate and society (figure 5.1).

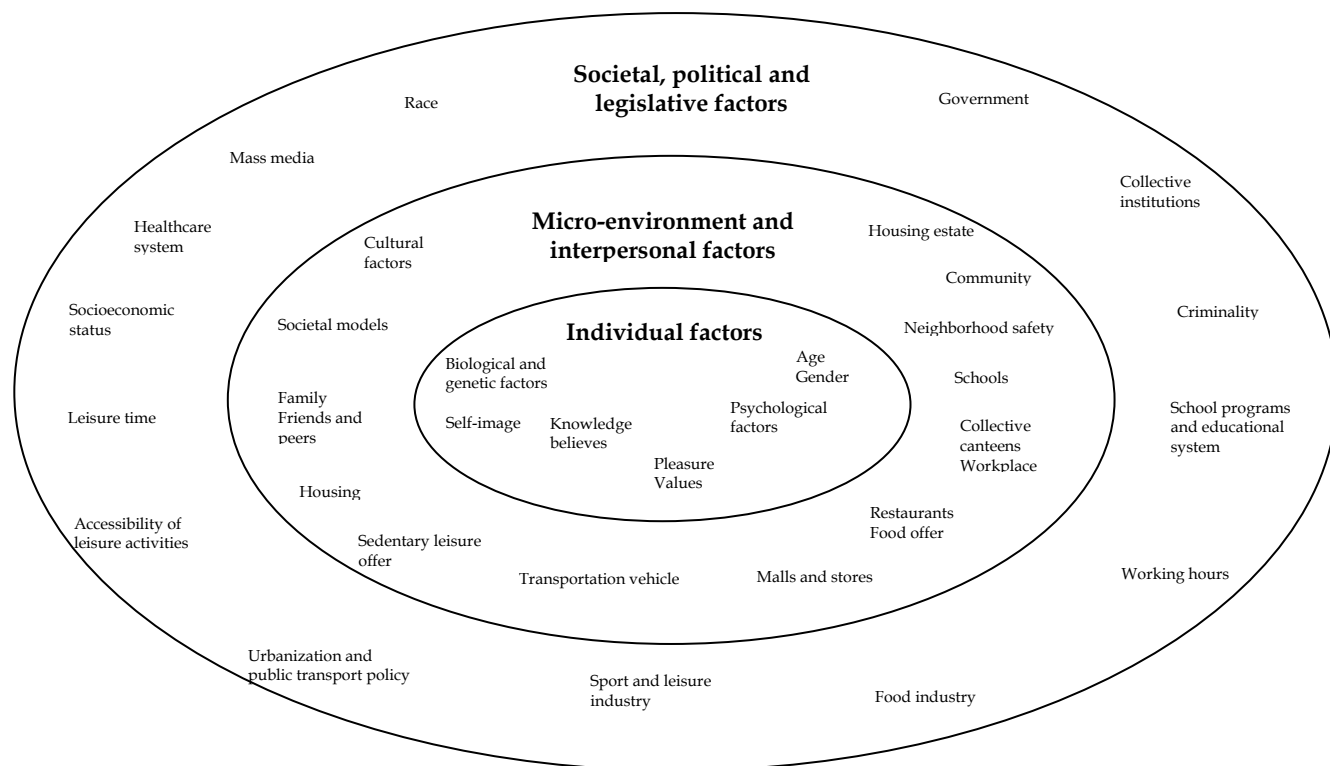


Figure 5.1: Determinants of physical exercise and food choices (after Booth *et al.*, 2001; Davison and Birch, 2001)

Thus, the attitudes and lifestyles or consumption of parents, friends, colleagues and, more generally, the social entourage (citizens, but also teachers, trainers, management, healthcare personnel, etc.) influence individual practices. More structural factors such as urbanization policy and public transport, the accessibility and cost of leisure facilities and sports grounds, the availability of facilities that could be used safely, the offers in the workplace are all factors liable to influence an individual's physical exercise. The same applies in the context of schools, the organization and content of physical education or the layout of the playground. Distances and lack of time are the most frequently reported obstacles to physical exercise. The time spent at work and school and traveling also indirectly influences the degree of physical exercise. Similarly, the food offer in school and company canteens, in the workplace and in schools (accessible water fountains, for instance) or in fast-food facilities directly influences choices and modes of food consumption. The cost of products, impact of the media and advertising or regulatory aspects with regard to food quality and restaurants are also to be cited.

Various interventional levels

Preventive actions may be classified by their interventional level. Three levels are usually distinguished: universal or large-scale prevention targeting the population or community as a whole; selective prevention targeting groups at high risk of weight gain; and targeted prevention addressing subjects who are already overweight or at a high risk of concomitant disease (figure 5.2).

The universal approach, whose objective is to reduce the obesity level throughout the population, has been criticized since it also affects subjects who are not concerned by the health problem. Given the high prevalence of obesity and insofar as the approach targets

behaviors (physical exercise, food choices) having effects on health independent of their effects on body weight, the universal approach appears justified and constitutes the form of prevention with the highest potential cost-effectiveness ratio.



Figure 5.2: Preventive action levels (after WHO, 2003a)

The objective of selective prevention that targets subgroups of the population at high risk of weight gain is to help the subjects become aware of their problem and provide them with the resources and skills to enable them to achieve more effective control over the factors contributing to the risk.

Targeted prevention if it is restricted to avoiding additional weight gain and the concomitant diseases associated with overweight, is usually based on more intensive individual or small-group strategies.

It should be stressed from the outset that while the levels may be distinguished by the populations targeted and their different short-term objectives, they are nonetheless interdependent: a coordinated and consistent approach at the various levels should enhance the probability of being effective in the long term. Moreover, obesity prevention cannot be totally dissociated from the thinking on obesity management. It is not only a question of avoiding normal subjects becoming obese but also of preventing additional weight gain in obese subjects and promoting weight stabilization in obese subjects having lost weight.

Strategic thrusts: concept of 'effort-free' prevention

The prevention of obesity involves both healthy eating behavior and regular exercise with the objective of achieving and maintaining the energy balance at the level of a 'healthy' weight. Overall, two types of strategy may be distinguished: those aiming at increasing individual understanding and skills (active changes) and those aimed at modifying the environment by proposing the adoption and maintenance of an active lifestyle and appropriate food choices (passive or 'effort-free' changes) for the population. The latter strategies are not restricted to the physical and structural environment but also incorporate the societal, economic, political and legislative environment and the vectors of over-consumption. They thus involve numerous sectors and partnerships (table 5.II).

Table 5.II: Examples of partners and sectors liable to be involved in an ecological and 'effort-free' strategic approach

The state, collective institutions and, more broadly speaking, the public authorities and political decision makers
Those involved in the school system
Town planners, real-estate developers
Food industries, food distribution and catering professionals
Leisure industries
Communication industries (media, advertising, etc.)
Civil society organizations (communities, associations, social players, etc.)
Companies
Health system

Objectives and assessment criteria

In contrast to individual approaches, preventive programs targeting the population or community overall do not aim to obtain an improvement in individual body weight or concomitant diseases but to stabilize or reduce the overweight or obesity level and the mean body mass index (BMI) (two closely related parameters) for the target populations as a whole (table 5.III). It should be borne in mind that considerable time may elapse before the environmental and societal changes generate effects with regard to population mean body weight. For that reason, other indicators may be of value as interim efficacy parameters: markers of the degree of physical exercise and choice of foods, but also more structural components such as the number and accessibility of active leisure facilities and the availability and accessibility of fruits and vegetables for low-income populations or in collective institutions, etc. The changes in attitudes and the motivation of the target publics, professionals involved in prevention and public authorities are also important stages and probably indispensable even if they have to be strengthened by subsequent effects on the state of health. Thus, effective preventive and regulatory actions in the field of smoking and road safety would probably not have been possible if they had not been preceded by information, awareness promotion, education and attitude campaigns for the public, rendering the solutions to the problems, including the enforcement measures taken, acceptable.

In addition, great vigilance is necessary in order to prevent and detect adverse collateral effects (Adams and White, 2005): stigmatization, exacerbation of social inequalities, food behavior disorders (Austin, 2001) and nutritional deficiencies, smoking in the hope of preventing weight gain, etc. Such collateral effects are to be incorporated in the assessment criteria.

Table 5.III: Objectives of a large-scale obesity prevention policy

Long-term objectives: creating a conducive environment on the population scale

- A decrease in obesity incidence
- A decrease in obesity prevalence
- A decrease in mean body mass index
- An increase in the number of subjects achieving the nutritional recommendations
- An increase in the number of subjects achieving the physical exercise recommendations

Intermediate objectives: necessary to evaluate the impact of actions more rapidly

- An increase in the number of children (adults) going to school (work) on foot or by bicycle in all safety
 - Enhanced accessibility - and real access to - fruit and vegetables, including for low-income populations
 - Increase in the accessibility (distance, cost), safety and use of public leisure facilities
 - Increase in the opportunities for active games and physical exercise
 - Availability of new industrial products and advertising messages promoting the equilibrium of the
-

energy balance at a healthy body weight
Increase in the accessibility - and real access - to healthy foods and beverages (in stores but also in schools, workplaces, canteens, etc.)
Institutional and environmental regulations promoting active behavior and a balanced diet

Secondary objectives: absence of harmful collateral effects

Stigmatization
Food behavior disorders and nutritional deficiencies
Other risk behaviors (smoking in the hope of losing weight)
Exacerbation of social inequality, etc.

Assessment, results and evaluation

Generally speaking, the interventions are designed to promote healthy dietary choices and/or an active lifestyle.

What can be learned from interventional studies?

It is important to distinguish between the results of studies targeting the individual and studies targeting the population in general or groups at risk.

Targeted interventions

In recent years, several studies have clearly shown that individualized and intensive interventions on lifestyle with objectives close to those intended for the general population enable limitation of weight gain and the risk of type 2 diabetes in overweight subjects presenting with glucose intolerance. In two studies conducted on 522 Fins (Tuomilehto *et al.*, 2001) and 3,234 North Americans (Knowler *et al.*, 2002) and based on promotion of regular physical exercise and a healthy diet (increase in fruit and vegetables and restriction of saturated fats and energy density), the intervention was accompanied by a 7% weight loss and a 40 to 60% reduction in the risk of progression toward type 2 diabetes. The challenge resides in determining what approaches enable the lifestyle of large populations to be changed and the results to be maintained over the long term. The latter objective is rarely achieved in interventional studies focusing on the individual, perhaps due to the absence of environmental changes.

Selective or universal interventions

Generally speaking, interventions based on information and education only (food guides, promotion of a healthy diet or active lifestyle through the media, advertising hoardings or interventions in schools, in the workplace, in clubs or in community centers) improve understanding but only have a limited long-term effect on behavior or the mean BMI of the target populations (EASO, 2002; Kahn *et al.*, 2002; Campbell *et al.*, 2005). However, encouraging results have been observed when the interventions were associated with actions stressing the opportunities for physical exercise (posters encouraging use of the stairs placed next to the elevators, for instance) or were included in vast community prevention programs, particularly with respect to cardiovascular risk (Vartiainen *et al.*, 1994; Puska *et al.*, 1998).

Similarly, the behavioral and social approaches which frequently target smaller groups of individuals and aim to inform, but also to confer skills, while structuring the social environment so as to promote change and maintain the changes, have demonstrated a degree of efficacy in some fields: physical education classes at school (change in the content and form of the classes in order to increase the effective time and the intensity of the exercise with participation of as many students as possible) (Mo-Suwan *et al.*, 1998; Kahn *et al.*, 2002),

programs intended to increase familial support (but only for actions designed to reduce the time spent in front of a television screen; Robinson, 1999) and social support programs at community level (particularly in the workplace; Kahn *et al.*, 2002).

While the studies based on an ecological and environmental approach (whose objective is to create an environment conducive to the options of physical exercise and a healthy diet) are rare, the results are nonetheless promising and the observational data available show that numerous actions can and should be investigated.

The number and accessibility of active leisure facilities and equipment, footpaths or cycling paths, their safety, and the organization of leisure activities (proximity, times, cost, free or regulated practice, etc.) around the school, close to the workplace or in the housing estate also constitute means of modulating the degree of physical exercise of citizens. The same applies to the regulation of car traffic and pedestrian-only zones, the construction, arrangement and location of schools and urbanization, and public transport policies.

A dozen studies of measures intended to promote the creation, accessibility and safety of sports facilities and/or coaching of such activities in the workplace, close to schools or in neighborhoods had have a positive impact on the degree of leisure physical exercise and the body weight of the target populations (Kahn *et al.*, 2002; Simon *et al.*, 2004).

Interventions targeting daily physical exercise (active transport or professional activity) are less numerous. A few programs of that type are under evaluation. They address, for instance, the impact of public transport policies and urbanization plans designed to promote walking and non-motorized transport in town. Some studies have more specifically addressed the home-school journey and particularly the safety aspects (safe footpaths and bicycle paths, possibly monitored) and equipment (bicycle park, etc.) for those journeys.

Modifications of food offer have less frequently been studied. Studies conducted in schools show that nutritional information and education is more likely to promote a change in behavior when accompanied by a change in the food offer within the school, particularly in school canteens (CNA, 1998; Sahota *et al.*, 2001). The Pathways (Caballero *et al.*, 2003; Story *et al.*, 2003) and Tacos (French *et al.*, 2004) studies showed that it was possible to reduce the percentage energy procured from fats by acting on the content of school meals. Similarly, a few ongoing studies are addressing the offer of company canteens and food aid programs (IOM, 2005). The results are encouraging. The impact of changing food offer outside of canteens, in the school or workplace (number and content of vending-machines, sales in the establishment, access to drinking fountains, etc.) requires evaluation.

The accessibility of 'healthy' foods and beverages is not restricted to spatiotemporal accessibility in the living space or restaurant but includes the cost of the products proposed. Economic incitements have been the subject of pilot studies, which should now be expanded. The organization of the food industry and supporting agricultural policies have made added sugar and fats and, generally speaking, high-energy density foods, the cheapest sources of energy on the market. In contrast, high nutritional density foods, in particular fruit and vegetables, are often expensive (Drewnowski and Darmon, 2005). Interventions conducted in schools show that it is possible to increase the consumption and/or sale of low-fat products, vegetables and fruits by modulating the cost of competing products (French and Wechsler, 2004). The impact of free food distribution at school is under study as is the impact of the Danish regulation making free access to salad bars in restaurants obligatory. The type of food distributed in food-aid programs to populations with precarious resources should also be reviewed (Gibson, 2003).

Other approaches, such as modifying the offer in fast-food restaurants or the energy density of foods have been identified but have still to be explored. One of the challenges is in having

a maximum number of subjects adopt the 'new' consumption products whose potential interest is great: a simple 20% reduction in the fat content of French fries through new frying techniques could passively induce a reduction in fat consumption of 0.4 kg per person per year (i.e. the mean annual weight gain for the French population) (Swinburn *et al.*, 1999). Reducing the portions served in restaurants or offered for sale is another potential impact point. Ea-in and eat-out portion sizes have markedly increased over the last 20 years, particularly in the United States, and no longer has any relationship with the portion size used for nutritional labeling (Young and Nestle, 2002). The same trend would seem to be at work in France, even though the size of servings in comparable restaurants or described in recipe books remains, overall, markedly lower than that in the United States (Rozin *et al.*, 2003).

Value of a multi-sectorial and concerted plan of action

In line with the ecological model, recent studies have shown that actions combining various strategies (information, awareness promotion and change of attitude, social support and environmental modifications) and several interventional sectors (school but also the family and housing estate) have a greater potential long-term efficacy. Simply encouraging individuals to eat and move differently without modifying their opportunities for food choice and appropriate physical exercise so that they are consistent with the discourse is unlikely to be truly effective.

Community cardiovascular disease prevention programs such as that of North Karelia (Vartiainen *et al.*, 1994; Puska *et al.*, 1998) are, in that respect, exemplary. The programs associated a media campaign targeting the various cardiovascular risk factors (physical exercise, fat intake, smoking, but also hypercholesterolemia and hypertension), educational sessions in the workplace and at school, screening actions for risk factors with individualized counseling, social support and environmental actions (footpath creation, for instance). The programs enabled frequently marked changes in the amount of physical exercise and dietary habits (at least as regard dietary fat intake) and a reduction in cardiovascular morbidity. The effect on weight, which was not included in the objectives, was more inconsistent. It may nonetheless be noted that there was a stabilization in the prevalence of obesity in the North Karelia study compared with an increase in obesity in all neighboring populations. The consistency of such programs was probably an essential prerequisite for their efficacy.

Similarly, an analysis of preventive strategies (IOM, 2002) having shown efficacy for other public health problems such as smoking (CDC, 1999; Yach *et al.*, 2005) or road safety (Gielen and Sleet, 2003) shows the value of the broad interdisciplinary ecological approach taking into account, in a concerted manner, the multifactorial character of behaviors and simultaneously targeting various aspects of the problem, combining information, responsibility promotion and social, environmental and regulatory interventions with a balance between the efforts required of individuals and the structural, environmental and regulatory actions (table 5.IV).

Table 5.IV: 12 lessons to be drawn from the anti-smoking campaign (after Yach *et al.*, 2005)

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1. Individual responsibility promotion and collective and environmental actions must be targeted concomitantly
 2. Evidence of the harmful effects is necessary but not sufficient to compel a change in regulations
 3. Deployment of the operations is not to await evidence of their efficacy but the operations are to be assessed
 4. Interventions already having proved themselves are to be applied broadly and unreservedly
 5. The real or perceived problems and needs of emergent countries have to be tackled even if that means
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moving beyond the targeted risk

6. The more the approach is multifactorial, broad and complete, the greater the impact
 7. Coordinated cooperation of the various sectors and levels involved is essential
 8. The changes necessary to control smoking required decades of joint effort from the media and informed leaders
 9. Modest funds well spent may have a massive impact, but without clear objectives, financing may not be obtained
 10. Believing that past actions will be sufficient for coming years may delay future progress
 11. The modes of operation and partnership with the tobacco (or food) industry must change and be continually reviewed
 12. One public health problem must not be taken into account to the detriment of other risk factors; a joint approach is necessary
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Thus, the results for road safety were obtained because the actions targeted making the infrastructure safe (development of freeways, eradication of black spots, building roundabouts), vehicle safety (active safety: better road holding, regular mechanical control; passive safety: impact absorption and airbags, rigidity of the passenger space), individual responsibility promotion, including through regulations (safety belt wearing mandatory, speed limits, campaign against driving under the influence of alcohol and drugs) and measurements to check that application was effective (monitoring in the field, automatic speed control, for instance).

Nutritional programs and policies proposed and implemented in various countries

It is difficult to summarize the content of all the reports and programs available. It should be stressed that application of the proposed measures appeared from the outset as a long-term task and no concrete result is available for the time being. A few items have nonetheless earned a strong consensus. Among the causes of the obesity epidemic, the generalization of a sedentary lifestyle and the change in eating habits, particularly the adoption of energy-dense foods, strongly promoted by television advertising, have been particularly strongly stressed.

Ultimately, the economic and social cost of obesity is also stressed. Management of obesity and its complications are liable to rapidly exceed the human and financial resources of most healthcare organizations.

The need to act immediately without awaiting definitive scientific proof of the efficacy of the actions that can be implemented is recognized. As a corollary, the need to conduct research and action in parallel and thus to rigorously assess the actions implemented is stressed. The announced or proposed programs are based on the best science available, but nonetheless recognize that it is not always the best science possible. Accordingly, further research on eating behavior and its construction together with the influence of the environment on that behavior appear to be a general need. Furthermore, it is necessary to circulate the results as widely as possible.

The need to act on the environment and not just on the individual is stressed. A failure or weak impact of actions only targeting consumers and consumer education with a view to changing consumer behavior is globally recognized. The concept of an 'obesogenic' environment, to be taken in the broader sense (Chopra *et al.*, 2002), involves dietary choices and physical exercise. The promotion of the least valuable foods in nutritional terms through marketing and advertising, particularly television advertising, has been stressed (EHN,

2005). In support of that finding, the important review conducted by the University of Strathclyde demonstrated the influence of television advertising on children's food choices and eating habits (Hastings *et al.*, 2003).

Turning more specifically to childhood obesity, the school occupies a central position in all the proposed policies. This applies to food and nutrition education and also to the food offer in school and the position of physical exercise and sports. Even though the very modest effects of nutritional education demonstrated by the published studies have led EASO not to make health education a priority for coordinated action at European level (EASO, 2002), training children in healthy nutrition is nonetheless cited as an important condition for success (Stockley, 2001; ADA report, 2003). Nutritional education includes education by example and the quality of the meals served in school canteens is an important component (CNA, 1999). This seems to be more easy to implement in Finland, where the state controls school meals, than in the United States, where, despite political resistance related to lobbying (Stilzel, 2003), the problem of competitive pricing for the most nutritionally valid foods remains an important factor to be taken into account (French and Wechsler, 2004). In France, although the nutritional content of the meals served in school canteens was subject to criticism (Czernichow and Martin, 2000), the INCA survey data (data obtained over the period 1998-1999) show that during the period of imposed menus in the primary school children eating regularly in the canteen had a better dietary profile than those who ate no meals or ate rarely in the canteen (Lafay *et al.*, 2002).

The need to promote the awareness, train and involve numerous players such as politicians, health system professionals and school system professionals (ADA Report, 2003; Martin, 2005), economic players (food industry, canteens, communication and leisure) and civil society and parents is stressed. Consistent and concerted action at the various levels (international, national and local) is also stressed.

The nutritional policies proposed in the various reports available are, overall, very similar. Differences are only detected when precise actions are described. Those differences are related to the cultural, political and social contexts of the countries involved. One of the constant features of the programs may be considered a shortcoming: not taking potential collateral effects into consideration. This does not call into question the need to act, but must focus attention on the manner of acting.

Prospects and orientations

In the light of the data and, particularly, the lessons on preventive strategies for other public health problems, it may be considered that a concerted and consistent action at national level targeting the various levels and involving numerous intervention sectors (figure 5.3 a, b, c) is advisable in order to implement large-scale effective obesity prevention (IOM, 2005; Swinburn *et al.*, 2005). The need to combine reflection and intervention at the international level also appears essential.

National action, as initiated in France with the National Nutrition Health Program ⁴ (PNNS) (HCSP, 2000; table 5.V) must aim for enhanced coordination and consistency of the actions set up by the various partners at local and regional level. The program must promote evaluation of the various actions and their sustainability through support over time. The program must also contribute to setting up regulations and legislative interventions.

⁴ The prevention of obesity, limitation of sedentariness and promotion of fruit and vegetable consumption are included in the 9 major objectives of the National Nutrition Health Program (HCSP, 2000) set up in France by the Ministry of Health in 2001 and enacted by the law relating to public health policy on August 9, 2004.

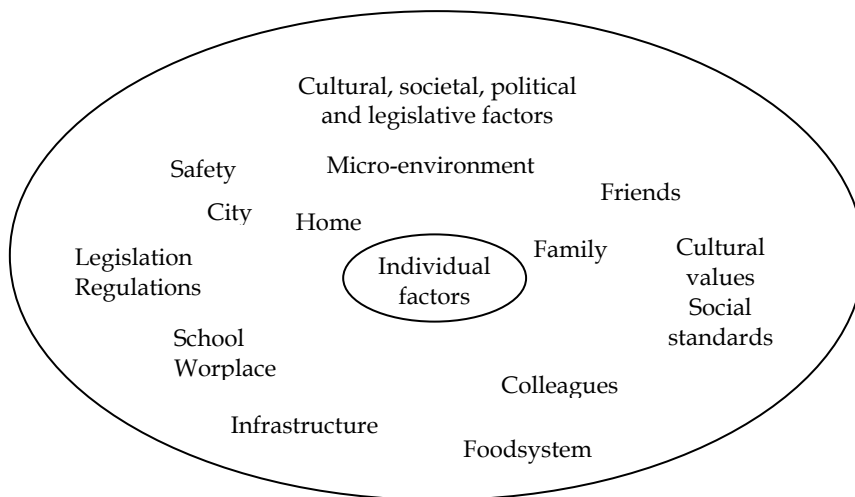


Figure 5.3a: Various parameters of the context

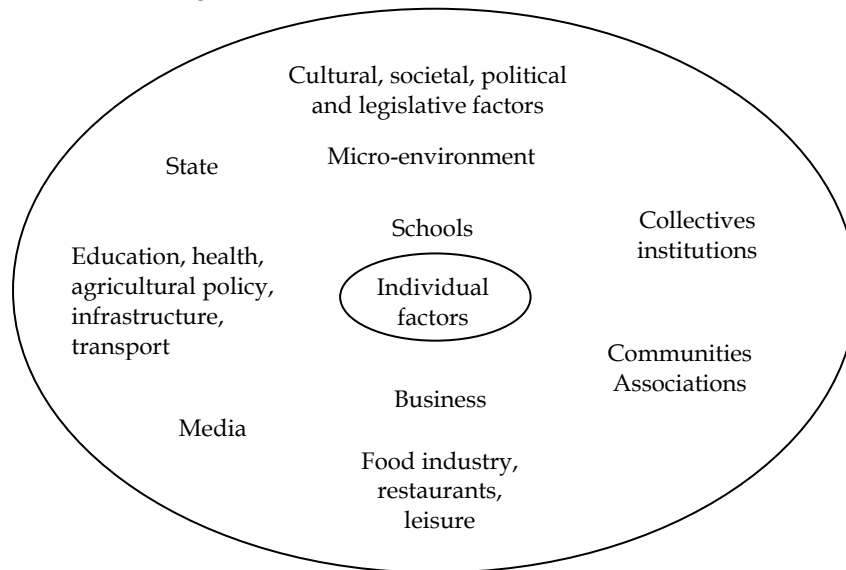


Figure 5.3b: Examples of the players involved

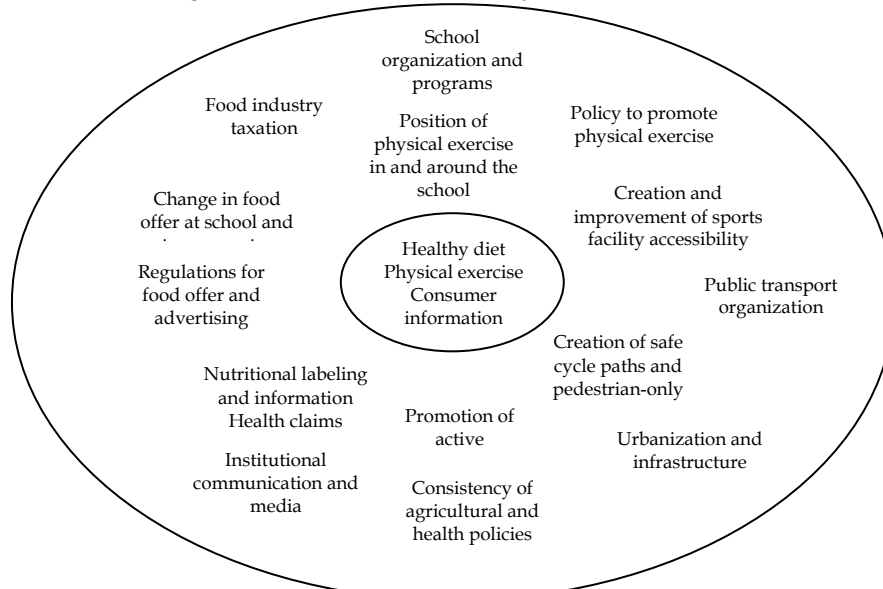


Figure 5.3c: Examples of actions

Figure 5.3: Strategy of actions based on the ecological model (after Booth *et al.*, 2001; Davidson and Birch, 2001; IOM, 2005)

Table 5.V: Preventing obesity, limiting the sedentary lifestyle and promoting fruit and vegetable eating are among the objectives of the French National Nutrition Health Program (PNNS)

Specific quantitative objectives

Halting the increase in the prevalence of overweight and obesity in children and reduce the prevalence of overweight and obesity (BMI > 25 kg/m²) in adults by 20%

Increasing, by 25%, the proportion of people of all ages taking the equivalent of 30 minutes of moderate physical exercise each day at least 5 times per week. The sedentary lifestyle is to be combated in children

Decreasing, by at least 25%, the prevalence of low fruit and vegetable intake people

Proposed strategic approaches

Informing and orienting consumers toward the choice of foods and a satisfactory nutritional status

Educating the young and creating an environment conducive to food consumption and a satisfactory nutritional status

Preventing, screening for and managing nutritional disorders in the healthcare system

Involving the food industry, canteens and consumers through associations and their technical structures

Setting up a population dietary and nutritional monitoring system

Developing research on human nutrition (epidemiological, behavioral and clinical)

Launching complementary public health measures and actions targeting specific groups of the population

The politicians and public authorities are strongly involved insofar as implementation of actions requires political commitment that is sustained in duration.

Communities, associations, collective institutions (national, but not only national), schools, local and regional businesses and health agencies are important links in a large-scale prevention policy. In addition to acting as information relays, the foregoing can act directly on the environment to promote opportunities for healthy food choices and an active lifestyle. Numerous potential actions are available, ranging from modification of food offer in schools and the workplace to urbanization and public transport policies.

The food industry, distribution professionals and catering companies are obvious partners for actions addressing food offer. In that field, the efforts of the professionals and public authorities must address the means of rendering the changes legible and acceptable. The changes need to be adopted by the majority of consumers through, among other methods, reflection on nutritional information, advertising and marketing, competitive pricing of the proposed products and regulations.

Similarly, the leisure industry has the opportunity of innovating to promote physical exercise and an active lifestyle as a desirable social standard.

The media and various sources of public information can support the preventive efforts and the regulatory changes or, on the contrary, hamper them.

The familial environment constitutes another sector for decisive intervention. It is frequently more difficult to access. The parents act as a societal model but also intervene through their ability to modulate or control the behavior of their children (encouragement to be active, enrolment in sports, accompaniment if necessary or, conversely, restricting the time the child spends in front of a screen). The consistency of the various sources of information and the setup of environments conducive to health are certainly important stages in promoting evolution of behavior.

The physicians and healthcare professionals are well situated to relay and reinforce the information on food and physical exercise, support the setup of long-term behavioral modifications taking into account the patient's immediate environment, detect changes in

body weight early and promote the patient's awareness of those changes. Healthcare professionals also play an awareness promotion role with respect to economic and political decision-makers and the environmental and political changes necessary for an effective preventive strategy. In the face of the challenge constituted by the progression of obesity in our society, which healthcare professionals could not combat alone, innovative modes of operation will probably have to be conceived.

Action at international level appears particularly pertinent for Europe where most of the food legislation and many other legislations relating to the overall environment have already been harmonized. It should be noted, in this context, that the European Union health ministers have proclaimed the ambitious objective of incorporating the nutritional dimension into all national and European public policies (European Union, 2000). In point 12 of the declaration dated December 14, 2000, The Council of the European Union 'stressed that numerous community policies, particularly in the fields of public health, agriculture, fisheries, research, transport, consumer protection and the internal market, have such an impact that national nutritional policies can only be fully effective if the aspects relating to nutritional health are taken into account in the definition and implementation of the community policies concerned.'

In conclusion, the obesity epidemic necessitates rapid actions which are to be based on the best available evidence (often a strong presumption of efficacy rather than empirical proof) rather than on the best evidence possible. In the light of the ecological model whose fit has been demonstrated for various public health problems, it would appear essential to develop new approaches that are not only centered on individual information and skills (active changes) but also associated with changes in the social, cultural, political, physical and structural environment which promote physical exercise and the choice of appropriate foods (passive changes). Those approaches cannot be considered the sole responsibility of a given sector but rather call for the active contribution of the public authorities, industrial and business sectors, media, national collective and community collective institutions, school system, consumers, etc. and address numerous action sites (schools, workplaces, housing estates, regions). A critical and rigorous assessment of the actions implemented, taking into account their feasibility, sustainability and the motivation of the players together with their cost-effectiveness and the potential adverse collateral effects is also indispensable.

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6

Preventive programs and operations in France

The question of reviewing and assessing obesity prevention strategies, programs and actions mainly concerns the assessment of the French National Nutrition Health Program (PNNS), whose scope is broader. Certain limitations need to be stated: PNNS evaluation is scheduled for 2006, a timeframe more compatible with that required for the collection of the INCA2-ENNS survey data. The survey is conducted by the Nutritional monitoring and epidemiological unit (Usen⁵) of the French Agency for the Safety of Foods (Afssa). The synthesis by the Directorate General of Health (DGS) is scheduled for 2005. The evaluation of the 2004 Public Health Act is scheduled for 2008. A more global putting into perspective and more pertinent approach given the importance of the time factor with respect to the issues of nutrition and obesity will then be implemented. Nonetheless, certain lessons can already be drawn from PNNS implementation. The presentation below is thus an assessment of the first stage rather than an overall assessment.

Nutrition and obesity prevention: public health priority since 2001

Prevention through nutrition is the subject of a committed public health policy and has been since the launch of the PNNS by the Ministry of Health in January 2001. The program consists of preventive actions and management with objectives to be achieved and a precise schedule. The general objective of the program is to improve the state of health of the French population by acting on one of the major determinants: nutrition. The priority objectives of the PNNS contribute to the combat against obesity (increase in fruit and vegetable consumption, increase in physical exercise, etc.).

Objective No. 8 directly targets reducing the prevalence of overweight and obesity in adults by 20% and halting the increase, particularly large in recent years, in the prevalence of obesity in children.

The French decision may be considered rather late compared to the alarm call issued by WHO during the international conference on nutrition in December 1992 in Rome. Several reasons explain the time lapse.

In a context characterized by the commitment to eradicating 'nutritional deficiencies', the weakness of the national alert and health monitoring system, the incomplete nature of the knowledge and the feeling of protection afforded by French cuisine and the 'French paradox' contributed to masking the epidemic of obesity. Moreover, nutrition, a poorly implanted and little recognized discipline in the healthcare system, largely exceeds, by the stakes involved, the remit of the Ministry of Health alone. Given that the theme does not elicit an immediate reaction from the French population, the implementation of a preventive policy could raise numerous questions, particularly at ethical and methodological level.

⁵ InVS / Cnam / Paris 13

Significant advances

Four years after the launch of the PNNS, the obesity issue, which, outside of the expert circles, attracted little interest in 2001, has become a major preoccupation for society and debates. The legitimacy of a public policy relating to nutrition and obesity is no longer controversial. The PNNS has undoubtedly greatly contributed to that change although the contribution cannot be accurately measured. Since the program's launch, substantial advances have been observed in the deployment of the strategies, programs and actions at both national and local level.

National framework

The national framework took the form of a set of laws, regulations and guidelines together with financing and mobilization operations.

Law, regulations and guidelines

The inter-ministerial permanent steering committee of the PNNS constitutes an essential organization ensuring the launch of actions, management, follow-up and, if necessary, alerting the public authorities. Act No. 2004-806 dated August 9, 2004, relating to public health confirmed the pertinence of the PNNS at legislative level. The objectives of the PNNS were broadly covered by the report appended to the act and defining 100 public health objectives for the period 2004-2008. Objective No. 5 relates to the reduction of the prevalence of adult obesity and includes quantitative measurement of the results (the adult overweight or obese population was to decrease from 42% in 2003 to 33% in 2008). Objective No. 12 maintained the ambition of halting the spread of childhood overweight and obesity.

The consistency of the public policy has been ensured. PNNS 2001-2005 is, *de facto*, legitimate and has been extended to 2008. The essential imperatives of continuity in the action and duration have been taken into account.

In addition, the public health act is innovative in that it states, for the first time, a limiting framework for certain aspects of food offer: obligation to include health information in the advertising and promotion of soft drinks and manufactured foods (article 29); prohibition of beverage and food product-vending machines accessible to school children from September 1, 2005 (article 30). The foregoing constitutes a considerable advance in the strategy of combating obesity: the plurality of the factors contributing to the epidemic necessitates responses at all levels, including those whose stakes exceed the health field. In April 2005, the submission of bill No. 2191 'Acting against obesity', to Parliament confirmed the awareness of the public health stakes at the highest level.

The period 2001-2004 was characterized by intense regulatory activity with several circulars from the Ministry of Health, for example on food and nutrition in healthcare establishments, the incorporation of the nutrition issue in priority action programs for sensitive populations, the decree dated April 27, 2004, on the conditions for experimental use of the 'PNNS' brand or logo. At the Ministry of National Education, several circulars on the issue, which had hitherto been little explored (except the health safety aspects) were circulated during the period. For example, a circular on the composition of meals served in school canteens (2001), and a circular on the morning snack served in schools (2004) were issued. The regulatory activity was based on the work of recognized organizations: recommendations of the French pediatric society (2003), opinion of Afssa (2004), opinion of Anaes (2002), opinion of the CNA (2004), Inserm expert review (2000), resolutions and proposals from the European regulatory authorities, etc.

Budgetary aspects

The PNNS was financed by the National Fund for Health Prevention, Education and Information (FNPEIS, Cnamts) from 2001 through the National Institute for Health Prevention and Education (Inpes) and, from 2002, from provisions of the state budget part of which were delegated to the Regional Health and Social Affairs Organization (Drass). Table 6.I shows an evaluation of the expenditures from 2001 through 2004 by the three institutions for the budget lines 'Prevention through nutrition'.

Table 6.I: Expenditures (€ million) on nutritional prevention

	2001	2002	2003	2004
Ministry of Health		2.6	2.7	3.3
FNPEIS	5.0	4.0	6.0	4.6
CFES-INPES	4.5	3.7	4.3	8.2
Total	9.5	10.3	13.0	16.1

The question of expenditures calls for several remarks: the initial financial commitment by the Ministry of Health was marked compared to other public health programs (except the cancer plan). For the three budgets taken together over the period 2001-2004, the continuous growth in expenditure is clear, particularly in 2004.

The expenditures throughout the country for prevention through nutrition were much greater than those recorded by the budgets of the above three institutions. The financial commitments of other sectors are noteworthy:

- financing actions and personnel expenditures for other ministries and organizations (research, National Education, Inserm, Afssa, Inra, etc.);
- financing by regional collective institutions, which was substantial in some cases. Thus, in 2002, the Drass of the Nord-Pas-de-Calais, region which is highly committed to the issue, estimated that for every Euro spent by the State, the total spending was 4 Euros thanks to the commitment of other local partners;
- several structures set up by the State devote an unidentified share of their credits to prevention through nutrition actions: for example, the cancer plan, the regional health programs, the regional programs for access to prevention and care (Praps), etc.;
- the hospital sector, the liberal professions and the healthcare networks.

Among the various forms of financing for prevention through nutrition, the expenditures specifically targeted on preventing obesity have not been separately identified, if indeed it is possible to do so.

Overall, two findings may nonetheless be formulated:

- despite the State's commitment, which remained constant over the period 2001-2004, there has been an overall increase in expenditures to promote prevention through nutrition;
- public spending has leveraged the financial mobilization of other partners.

Communication, education and information of the general public and healthcare professionals

The national budget credits have, in particular, enabled two types of complementary action to be implemented, one type addressing the population and the other healthcare professionals. All the partners committed to the PNNS have contributed, each in their field

of skills.

In addition to the national information campaigns (consumption of fruit and vegetables), several nutrition guides, some general ('Good health through eating: the food guide for all'), others more targeted (parents of children and adolescents, adolescents, physical exercise, etc.), have been drawn up and widely circulated. Each guide is accompanied by a version specifically intended for healthcare professionals. The healthcare professionals and social services sector have also been targeted by instruments adapted to their practices (e.g. a disk enabling calculation of the body mass index, training modules, and a collection of fascicules: 'The PNNS reviews'). All the tools developed and circulated were compiled using rigorous methodologies by recognized institutions and scientific experts. This constitutes one of the strengths of the PNNS.

The PNNS website was set up by the Ministry of Health and constitutes a forum for the review of ongoing actions and potential sharing of the experience generated. The Inpes site offers those involved references and practical tools. The National Education site, Eduscol, particularly addresses school canteen professionals.

The increasing demand from elected representatives led to the compilation of tools suitable for municipal players (guide for the use of elected representatives and municipal technicians), specific undertakings (charter: 'towns active in the PNNS', in liaison with the association of French mayors), support for inter-communal exchanges, particularly through the French network of health towns (WHO), subsidies for various nutritional projects implemented under the auspices of the municipalities and specific projects deployed by private players in some towns (program: 'Together we can prevent childhood obesity', Epode).

In-depth

At national level, numerous think-tanks involving numerous players (economic players, consumers, regional collective institutions, associations, other ministries) have been set up prior to actions that attract little media attention but are as varied as the revision of the nutritional aspects of school books, the setup of the logo, and the mobilization of learned societies, etc. In parallel, Usen has pursued setup of a national epidemiological monitoring system. In addition, the main studies and surveys conducted in France over the last 5 years and collecting data pertinent to nutrition have been inventoried (Usen, InVS, Cnamts, etc.).

Mobilization of local players

The mobilization of local players was achieved through the regional PNNS structures, the definition of priorities, the compilation of tools and the sharing of experience.

Regional PNNS structures

The DGS circular relating to implementation of the PNNS was dated January 9, 2002. In the future, the public health act is to lead to nutrition being taken into account in the regional public health programs.

From January 2002, the Drass have invested by appointing regional coordinators (hospital physician, Director of the Departmental Committee for Health Education (Codes), physician public health inspector (Misp), etc.) and by setting up regional nutrition-health technical committees. Most frequently, in the four regions under review (Franche-Comté, Haute-Normandie, Lorraine, Poitou-Charentes), the committees have frequently set up subject working groups (e.g. universal prevention, information-communication for the general public, screening for and managing childhood overweight and obesity, canteens, healthcare

establishment food-nutrition liaison committees (Clan), etc.).

Progress report and priorities

The first task for the regional nutrition-health technical committee was to conduct a review in accordance with the recommendations of the DGS circular. The review took various forms depending on the resources available locally (teams and work of the Regional Health Monitoring Structures, teaching hospitals, etc.) and the committee members' centers of interest: synthesis of the regional references relating to measurement of the prevalence of overweight and obesity, inventory of the actions financed, players involved and publics targeted, inventory of the nutritional care offer and training offer, compilation of a directory of players and resources, etc. With the objective of enhanced understanding of the existing situation, some committees implemented surveys, sometimes calling for a considerable commitment, such as further elucidating the situation in all the teaching establishments of the region, the eating behavior of junior and high school students, under-nutrition in hospitals or setup of Food-Nutrition Liaison Committees (Clan) in hospitals.

The inventories of the actions financed and implemented in certain regions shows, over a short period (2001 to 2003), the emergence of a regional dynamic with the involvement of multiple players (National Education, towns, associations, health insurance organizations, etc.), the multiplication of the number of actions, generally targeting the immediate proximity, and the priority accorded to certain types of public, schools (pupils) and PNNS-target populations (people of precarious means, pregnant women, etc.). The inventories constitute an important indicator of the impetus of the PNNS. The latter role is particularly clearly illustrated by the calls for projects, at national level first, then at local level, from 2002.

The preliminary work of the committees required time but has proved indispensable in enabling those committees to define and justify their priorities, which are necessarily selective given the size of the field. The regional actions were thus ready at the end of 2003 or the start of 2004.

Given the varied contents of the progress reports, the priorities of the four regions varied. Nonetheless, certain constant features may be identified: PNNS approach No. 1 (informing, educating, orienting), No. 2 (preventing, screening and managing nutritional disorders in the healthcare system) and No. 6 (deploying public health measures and actions targeting specific groups) are included in all the regional priorities. Approach No. 3 (promoting consumer and food industry professional involvement) has only been weakly implemented. Mobilizing the industry professionals has not always been easy. Approach No. 4 (setting up a food consumption and population nutritional status monitoring system) is complex and seems to be mainly considered a national issue. Approach No. 5 (developing human nutrition research) is almost exclusively national except when competent and motivated local resources exist (research organizations, teaching hospitals).

Method and tools

With regard to methodology, certain committees were very rigorous in their definition of actions addressing the following points: objective, status report, description of the action, target, schedule and milestones, implementation and follow-up, assessment indicators, budget, profitable exploitation and communication, prospects.

The work implemented by the regional committees, initially to take the inventories, then to determine the priorities at operational level, led the committees to construct tools. For instance, following the school food survey, a committee circulated to all the schools having contributed and to the elected representatives, not only the survey results but also a fact sheet on food distribution (organization of canteens, meal environment, choice of beverages,

distribution of foods outside of meals) in the school environment. Another region, after having surveyed institutional under-nutrition, compiled a guide for screening for and preventing under-nutrition in healthcare establishments and establishments for the dependent elderly. Other regions developed a protocol for the follow-up of positively screened children, a guide for retirement establishments and a teaching aid.

A further positive aspect in the setup of regional structures consists in the approach adopted by the Drass and coordinators. The approach was characterized by a participatory method ensuring mobilization of regional players around the PNNS, transparency, and time to build. The approach enabled appropriation, commitment to realism in the choices and continuity over time.

Sharing experience

At national level, several initiatives enabled promoting the awareness of or co-opting local players such as the awareness promotion days targeting local decision-makers organized from May 2002 and the PNNS colloquium in November 2004. The latter was particularly rich and provided the opportunity for presenting exemplary actions.

Innovative actions

In 2002, the DGS set up a national procedure to call for projects. In 2003, regional relinquishment of 70% of the credits afforded the possibility for local actions. The Drass was to filter the candidate projects at national level. From 2005, all the funds (State, National Health Insurance Organization, Cnamts/FNPEIS) were regionalized. The nutritional projects were selected by a mixed State-Health Insurance Organization Regional Committee which foreshadowed the future Regional Public Health Group (GRSP). The numbers of projects financed nationally were 41, 45 and 65 for years 2002, 2003 and 2004, respectively. The number of candidate projects doubled or tripled.

Fleurbaix Laventie Healthy Town

Certain innovative and older projects have a strong reputation. This was the case in particular for the first program launched in France in 1992, 'Fleurbaix Laventie Healthy Town' (2 neighboring *communes* with a population of 6,000 in the Pas-de-Calais region). The program is noteworthy for its duration, commitment to proximity, scientific and methodological management, overall approach and amplitude, mobilizing both the population (parents and children) and all the proximity players able to play a role (teachers, local physicians, elected representatives, etc.). The results of the program covered numerous fields that have been the subject of research. One remarkable result is that, in 10 years, the increase in the prevalence of childhood obesity in the two communes was halted although that prevalence increased almost 2- and 3-fold, respectively, for boys and girls in the Nord-Pas-de-Calais region.

Other projects have received less publicity. Their innovative character and the existence of veritable assessment and results provide the grounds for citing some of those projects in order to illustrate the local dynamics.

Santal project: health, food and physical exercise in the workplace

The Santal program developed by the Rennes PSA Peugeot Citroën site is the only action implemented by a private company to have received a State subsidy under the PNNS. The project is managed by the company's medical department and both the site catering company and the main personnel mutual insurance organization are contributing.

The program has several characteristics:

- it is in line with an older overall approach on site with regard to health prevention and education (alcohol, psychotropic agents, influenza, migraine, etc.);
- an in-house medical study showed that the personnel had not been spared by the phenomena of overweight and obesity and provided the rationale for tackling the issue;
- the program is unique in terms of its scale in France since it targets the 10,000 personnel on site and has benefited from sustained commitment (startup in 2002);
- several types of complementary actions have been deployed and the results are encouraging.

Santal first aimed to offer the personnel nutritional assessments in order to enable personalized counseling: medical checkup by the occupational physician, then orientation toward a dietitian and, if necessary, coaching and follow-up appropriate to the risk assessment and the urgency of management.

In parallel with the personalized counseling, the attention of all the personnel and their families was drawn to the importance of a balanced diet (circulation of brochures, campaigns oriented toward certain classes of food whose consumption in France is inadequate according to the PNNS, fit between the information campaigns, displays and food offer onsite, increase in the offer of water instead of carbonated beverages, etc.). The site catering personnel (87 people) were trained in order to enhance their ability to advise the personnel on a balanced diet. In addition, actions to promote the awareness of the importance of sports and to promote them were conducted.

With regard to the results, 88 members of personnel regularly followed up by the dietitian in 2004 have, in the majority (84%), lost weight. The impact of general information and education actions requires further follow-up before it can be evaluated. Already, the satisfaction surveys and measurement of the consumption rate for the products offered by the caterer show the personnel's commitment and increased consumption of certain products (vegetables, fish).

Moving beyond the results, one of the major interest of the Santal project is to show that business, an area little committed to the nutrition issue, may constitute a special site for personnel awareness promotion and sustained action if certain conditions are fulfilled (commitment of management, the medical department and partners, rigorous management, complementarity of the actions, scheduled evaluation, etc.).

Val-de-Marne project

The Val-de-Marne project, launched prior to the advent of the PNNS, originated in a study on the potential association between school canteen frequentation and low-income families. The unexpected finding was a high level of obesity in children aged 10 to 18 years and the already observed association between overweight status and low income. The General Council initiated and managed the project. With healthcare, education and sport professionals and their institutions, the General Council initiated two primary prevention programs. The first aimed to 'create informed adolescent consumers', the other, concomitant and consistent, aimed at improving the nutritional policy in junior schools. The program was completed by obese child screening and management program which is briefly described below.

'Val-de-Marne Obesity Prevention' is a program that addresses overweight young people detected in all of the department's junior schools (class: 5, 12-13 years) since 2002 (2,261 pupils). After screening that class, the baseline data showed that 22% of the children were overweight (17% overweight and 7% obese). The frequency of overweight and obesity was higher for the children in priority education zones.

In 2003, the program took on board collective management, outside of the school, in the form of practical workshops on therapeutic education accessible to the positively screened pupils and young patients of the attending physicians.

The objectives of management were based on two central concepts:

- enabling an overweight child to find nutritional guidelines and physical activities, calling for an educational approach and the child's compliance;
- identifying and treating the concomitant diseases, which presupposes a request for care from the child and an appropriate medical response.

The effects of the practical workshops outside the school and therapeutic and educational management of overweight children are under assessment. The workshops already seem a pertinent response to the problem of obesity in families whose living conditions are difficult and to the psychological distress of overweight children.

The main results obtained in the schools involved may be summarized as follows:

- few children refuse the offer of help (8%); most of the children having accepted management (78%) built a change program;
- after 6 months of follow-up in school, it was observed that changing diet was easier than changing sedentary lifestyle;
- attending physician consultation was low (35%) but related to proven distress;
- 8 children out of 10 felt motivated and/or helped by the program. At the end of the year, while 5% of the initially overweight children had become obese, 19% were no longer overweight and 30% of the initially obese children had become simply overweight.

In addition to its departmental scale, the general approach of the Val-de-Marne was characterized by management that was at first educational and then, when necessary, medical. The approach is also characterized by the mobilization of the paramedical and educational networks and the taking into account of both the individual (the adolescent, his/her parents) and the collective (peers) aspects.

Icaps

Icaps (Intervention targeting junior school pupils with regard to physical exercise and sedentary lifestyle) was a study of primary prevention initiated in the Bas-Rhin department (Université Louis Pasteur, Strasbourg) in 2002. Icaps has several specificities due to the strong interaction between the research aspects, public health and educational action:

- Icaps' point of departure was the finding that diet, which plays an incontestable role, is not the only determinant of state of health or body weight. Physical exercise also plays a role that is nonetheless poorly evaluated. Icaps' objective was thus to establish the most simple causal relationship possible by concentrating on that single determinant;
- Icaps selected a control group: 1000 junior school pupils (class: 6, 11-12 years) were divided into 2 groups. The control group, half of the pupils, maintained their usual physical exercise frequency. For the action group, a strategy targeting various levels of intervention was developed with a view to modifying knowledge, representation and behavior by providing the conditions for physical exercise through a broad partnership with collective institutions and the educational environment.

The initial results at time point 2 years showed that the pupils had increased their leisure physical activity (87% vs. 62% for the control group) and daily physical activity (41% vs. 34%), and reduced their sedentary behavior (vs. an increase in sedentariness for the control group). Lastly, the proportion of junior school pupils with excess weight was reduced by

21% while it continued to increase, from 24 to 28%, in the control group. The positive effect of Icaps on body weight was accompanied by an improvement with respect to cardiovascular risk factors.

Breast feeding

Another noteworthy action, since the issue of breast-feeding has as yet been little explored, was the promotion of breast-feeding launched by the Rhône department in 1996 mainly through the centers for Maternal and Infantile Protection (PMI) and the open-care-hospital network. The initial results showed an increase in the initiation of women to breast-feeding (from 52.7% in 1995 to 70% in 2002).

Synthesis and prospects

The emblematic and exemplary actions cited do not reflect the reality or the scope of the strategies, programs and actions. PNNS - and its extensions - have played an indubitable important role in providing the impetus. The PNNS has contributed to society's awareness of the public health problem that obesity constitutes. The PNNS has enabled us to move on from the question 'Why act?'. In contrast, analysis of its weaknesses show that the responses must now be adapted and made to progress. It is time to attack the complex question of 'What shall we do?'

Worrying subjects

Despite the methodological reservations reported above, a partial review and assessment of the strategies, programs and actions implemented in France at various levels may now be conducted.

ObEpi: alarming findings

The 2003 ObEpi epidemiological survey cannot constitute a reference for the assessment of obesity-related objectives in the context of the nutrition-health policy since that policy was only just starting. However, the alarming results reported by ObEpi will be summarized in order to demonstrate that the issue was urgent.

ObEpi 2003 reported pursuit of the increase in overweight and obesity prevalence in adults: in 2003, 11.3% of French adults were obese (vs. 8.2% in 1997 and 9.6% in 2000) and 30.3% were overweight. The number of massively or morbidly obese people doubled (from 0.3% in 1997 to 0.6%). The progression of overweight and obesity did not spare any age group, socioeconomic category, region or zone.

The projections show that if the same trend persists, the prevalence of obesity will reach 15% in 2010 and 20% in 2020. France will then have the same prevalence as that reported for the United States in 1990.

Outside of the ObEpi survey, all the local studies on children also show an increase in prevalence. Given the relative situation of adults, a snowball effect is to be feared, since parental obesity constitutes a supplementary risk factor for childhood obesity.

Low overall legibility of local actions

While exemplary actions can be stressed, they are little representative of all the actions deployed in the field. The PNNS review of regional programs for 4 regions and the local

action projects financed in the context of the national call for projects shows certain recurrent weaknesses. For the above reasons, regional actions cannot be evaluated on the basis of the results (fit with and/or deviations from the prevalence decrease objectives). The assessment therefore addresses the regional policies and their translation into actions.

Insufficiency of methodological framing and sharing

The insufficiency of methodological framing and sharing is patent at several levels. It was first revealed by the review conducted by each region, prior to selecting priorities. The content of the review was very much left to local assessment in the PNNS implementation circular. The variety of methodologies and findings is the logical result. The variety is also observed at priority selection level.

When the regions chose to invest in research on references based on local resources (regional health monitoring stations, teaching hospitals, etc.) in order to obtain information for the future assessment of their actions, the references were not always suitable for comparisons with France as a whole or other regions, or compliant with the 'standards'. While the regions' commitment to obtaining references is legitimate and motivational, the question of their investment in that area needs to be raised given that national surveys are available. The latter contain homogeneous regional data (e.g. ObEpi) and enable more effective use of limited resources (human resources, statistics, etc.).

The same remark may be applied to the development of local tools. Since the problems associated with actions are usually shared (how to develop such and such a type of action, for such and such a public, in such and such a context, etc.), a balance needs to be found between the current multiplication of adaptations to local 'specificities', the necessary appropriation of the instruments by the players and a commitment to a degree of efficacy and less loss of energy.

Fragility of local little institutionalized structures

The impetus and implementation at local level were frequently based on voluntary commitment and the involvement of a few motivated people. The structures are thus fragile and at the mercy of job changes and other events. The fragility was increased by the very unequal commitment of the institutions as such (local collective institution, National Education, etc.). Once again, a few people carry the institution (a mayor, vice-chancellor, school inspector, school director, etc.). The maps compiled by certain Drass clearly show the very unequal commitment and actions of the various zones.

Crumbling actions: a public health policy?

The heterogeneity of the national coverage evidenced by mapping raises the question of the meaning of a health policy that only covers a small part of the population. Outside of the national communication actions implemented by the Ministry of Health and Inpes and targeting the whole population of France, the sum of the publics addressed by proximity prevention actions would probably have a weak or even derisory impact with no real relationship with the degree of overweight and obesity prevalence.

With regard to screening for obesity and educational and medical management, the number of care networks remains very small (4 operating and 3 projects ongoing) and has no common measure with the management needs. The networks frequently experience marked setup difficulties: financing, uncertain mobilization of open-care physicians, etc.

These findings raise questions with respect to overall strategy, generalization of more effective actions and the participation of institutional vectors.

Assessment weakness

The weakness of assessment is to be observed at several levels. The absence of centralization of local actions at the regional, then national, level prevents an exhaustive view of the public resources devoted to prevention by nutrition. This constitutes a handicap in an overall assessment of the policy. There is no visibility with respect to the credits devoted to nutrition actions or obesity prevention actions. The financial data are not reported to a single site and reviewed. The DGS department, objectively, does not have the resources needed.

The absence of rigorous assessment of most of the actions constitutes a handicap when we wish to make progress on the question of 'doing things well'. The action projects financed have not always submitted the form used to develop the assessment methods. When the form has been completed, it mainly provides information on the activities implemented from a quantitative point of view (number of people affected, having attended training, number of hours, number of meals, etc.). The form is thus more of an activity report. While those indicators provide information, they do not give any indication on the fit between the actions implemented and the problems encountered. Some assessments mainly describe the process: how the devices and actions were set up; the obstacles encountered and overcome. The information was generally collected from players/professionals. This type of assessment is useful since it enables improvement and progress with regard to practices. But it is also necessary to evaluate whether the objectives have been achieved in order to give meaning to the processes. Another type of assessment sometimes proposed addresses the change in the knowledge of the targets and public satisfaction. While satisfaction and knowledge are certainly necessary, they are not predictive of change in behavior. Too few actions include assessment of the behavioral changes and medical indicators (e.g. BMI time course) when the real objective is a reduction in overweight and obesity.

The heterogeneity of the assessment approaches, the absence of reference systems and the reinvention of methods by each team constitute the marked weaknesses of the local actions and are in part related to inadequate definition of the objectives. In the context of limited resources allocated to research on nutrition issues, assessment of local actions with strengthened frameworks and 'action-research' projects could constitute, if not a substitute, at least a useful complement. Lastly, the availability of firm assessments would be a major asset for the financing bodies with a view to orienting resource allocation.

Unmet strong commitments

Despite the significant advances noted, implementation of the PNNS was sometimes associated with substantial delays (with regard to communication campaigns, brochure circulation, logo setup, etc.) relative to the ambitious schedule. The administrative aspects (inter-ministry administration, etc.) and budgetary aspects (frozen credits, complexity of co-financing, etc.) were not devoid of effect. The assessment of the PNNS at national level, like that at regional level, cannot address the achievement of objectives. The assessment focuses on the implementation of certain strategic approaches (approach 4 relating to the development of epidemiological monitoring and approach 5 relating to development of research, are considered elsewhere).

Approach 1, 'Informing, educating, orienting', was that which received the greatest investment at national level (communication actions) and at local level (actions). The priority was justified by the 'founding' nature of the approach relative to the actions to be implemented downstream. Discounting the gaps and weaknesses indicated above, which strongly apply to approach 1, the core of the local programs, the deviation from the initial theoretical approach is likely to be smaller.

The same applies to approach 6, 'Initiating measures and actions targeting specific groups'. The regional programs and local actions financed at local level, generally focused on that approach. The approach was also developed in the regional programs for access to prevention and care and targeting young people (sometimes with their families) and certain fragile populations (various precarious situations). The heterogeneity of target publics is however the rule and the fragmentary nature of the actions prevents a homogeneous and complete strategy being implemented over the whole country.

The assessment of approach 2, 'Preventing, screening and managing nutritional disorders in the healthcare system', has made some advances. The advances mainly concern the tools and recommendations to help healthcare professionals in their clinical practice. But essential programmed commitments were not implemented: the Kempf report on nutritional functions and professions in order to adapt training and management to the current issues has not been acted on. The PNNS has thus had little incidence on physician, paramedical personnel and social worker training. The facilitation of access to nutritional consultation and dietetic consultation in hospitals and the care networks has been very little implemented. The number of job creations announced for 2001-2005 was derisory (50/800 for dietitians and 3/50 for hospital professors, those 3 positions being in the care network whose very weak development has been reported). One of the findings, additional to the impossibility of managing patients, was the demobilization of the CLAN and hospital environment. Thus, the good will system continues to prevail in an environment that has the strength of being highly structured and able to elicit synergy.

Approach 3, 'Promoting consumer and food industry professional involvement', was subject, at local level, to scarce and one-off initiatives, and, at national level, by a few actions targeting professionals (e.g. the action relating to salt and addressing bakers). But the question of food offer and communication on that offer remains the major unresolved question which the PNNS logo, based on the voluntary commitment of the food industry, cannot resolve alone.

In conclusion, the stakes of the combat against obesity suggest two lines of action. The first addresses effective implementation of the scheduled devices and correction of the weaknesses reported while stressing continuity in the objectives of the PNNS. The objects remain pertinent and are strengthened by the public health act: resumption of the commitments not made good, particularly with regard to job creation, recognition of the professionals committed to nutrition, methodological refocusing, which is all the more necessary because of regionalization, and sharing and profitable exploitation of the effective and evaluated actions. With regard to the advisable systematic application of a policy of prevention by nutrition and combat against obesity, systematic application requires strategic management based on lasting political commitment. This is all the more necessary in that the second line of action relates to food offer and communication on that offer. While the public health act has in part refocused that aspect, the letter and spirit of the law have yet to be applied. Moreover, the approach has to be markedly intensified. Given the multiplication of messages and the importance of the resources committed by the food industry, the setup of devices ensuring the quality and truthfulness of nutritional information for consumers, by appropriate means (legal, control, etc.), is a major task whose importance is that of the stakes involved. This is shown, *a contrario*, by the American 'example'. Despite numerous preventive programs, the complementary instrument for citizen education is still not available in the United States.

Nonetheless, obesity must not become an exclusively public health problem because of two risks. The first risk is that of overlooking the majority of the population which is not

overweight or obese but which is still exposed to nutritional risks (cancer, cardiovascular diseases, osteoporosis, etc.). That part of the population may feel unconcerned if the relationship between food and health is reduced to its visible aspects. The other risk is exacerbating the stigmatization of the obese. This would be ethically debatable and counterproductive.

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International recommendations and guides

After a vast expert consultation, the International Obesity Task Force (IOTF) defined the bases of the recommendations for the diagnosis, management and prevention of obesity. The IOTF's conclusions were adopted by the World Health Organization (WHO) in its 1997 report entitled 'World Health Organization. Obesity: preventing and managing the global epidemic' (WHO). The report, one of whose recommendations was to adapt the generic proposals to the specificity of each country, underlay a series of initiatives worldwide, in Europe and in France.

Subsequent to that publication, the Association française de recherche et d'étude sur l'obésité (Afero) in cooperation with the Société Française de Nutrition (SFN) and the Association Française pour l'Etude du Diabète et des Maladies Métaboliques (Alfediam) defined the 'French recommendations for the diagnosis, prevention and treatment of obesity'. The recommendations received the Anaes label for their methodology (Afero *et al.*, 1998).

At international level, the principal initiatives have been implemented in English-speaking countries, Europe and, more recently, Asia.

The United States' recommendations

In the United States, a remarkable document was published by the North American Association for the Study of Obesity (NAASO) in 1998. The document derived from cooperative work between National Institute of Diabetes and Digestive and Kidney diseases (NIDDK) and the National Heart, Lung, and Blood Institute (NHLBI). The document is entitled 'The practical guide: identification, evaluation, and treatment of overweight and obesity in adults⁶'. Based on the evidence-based medicine methodology, the detailed report develops a rational argument for recommendations on the assessment and management of obesity. The recommendations cover several areas and are associated with written and electronic presentations and software.

Recently, updated and simplified recommendations were forwarded to general practitioners by the American College of Physicians (Hegmann, 2005; Snow *et al.*, 2005). The recommendations are based on 5 points: tackling the question with patients consulting their general practitioner and explaining that the objective is not only weight loss but also prevention and treatment of complications; while behavioral measures are the priority, pharmacological treatment is to be envisaged in the event of failure; patients are to be informed of the immediate adverse effects of medications and to be aware that their long-term safety has not been established; surgery is only indicated in the event of morbid obesity and the patient is to be very clearly informed of the risks; candidates for surgery are to be referred to expert centers.

⁶ www.naaso.org/

Canadian recommendations

The government of Canada, the Canadian provinces and territories and non-governmental organizations have issued a series of recommendations on obesity (Canadian task force on preventive health care). Outside of the diagnostic recommendations, there is no specific obesity plan like that launched by the NIH in the United States (NIH, 2000) in Canada. However, a series of non-specific measures exists (Douketis *et al.*, 2005). The 'integrated' strategy is based on promotion of health and prevention through a healthy diet and physical exercise, which are not only beneficial with regard to obesity but also with regard to the prevention of cancer and cardiovascular disease. The 'Canadian food guide for healthy eating' and the 'Canadian physical activity guide for a healthy life' have been circulated to help Canadians be physically active and make healthy dietary choices. The strategy targets all Canadians, irrespective of whether they are in good health, at high risk or present with a chronic disease. The 2005 budget provides an envelope of \$ 300 million over 5 years.

With a view to preventing infantile obesity, the Canadian government has selected an overall approach to health in schools. Combating obesity thus only constitutes one aspect of public health policy. The Bureau of Nutrition Policy and Promotion supplies teachers with guides and teaching aids. In practice, the recommendations are adapted to each province. In Québec, the government has launched the program entitled 'Écoles en forme et en santé'. The program finances school projects designed to give children 'healthy life habits, including regular physical exercise and a healthy diet'. Recommendations are given on the composition of packed lunches at school. In low-income areas, 'nutrition programs' have been set up subsequent to local initiatives on the part of school communities or non-governmental organizations. These programs, amounting to some € 3 million, are financed by public and private funds (parent associations, companies and businessmen) and implemented by volunteers.

In Ontario, the Ministry of Education has recommended withdrawing excessively fat or sweet products from sale, only selecting foods meeting criteria defined by dietitians and particularly carefully monitoring the size of individual servings. Thus, carbonated soft drinks are to be replaced by pure fruit juices, skimmed milk or bottled water. The document also advises reviewing the contracts concluded with suppliers. In Québec, all commercial advertising targeting children aged less than 13 years is legally prohibited. In the remainder of Canada, advertising targeting children aged less than 12 years is regulated by good conduct codes.

A tax on retail carbonated beverages, fruit juices, fruit drinks, confectionary and snacks (chips, pretzels, popcorn, salted peanuts, crackers, etc.) is applied in most provinces. However, the revenues are not allocated to financing infantile obesity prevention programs.

Recommendations in the European countries

Various recommendations have been published in Europe (Hainer *et al.*, 1998; Swiss Society of Infection Disease, 1999; Dutch Association for the Study of Obesity, 2001; Grandjour *et al.*, 2001; Hancu *et al.*, 2001; Muls 2001; Magnusson, 2005).

Scotland

The Scottish experts were the first to formulate recommendations, which were subsequently to inspire all the communication worldwide. It is therefore of particular interest to look at the work of the Scottish Intercollegiate Guideline Network (SIGN, 1996), 'Management of obesity

in children and young adults⁷.

Great Britain

The Royal College of Physicians of London has defined a series of recommendations, in particular with regard to the clinical and pharmacological aspects (O'Meara *et al.*, 2000a and b; Royal College of Physicians of London, 1998 and 2003). The National Institute for Clinical Excellence (NICE) and the Health Development Agency (HDA) are currently responsible for developing updated recommendations⁸.

Belgium

In 2004, the Federal Government of Belgium launched a national nutrition and health plan, 2005-2010, aimed at combating 'the physiological disorders related to an inappropriate diet and lack of physical exercise' and thus, in particular, at combating childhood obesity. The initiative recommends increasing physical exercise, intake of fruit and vegetables and restriction of fats in food products. Schools are encouraged to dispense 'media education' to enable children to interpret advertising messages. Schools are also encouraged to develop sport in schools. The charter entitled 'At school, a healthy diet' is designed to enhance the quality of food through the discovery of tastes, compliance with hygiene, etc. In order to influence child eating habits, the government of the French community considers it necessary to sign an ethical charter with the food industry. The charter is to address the products served in canteens and sold in vending machines. The plan provides for prohibiting sweetened beverage vending machines in schools and their replacement by water fountains. The food industry professionals have compiled a nutritional policy charter. An advertising self-regulation code is scheduled (Muls, 2001).

European recommendations

The European recommendations on the management of obesity in general practice were compiled by an expert group under the auspices of the European Association for the Study of Obesity (EASO): 'Management of obesity in adults: project for European primary care' in 2004⁹. The recommendations define the conditions for first-line diagnosis and management. The conclusions of the report are, practically word for word, the same as the French recommendations of 1998 (Afero *et al.*, 1998; Hainer *et al.*, 2004). Recommendations have been compiled for obesity surgery and for the setup of European reference centers. In addition, EASO has compiled a European training course for physicians wishing to focus on obesity management.

Indian and Chinese recommendations

The two most populous countries in the world, China and India, have also been stricken by the obesity epidemic. Urban and suburban environments are particularly affected. This apparently paradoxical situation in countries that were long affected by malnutrition and under-nutrition in reality reflects fast economic and social change. It is interesting to note

⁷ www.sign.ac.uk/pdf/qrg8.pdf

⁸ www.nice.org.uk/

⁹ www.easoobesity.org/

that the recommendations have been published in India and China (Bhave *et al.*, 2004; Chen *et al.*, 2004).

Assessment

Assessment of the effective application of the programs and their impact would be premature given their recent nature. Nonetheless, noteworthy differences at the developmental stage may be cited.

Countries like the United States, France and Belgium which have included the recommendations in an overall consistent strategic plan for preventing and treating nutritional diseases or, more specifically, obesity are rare.

Most of the recommendations remain paper documents, articles and guides. The initiatives in the United States and Europe with regard to developing communication tools and training courses with the aim of circulating and promoting application of the recommendations are therefore noteworthy. NAASO has developed a wide range of tools in the service of its recommendations¹⁰. A training program is available to physicians online. Its pedagogic objectives consist in the following fields: pathophysiology of obesity and its complications, relationship between metabolic syndrome, obesity and cardiovascular diseases, obesity treatment. The training courses are available to general practitioners and credited in the in-service training system. EASO has also developed a training program in cooperation with the IOTF. The program, named 'Scope', was launched by the Obesity summit of the European Community held in Copenhagen in September 2002. Scope¹¹ validates the training of practitioners trained in obesity.

By generating national and community initiatives worldwide, the impact of the WHO report on obesity was considerable. The report led to the design of recommendations and, in certain cases, action plans for the prevention, diagnosis and treatment of obesity.

The contents of the recommendations do not differ fundamentally from one country to the next. In contrast, important differences in terms of application exist. The differences are both conceptual and practical. Certain countries like Canada have selected a non-specific nutritional prevention option considering that preventing obesity shares the same modalities as preventing cancer and cardiovascular disease. Other countries such as the United States have developed strategic programs specifically targeting obesity. In practical terms, only the United States and the European Community have set up healthcare personnel training strategies with a view to furthering the recommendations. Web tools and online training courses have been developed.

A critical question is that of partnerships. The North American countries have chosen a partnership with industry. That choice has not been explicitly debated in Europe. At the present time, no assessment of the impact of partnership strategies is available.

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¹⁰ www.obesityonline.org

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8

Management of children in France

The National Nutrition Health Program, 2001-2005 (PNNS¹²) provided the impetus for strong mobilization with regard to screening for and managing obesity in children, with regard to care, training, information and research. A large number of research projects selected in the national or regional calls for projects target childhood obesity with respect to the various aspects: prevention, screening and treatment.

Governmental national strategies have been developed to target healthcare professionals, care services and schools. In addition to circulars and laws designed to improve the health and diet of children, more specific proposals targeting childhood obesity are currently under discussion.

The learned societies have also set up targeted training operations and interventions. A plethora of press articles, television programs and books for the lay public address childhood obesity and numerous local initiatives in that area have been set up.

The PNNS has essentially targeted its approaches and strategic objectives and set up a general framework for action, in particular the regional technical committees, mobilized the potential players and funded research actions. The PNNS has not really developed programs to combat childhood obesity.

France was one of the first European countries to formulate a plan supported by the government. Pursuit of the program through 2008 has been reconfirmed. The objective is to halt the increase in the prevalence of infantile obesity in the more general context of improving the nutritional quality and healthy lifestyle of children.

While no assessment of the actions initiated is yet available due to insufficient follow-up, the strategies and screening and management actions deployed may be described.

National, regional or local strategies

Several strategies have been developed at national level to modify eating habits and lifestyle, to train physicians and promote their awareness with regard to the early screening for and treatment of childhood obesity, and to develop professional networks. Actions set up at regional or local level also constitute examples.

Laws and circulars

A number of laws and circulars are intended to modify eating habits and lifestyle (Senate, 2005).

The French parliament enacted law No. 2004-806 dated August 9, 2004. Article 29 stipulates that beverages with added sugar, salt or synthetic sweeteners and manufactured products ...

¹² Web site: <http://www.sante.gouv.fr>

which are the subject of television or radio advertising are to contain health information. However, advertisers may be exonerated from that obligation if they pay a sum to the National Institute for Health Prevention and Education (Inpes) equivalent to 1.5% of the amount spent on advertising the products (applicable at the latest in January 2006). Article 30 prohibits sweetened carbonated beverage and snack vending machines in primary and secondary schools. It came into effect at the start of the school year 2005.

In Sweden, the government went further by prohibiting television food advertising at prime time for children. No assessment of the impact of those laws is available. The consequences of those measures need to be followed closely and any perverse effects countered. The measures call for concomitant education of children with respect to a balanced diet and healthy lifestyle. If not, they are liable to be counter-productive. A working group set up in the context of the PNNS has made proposals with respect to introducing that education into school programs.

Two circulars issued in June 2001 and December 2003 relate to school canteens. The circulars review the nutritional requirements, meal composition and need to train children in dietetics. The ministerial circular in 2003 stressing the importance of drinking water fountains in schools has been little implemented. However, the eradication of sweetened carbonated beverage and other sweet product vending machines should promote the installation of drinking fountains. With regard to the morning snack in nursery schools, the circular aims to prevent snacking becoming systematic, particularly for infants having already eaten a normal or perhaps excessive breakfast.

These measures are to be seen in the light of the attempt to ensure consistency between the various messages targeting schools. These measures should promote management of obese children by decreasing their consumption of high-calorie products. Nonetheless, the attraction of the forbidden may induce the opposite effects.

Bills presenting a set of specific measures intended to combat childhood obesity have been drawn up. Some of them predate the law dated August 2004. The bill compiled under the responsibility of Claude Saunier in July 2004 provides for creation of an agency responsible for national management of the combat against obesity. The bill drawn up by Jean-Marie Le Guen in March 2005 provides for creation of a high committee for combating obesity and an obesity epidemic monitoring station.

Physician training and awareness promotion

Various studies conducted in the context of in-service medical training and through the networks have shown that physicians are not familiar with the definition of obesity, the use of BMI curves - although they have been included in each child's health diary since 1995 - or the value of early screening for obesity. A recent study conducted by Bocquier *et al.* (2005) on adult obesity and the knowledge and practices of physicians shows that 79% of physicians are convinced of their role with regard to the management of obesity but 58% feel poorly equipped to fulfill it. The results of a study of childhood obesity in Lyon conducted in 1998 generated results that were consistent with those of the study by Bocquier *et al.* (2005).

In November 2003, the Directorate General of Health (DGS) forwarded a dossier on childhood obesity to all the physicians in France, general practitioners or specialists, open-care, hospital or institutional. The dossier defined childhood obesity of degrees 1 and 2 and overweight and also indicated the international definition. As tools, the dossier proposed: a specific child disk enabling calculation of the BMI and a number of child corpulence curves (girls/boys). It was accompanied by a theoretical text on child obesity with clinical case reports. The action has not been evaluated. The overall reception was positive. 2 years after

forwarding those documents, a national assessment of a representative sample could be proposed in France with a view to evaluating the physicians' practices and the demand for training and tools.

An editorial (Tauber *et al.*, 2003) published in the journal, 'Archives de pédiatrie', drew pediatricians' attention to early screening for obesity in children and the value of using BMI curves.

Under the impetus of the Société Française de Pédiatrie (SFP) and through the intermediary of the Association pour la Prévention et la Prise en charge de L'obésité Pédiatrique (Apop), the DGS financed the compilation of two training dossiers on the management of obesity in children and adolescents under the responsibility of François Kurtz. The dossiers, intended for general practitioners and specialists, were compiled using the format used by the Acalis company for dossiers on childhood fever and pain. The dossier on infantile obesity was published in 2004 and the second, on adolescents, is currently being printed.

Creation of an association of professionals mobilized in the prevention, screening and management of pediatric obesity (Apop)

Apop, an SFP body, was set up in March 2002 with the aim of optimizing the prevention, screening and management of pediatric obesity with the assistance of hospital pediatricians involved in childhood obesity. Currently, the association also includes general practitioners and specialists (pediatricians, sports medicine specialists, psychiatrists, endocrinologists and nutrition specialists), open-care and hospital physicians and the paramedical professions (dietitians, physiotherapists, psychologists, etc.).

Apop has promoted the development of pediatric obesity prevention and management networks (Répop) and compiled a joint pediatric dossier used by the Répop as a basis for evaluation. The association has contributed to compiling the DGS dossier (BMI disk, corpulence curves and clinical case reports) and to compiling a practitioner's guide to childhood obesity.

Apop together with SFP and the Société de Nutrition was at the origin of the request for compilation of recommendations on the management of childhood obesity validated by Anaes (September 2003). Apop recently (June 2005) finalized a guide to setting up Répop in the context of a working group of the Direction de l'Hospitalisation et de l'Organisation des Soins (Dhos). Apop also promoted setup of a hospital clinical research project (PHRC) in 2003. The protocol is designed to assess the physical capability of obese children.

Setup of the program entitled 'Ensemble pour l'obésité de l'enfant': Epode

Compiled under the auspices of the PNNS, the Epode program launched in January 2004 involves 10 pilot towns in infantile obesity prevention and screening actions for a duration of 5 years. The program is designed to mobilize all the local players by drawing on the Répop when they exist locally. The program is in part financed by private partners including the food industry and insurance companies. The program involves elected representatives, teachers, parents, local economic players, physicians and nurses. Its actions include information, workshops, education, etc.

Setup of pediatric obesity prevention, screening and management networks: the Répop

The model of an open-care-hospital network for childhood obesity was finalized by a Dhos working group in the context of devolving the PNNS to healthcare establishments (figure 8.1). In the 2002 call for projects, 3 pilot sites were selected: Paris/Ile-de-France,

Toulouse and Lyon. The first two have been active since September 2003 and will be evaluated after 2 years of operation. The 'Grand Lyon' Répop began later, at the same time as another network in Franche-Comté. Apop has greatly promoted the exchange of information and tools, providing the impetus for project compilation and regional financing from the regional hospitalization agencies (ARH), regional health insurance unions (Urcam) and regional network management (DRR). A recently finalized guide is available from the PNNS website. Other Répop have also now made considerable progress.

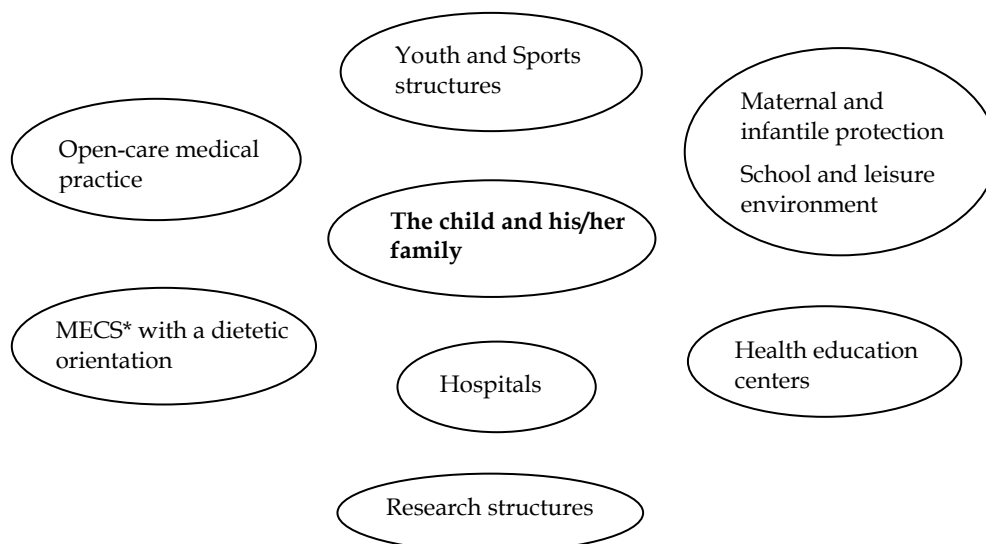


Figure 8.1: Répop model proposed in 2002 by the Dhos working group

* Healthcare homes for children

Anaes validated recommendations for the management of childhood obesity

The recommendations for the management of childhood obesity were published in September 2003 and based on the data available in the international literature. Overall, the recommendations stress the need to involve the family, ensure proximity management, and to ensure an overall approach to the obese child, integrating the child's psychology and cultural and socioeconomic context. Management is oriented towards obtaining lasting changes in food behavior and lifestyle, and, in particular, a decrease in a sedentariness and an increase in regular physical exercise (ultimately a sports club) through a close educational approach and long-term approach. The need to be attentive to non-discrimination and non-induction of guilt together with optimization of compliance and follow-up over the long term are stressed. The Répop are cited as an innovative alternative for management that have yet to be evaluated.

National day of screening for infantile obesity

The Association française pour la pédiatrie ambulatoire (Afpa) organized a national childhood obesity screening day in January 2005. The event was given widespread media coverage. The operation was a great success with regard to participation and the number of families consulting on that occasion.

Local and regional actions

Numerous actions have been implemented in the general context of the PNNS. Some actions which had been initiated before the plan were pursued and amplified and sometimes reproduced at other sites.

One of the best examples of that type of local action was the action deployed in Val-de-Marne. The action was initiated at General Council level under the responsibility of Elisabeth Feur. The action applies to junior schools and one of its objectives is to screen for childhood obesity.

The setup of the Répop also gave rise to or constituted an important support for numerous infantile obesity prevention and screening actions. The actions were most frequently developed in nursery schools (Epipoi study of the Toulouse Répop) or primary schools (study with the Paris town hall and in Lorraine). The results have yet to be evaluated but the repercussions are already of interest: in the Midi-Pyrénées region, the Epipoi study was taken over by the health insurance organizations (CPAM) of all the departments with the objective of adding two new schools per year. An overall assessment is scheduled. Instruments have been shared and numerous exchange and working meetings have taken place, breaking down the barriers between National Education, teachers and the student health promotion department (PSE), the Répop care systems and the Maternal and Infantile Protection (PMI) departments. Financing for those actions has come from various funds (FAQSV, FNPEIS, insurance and mutual insurance organizations, etc.). In 2004, a teaching kit based on the Epipoi study was financed by the DGS and implemented with the assistance of Adosen (Action et documentation santé pour l'Éducation Nationale). The kit has been circulated in 3 regions: Midi-Pyrénées, Rhône-Alpes and Nord-Pas-de-Calais.

A precise inventory of the local and regional actions was conducted in the context of the PNNS through the regional technical committees. In the Midi-Pyrénées region, a questionnaire forwarded to all the committee members enabled a precise inventory of the numerous actions targeting childhood obesity.

However, very many of the actions implemented in France have not been inventoried and an effort to do so appears indispensable. Should we continue to subsidize a large number of more or less scattered local actions with no possibility of assessment or should we rather focus the energies on larger scale actions in order to obtain a reliable assessment?

Synthesis and prospects

A first assessment of the strategies deployed at national, regional and local level may be conducted without it constituting an evaluation in the strict sense of the term:

- healthcare professional training: awareness promotion, provision of screening tools and management recommendations by the DGS, Répop and learned societies;
- mobilization of healthcare professionals and institutions (National Education, local collective institutions, Maternal and Infantile Protection (PMI), health insurance organizations) in the context of calls for projects;
- de-compartmentalization of professionals in the context of the Répop or actions setup;
- need to inventory and regroup the actions in order to enhance efficacy.

Screening for childhood obesity

As is the case in most countries, France has no organized, systematic national program to screen for childhood obesity. This in part explains the delayed diagnosis and management of the disease.

How to screen?

Obesity screening cannot be conducted by simply inspecting the child or weighing him/her. It is necessary to calculate the BMI [BMI = weight (kg)/height² (m)] and the corpulence curve is to be plotted in the child's health diary at each visit by the physician. The cutoffs defining overweight and obesity must be known (table 8.I).

Table 8.I: Terms and cutoffs used to define overweight and obesity

References	Terms used	Cutoffs
Cole <i>et al.</i> , 2000 (IOTF)	Overweight including obesity Obesity	IOTF C-25 percentile IOTF C-30 percentile
Rolland-Cachera <i>et al.</i> , 2002	Overweight (including obesity)	97th percentile French references
PNNS curves, 2003	Obesity degree 1 Obesity degree 2	97th percentile French references IOTF C-30 percentile

*PNNS (French National Nutrition Health Program) available online: www.sante.gouv.fr, path: 'dossiers', 'nutrition'

Who should screen?

In France, the provision of a child health diary to families and physicians means that a precious preventive instrument in support of child screening and follow-up is available. Mandatory visits give rise to a certificate forwarded to the Caisse d'Allocation Familiale in order to receive national child support. The certificates are issued for ages 8 days, 9 months and 24 months. The health checkups conducted in nursery school between the age of 3 or 4 years (most frequently conducted by Maternal and Infantile Protection (PMI) physicians) and between 5 and 6 years (PSE physicians) are very important with regard to screening for obesity. However, since those assessments are not mandatory, not all children undergo them. Wide regional and even local divergences exist. In Paris, all children are systematically examined, while in Haute-Garonne only half of the children aged between 3 and 4 years are examined. In addition, the PMI and PSE physicians are not able to directly refer screened children to a physician, impairing the effectiveness of their screening. The Val-de-Marne study showed that the vast majority of the obese children detected by junior school screening were lost to follow-up. Screening is only effective when families are issued a reminder or even helped to take care of the problem. For that reason, Répop-Toulouse signed an agreement with the Haute-Garonne PMI physicians with a view to obtaining a derogation enabling them to take part in obesity screening and the follow-up of obese children.

The Ministry of Health wishes to involve the PSE departments in individual screening for obesity and also in collective actions. The PMI departments should also be requested to ensure earlier screening in liaison with the PSE and healthcare sectors.

Recent surveys

A health survey of pupils was conducted in 2000-2001 by the Ministry of National Education, the Ministry of Health and the Institute for Health Monitoring (InVS) in conjunction with the Direction de la Recherche des Études de l'Évaluation et des Statistiques (Drees). The survey was published in 2004 (De Peretti and Castetbon, 2004). It showed that, out of the 15.7% of junior school pupils in class 3 (14-15 years) who were overweight (of whom 3.3% obese as per the IOTF curves), 60% were already overweight at the age of 6 years. At that age, the prevalence of overweight is 14.3%, of which 3.9% obesity. Out of the overweight or obese children at age 6 years, almost one child in two remained overweight or obese.

Another recent study conducted by the Health Insurance Organization (Cnamts, 2005) reported similar results: 13% of children aged 2 to 17 years are overweight, of whom 4% obese. A peak occurs between age 8 and 9 years, when 19% of children are overweight, of which 17% obese. The study provided further information, namely that 4.4% of overweight children do not receive open-care medical attention vs. 3.4% of normal-weight children. In addition, the study showed that 61% of the obese children (IOTF definition) had at least one obese parent.

Physicians' experience

Another aspect of delayed screening is that physicians do not feel comfortable with a family with an obese child consulting for another reason. This is sometimes even more marked when one of the parents is obese and ill at ease with his/her weight. Some physicians are pessimistic with regard to the impact of management and actually reject the problem. Others argue that they have little time or skill to deal with a social and societal problem outside their experience (Bocquier *et al.*, 2005). The physician's role in management has recently been more clearly defined (Shepphard, 2004): the improvement in theoretical training is an important point and that aspect may be addressed in workshops and role-playing. The latter are already available in certain in-service medical training courses. From that point of view, the link with the Répop may be useful.

What age for screening?

The optimum age for screening for infantile obesity is between 4 and 6 years. At that age, the early adiposity rebound has taken place and the profile of the corpulence curve is highly informative. Moreover, recent studies, particularly that published by Reilly *et al.* (2005), show early risk factors for obesity enabling targeted screening. Those factors consist in genetic factors identified by parental obesity and particularly maternal obesity, intrauterine factors such as exposure to maternal smoking (von Kries *et al.*, 2002), maternal diabetes (Dabelea *et al.*, 2002), and fetal macrosomia. The impact of low-birth weight when excessively rapidly made good is also noteworthy (Ong *et al.*, 2000). In addition, individual factors have been evidenced and include excessive weight gain between age 0 and 24 months (Toschke *et al.*, 2004), particularly a high BMI at 8 months, together with socioeconomic and cultural factors (Moore *et al.*, 2002).

Targeted or generalized screening?

A child presenting with two or more of the above factors should undergo close follow-up in order to ensure early screening for overweight and prevention of obesity. Screening is possible in the context of the health checkups described above, if those checkups are

systematic for all children and if the corpulence curve is regularly plotted in order to identify an abnormal curve profile early. The Epipoi study (whose results are pending) identified the same early risk factors associated with infantile obesity as those described by Reilly *et al.* (2005). However, there are populations at a high risk of obesity, namely migrants, subjects in a precarious situation (Chamberlin *et al.*, 2002), Romanies, etc. Those populations should be targeted by specific programs.

Synthesis and proposals

The prevalence rates and progression of infantile obesity together with the recent data on early risk factors provide the rationale for organizing systematic screening and following up that screening. Screening should benefit from the existing framework of health checkups conducted by the PMI and PSE. Currently, screening has yet to be set up. The management approach has also to be determined.

The various surveys conducted in France already enable definition of the children and populations at a high risk of obesity. The children are to benefit from early screening and specific management in liaison with the caregivers.

Healthcare professional training, the circulation of screening tools and promotion of awareness of the infantile obesity problem should strengthen the efficacy of screening. Enhanced communication with the families and particularly the families most at risk still needs to be developed. The latter have limited access to care and are reticent with respect to management due to the negative discrimination to which obese parents and children are subject (Chamberlin *et al.*, 2002). Moreover, with regard to childhood obesity, culpability also affects the parents. Information needs to be carefully given. This is not always facilitated by press and television coverage of the subject, which too frequently dwells on the 'record' or sensational aspect.

Management of obese children

Few studies of the management of obese young children (age less than 6 years) have been published, probably due to the frequent delay in diagnosis. In contrast, studies of obesity management programs for children aged over 7 years have been conducted in North America and Europe. Numerous studies are available.

Recommendations

The recommendations (available online¹³) were published in 1998 by Barlow *et al.* and constitute the conclusions of an expert committee on the management of obese children. In France, Anaes published recommendations in 2003. The New England Journal of Medicine, published a review by Dietz *et al.*, in the 'clinical practice' section, in May 2005.

The conclusions of those studies evidenced the need for appropriate management of children, taking into account the child's age, the degree and severity of the obesity, the presence or absence of complications, a familial history of diabetes, obesity or vascular complications and the psychological, cultural and socioeconomic factors.

Management must be frequent and close proximity is to be established. The objective is to decrease the risk of morbidity by lastingly modifying the child's and his/her family's behavior and lifestyle. Management is to include an educational component and integrate

¹³ <http://www.anaes.fr>

the various factors responsible for pediatric obesity. The therapeutic strategies consist in nutritional changes aimed at obtaining a balanced and non-restrictive diet with special attention to preventing the emergence of eating behavior disorders. Counseling is to be given with a view to setting up actions intended to decrease the sedentary lifestyle. Particular insistence on the harmful effect of television and videogames is required. The child is to be encouraged to take regular physical exercise. Group therapeutic education may be an adjunct and psychological or psychiatric management is frequently necessary.

With regard to body weight, the objective is to reduce the excess fat mass over 6 to 12 months while maintaining normal growth. The degree of reduction is a function of the baseline level. Medicinal and surgical treatment of obese children is not indicated. Investigation is always to be conducted for the adverse effects of management, which may consist in decompensation of depression or food behavior disorders. It is important not to discriminate against such families.

The role of children's homes with a healthcare aim (MECS) and dietetic orientation is discussed in the recommendations. The Répop have included those centers in their geographic network. Most of the centers have signed the network's charter. The indications for center placement remain rare for infants. The child's discharge must be carefully managed and prepared during the stay.

Evidence-based medicine

The meta-analyses by Summerbell *et al.* published in 2003 and 2005 by the Cockrane database and based on data derived from controlled studies do not enable any conclusion on the most effective type of management. No consensus on the best modalities for management in the short or long term has emerged. Only a small number of studies meeting the criteria for rigorous analysis are available: 18 evaluable studies of which 7 by the same American author on children aged 7 to 12 years.

In France, programs aiming to evaluate the most effective type of physical exercise in the management of pediatric obesity are currently ongoing. One study, shortly to be published, compares the efficacy of structured physical exercise managed by coaches twice per week for 3 months with prescription and 'conventional' practical counseling in two groups of children followed up in an educational program over 1 year. The first group had a superior trend for waist measurement at 3 months and superior self-esteem. The results at time point 1 year are pending (PHRC local project in the Toulouse teaching hospital, 2004).

Generally speaking, the efficacy of short-term management is about 50% but the long-term efficacy remains difficult to evaluate. Overall, it is poor with frequent relapses and even exacerbation of the problem. No recent French data on the long-term course have been published. Efficacy appears to be better if management is initiated early and the family is strongly involved (Dietz *et al.*, 2005; Nemet *et al.*, 2005).

Nonetheless, the strategies proposed in the recommendations, even in the absence of a sufficient level of proof, appear logical.

The school's role

In 2003, the National Education authority suggested setting up an individualized reception project for obese children, similar to what is done for allergic children, at the request of parents and involving the school, teachers, canteen and pupil health services. This has already been done in some schools and is under way in the context of the Toulouse Répop.

At primary school level, local actions have been developed to prevent a sedentary lifestyle

with inter-class leisure and activity centers (Clae).

In the context of the Répop, the links with the school have been made clearer and local initiatives have been proposed in all cases involving the PSE services. The school physician or nurse may be responsible for managing an obese child in the Toulouse Répop. Some school districts (Versailles, Toulouse, etc.) have designed actions involving junior and high school EPS teachers in order to prevent excessive absenteeism of obese children. Sports physicians have been proposed partial aptitude certificates in order to promote appropriate activity. A school in the Midi-Pyrénées region has also agreed to take obese junior and high school children as boarders for 1 year. A management program has been set up and is coordinated by the Toulouse Répop. This type of innovative action is to be analyzed as an alternative to hospitalization for obesity.

These actions are to be viewed in the general context of pupil health promotion rather than in the context of childhood obesity management.

Répop

The Répop constitute an innovative alternative for management. They apply the current recommendations and a common language is adopted by all the partners. The Répop are based on a network charter, mandatory initial and in-service training and developed and shared communication tools. The Répop thus propose management in which several parties are involved, each with the same 'network' culture. The management protocol involves the child and his/her family and various partners, who commit for 2 years.

All the Répop are organized in the same way and include, as a minimum, around the child and his/her family, open-care and healthcare establishments, schools and child living environments together with the PMI departments. In contrast, the way the Répop operate, the number of contributors for a given child and the organization of those contributors are variable. Thus, the Toulouse Répop has obtained consultation reimbursement for dietetic and psychological consultations for a limited number of consultations per year and per child. The Midi-Pyrénées region sports physicians are highly involved in Répop. The fees for computer-file maintenance vary depending on the Répop. Local discussions with the financing organizations have resulted in those different arrangements.

However they operate, all the Répop currently stress the value of intra-network and between-network exchanges and breaking down barriers. This has been possible thanks to the system. An overall assessment of the Répop is ongoing. The Ile-de-France, Toulouse and Franche-Comté Répop will be evaluated by the same outside assessor.

Final evaluation of the Répop is indispensable in order to render them sustainable. However, there are no non-Répop baseline data to enable a comparative assessment of 'classic' management and Répop management. Epidemiological studies are thus indispensable prior to setup of future Répop. Moreover, it would be of interest to monitor the long-term effects and develop instruments enabling follow-up with the health insurance organization.

An assessment of the Répop with precise guidelines should enable analysis of structure operation, partner training and the partners' degree of involvement and satisfaction, the links between the various partners and user satisfaction. The results would enable the structures to progress and enable identification of the shortcomings. Optimization in the setup of other Répop would then be possible. It would be of particular interest to analyze the changes in professional practices in the Répop and outside of them but also the professionals' requests.

In order to meet the demand for care over a given area, the starting hypothesis for setup of the Répop was that the effect would exceed the framework of the network in order for all

obese children to be able to benefit ultimately from the same management quality within or outside the networks.

In conclusion, management of childhood obesity should be organized in liaison with the screening structures. The assessment of the first Répop is greatly awaited. Epidemiological studies on the assessment of 'conventional' management are lacking and this point requires improvement. Innovative local initiatives and particularities are to be analyzed and encouraged. Breaking down the barriers promotes the setup of Répop by the various structures receiving children. It also enables real awareness promotion and mobilization of the various players. These are very positive consequences that are to be valued and amplified. The place of the school, which is fundamental, needs to be precisely defined but teachers' strong awareness and motivation, and the awareness and motivation of PSE structures with a view to involvement, in liaison with other care structures, are already apparent.

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9

Management of obese adolescents in France

Adolescence, a period of transition between childhood and adulthood and of sexual differentiation, has several characteristics which call for particular attention with regard to obesity, both at preventive level and at screening and treatment level. Obesity that has become established in childhood is likely to persist through adolescence into adulthood. The risk of an obese adolescent remaining obese is estimated to be 78% for men and 63% for women (Zwiauer *et al.*, 2002).

In addition, obesity is a dynamic phenomenon due to interaction between genetic and environmental factors. The latter evolve rapidly during growth (Frelut *et al.*, 2002a).

During adolescence, increasing independence and self-affirmation generate changes in behavior in relation to various contexts:

- the influence of peers, fashion phenomena, psychological difficulties and the emergence of food behavior disorders;
- The evolution of critical faculties, opening to the outside world and sexual maturity accompanied by the desire to attract;
- evolution of spontaneous behavior: while physical exercise remains important for boys, its importance tends to decrease for girls;
- major hormonal changes influencing body composition: in girls the fat mass increases by 13% on average, while it decreases by 4% in boys. The increase in muscle mass in boys increases resting and energy expenditures during exercise: the expenditure is thus higher than girls for the same activity.

Independently of the influence of the social environment on the risk of obesity, subjective social status (different from the parental socioeconomic category), as perceived by the adolescent, becomes very strongly associated with corpulence during adolescence (Zwiauer *et al.*, 2002). The subjective status is also closely linked to depressive manifestations (Goodman, 2001).

Public health actions and the management of adolescents need to take into account the specificities of that period in life and are to be implemented over a sufficient duration.

Data sources and conceptual bases

The data available for the analysis of the problems raised by adolescent obesity are of three orders:

- knowledge of the behavior of adolescents in general and their lifestyle, studies comparing obese groups with normal-weight groups without interventional studies;
- the results of interventional studies on adolescents in various countries;

- the very heterogeneous national programs and recommendations; the heterogeneity resides in the formulation which derives from the above observations and takes each of the components into account to a variable degree.

Adolescent characteristics and behaviors as an obesity risk factor

During adolescence as at any age, the risk factors for obesity are as follows:

- a reduction in physical exercise and an increase in sedentary behavior;
- unbalanced nutritional intakes that are excessive relative to energy expenditure;
- psychological factors and the strong impact of age- and development-related social factors.

The risk factors and circumstances of emergence of obesity have characteristics specific to adolescence.

Decrease in physical exercise and increase in sedentary behaviors

The decrease in physical exercise (a natural phenomenon during aging) differs from the increase in sedentary behavior related to lifestyle and technologies. Adolescence is characterized by lifestyle changes and facilitated access to new technologies: targeted offer, learning ability, peer group impact, positive image of IT conveyed by the school system. Follow-up of 2,287 female adolescents aged 9 to 18 years confirmed the association between the decline in physical activity and the increase in corpulence (Kimm *et al.*, 2005). The difference in corpulence increases through adolescence reaching 2.98 kg/m² and 2.10 kg/m² in girls of Afro-American origin and Caucasian origin, respectively. Television, computer and console games reduce energy expenditure to a level close to that during sleep. In order for an adolescent to exceed the cutoff of 2-fold the energy expenditure during sleep in a given activity, it is necessary for that activity to take place outdoors. Walking provides the most available opportunity (Vermorel *et al.*, 2005). However, in adolescents, spontaneous but sufficiently vigorous activities seem to confer the best protection against obesity (Gutin *et al.*, 2005).

Numerous references support the association between sedentary behavior and fat mass. A meta-analysis of 52 studies (Marshall *et al.*, 2004) not only confirmed the sedentary lifestyle-television time link but also the inverse correlation with physical aptitude. Spontaneous but vigorous physical exercise is reported to predominantly contribute to that aptitude (Gutin *et al.*, 2005). In France, the importance of the intensity of the activity, which has a key impact on preventive strategies, was confirmed in junior school pupils in the Bas-Rhin (Klein-Palat *et al.*, 2005).

The increase in sedentary behavior reflects, in part, an environment that is not very stimulating or authorizes few or no outside activities in addition to the attractive character of new leisure activities. The environment must thus be modified if the messages on lifestyle are not to remain devoid of effect. Most prevention programs reflect that need.

Unbalanced food intake enhanced during adolescence

The changes in foods on the one hand and the multiple occasions for eating on the other have profoundly changed the dietary behavior of adolescents.

Adolescents, who are very sensitive to fashion and advertising, are the main clients of fast-food restaurants. In the United States, 30% of children go to a fast-food outlet on a typical day each week (Bowman, 2004). Frequenting such establishments induces a mean excess consumption of 187 kcal/day, increased high-energy food consumption, and less

consumption of milk, fruit and green vegetables (Bowman, 2004). In the same country, the association between obesity and sweetened carbonated beverage drinking was confirmed by 10 years of follow-up from childhood through adolescence (Philipps *et al.*, 2004). In Australia, adolescents obtain 43% of their energy from high-energy density foods (non-core foods, biscuits, sweetened beverages, chocolate bars, chips, etc.) not recommended for a balanced diet. The percentage increases throughout childhood and, in adolescence, exceeds that observed in any other age group, adults included.

A study of carbohydrate consumption (Afssa, 2005) showed that sweetened beverages, particularly sodas, considerably increase the energy intakes of adolescents who consumed the most of those beverages (750 mL, i.e. a little more than 2 x 33 cL daily). The data have since been confirmed (Berkey *et al.*, 2004). In the United Kingdom, the British Soft Drink Association reported to the Health Committee on Obesity that, on average, each child consumed 4.7 L of sweetened beverages per week. Only 10% of beverage intake consisted in water or fruit juice (British Medical Association, 2005). Studies have shown that learning to control that consumption has a positive impact on obesity prevalence (Afssa, 2005).

Access to sweetened beverages and high-energy density foods (fat and salty or sweet) is particularly facilitated by vending machines.

In addition, there is a direct link between the number of advertisements to which an adolescent is subjected, the time spent watching television and the impact on the induced purchasing and consumption. These findings have given rise to legislation, applied or pending, in the field of combating obesity. In addition, obese adolescents are more sensitive to advertising. Studies show that they recognize more advertisements and consume more of the foods advertised after having been exposed to the message (Halford *et al.*, 2004).

Screening and public health actions

In 2000, the Inserm collective expert review constituted an initial assessment of screening and obesity prevention in children and confirmed the need for early, prolonged and multidisciplinary actions (Inserm, 2000).

In 2002, the International Obesity Task Force (IOTF) chaired by Prof. Philip James, published an initial report calling for decisive action worldwide in the interest of children and adolescents (Obesity in Europe, the case for action). In 2004, a worldwide review of the situation of children and adolescents stressed the multiple shared features of the obesity epidemic worldwide and, thus, the double constraint of multidisciplinary actions that are adapted to local situations. A breakthrough in the scientific bases for the combat against obesity thus occurred less than 10 years ago.

In France, the National Nutrition Health Program (PNNS) launched a few weeks after the presentation of the Inserm expert review defined as its major objective the stabilization of childhood and adolescence obesity prevalence. The tools developed for the program (curves, rules, software, etc.) cover all age groups and, in principle, target *all* general practitioners and pediatricians. The PNNS stressed the particular importance of a consistent strategy addressing young people: consistency between the information, education and food offer.

The document entitled 'I like to eat, I like to move, nutritional guide for adolescents' intended for adolescents was published in the third quarter, 2004. As the General inspectorate of social affairs (Igas) stressed in 2003 in its report entitled 'Prevention through good nutritional hygiene', we can only regret the lack of financial and human resources allocated to implementing that mission. The situation led to the nutritional information

objectives for children only being achieved over a timeframe of more than 3 years.

The Anaes recommendations on the 'Management of obesity in children and adolescents' published in 2003 are rather academic and not very pragmatic. Since then, the Association for the Management of Pediatric Obesity (Apop), with the approval of the pediatric societies, has developed a practical formation module consisting of two sub-modules, children and adolescents. The modules are intended for physicians. The adolescent sub-module develops an approach integrating the difficulties specific to adolescents, in particular the psychological background and the risk of food behavior disorders.

The strengths and weaknesses of the program in France need to be seen in perspective: only in 2005 did the British medical association, Swedish National food administration and US National institute of health published their reports and recommendations. In contrast, Scotland published its own practical recommendations for management and screening in 2003: the document consisted in a 'Quick reference guide' that could be downloaded¹⁴. The preventive programs have frequently developed instruments whose use is restricted to the operations provided for in the programs. The circulation and exchange of instruments would enable substantial time and money savings in other regions.

Public health actions in France

Two major preventive actions addressing adolescents are under way. One is taking place in Val-de-Marne and the other in Alsace. Their shared features are deployment in junior schools (classes 5, 12-13 years, and 6, 11-12 years, respectively), the basic observation that the adolescent lifestyle is excessively sedentary and the link between sedentariness and eating disorders, messages bearing on the improvement in wellbeing and health, and integration of educational professionals, particularly physical education teachers, in addition to healthcare professionals, in the projects. The actions are recent and the results, while preliminary, are very encouraging. With scientific boards, the programs are being implemented, an interesting fact, in one case, by the University of Strasbourg and national research organizations and in the other by the General Council of Val-de-Marne.

Val-de-Marne: program 'Eat better, move more'

The program began in 2000 (Feur, 2004). After a gradual buildup, it was extended to 44 junior schools in which pupils in class 5 (12-13 years), after screening by the school physician, could receive management involving the physical education teacher, dieticians, attending physician and family. In each participating school, a real nutritional policy was developed in order to cover 13,000 adolescents. Outside of the school, in 13 partner communes, educational workshops ('Eat better, move more' workshops) were set up. The workshops included the possibility of exploring various active leisure pastimes. During the pilot study, the regular participation of 80% of the adolescents included was observed. At the start of the year, 22% of the pupils in priority education zones and 16% outside of those zones were overweight or obese. At the end of the year, 5% of the overweight pupils had become obese and 17% had returned to a normal weight. In parallel, 29% of the obese pupils had become simply overweight.

Bas-Rhin: the Icaps study (intervention centered on physical activity and the prevention of sedentary behavior)

Set up in a group of 8 junior schools in the Bas-Rhin department, of which 4 control schools, the program addressed 1,048 adolescent pupils in class 6 (11-12 years), 92% of whom agreed

¹⁴ www.sign.ac.uk

to the follow-up. The objective was to increase awareness of physical exercise and improve its practice while supplying social and environmental support. As of the first 6 months, the proportion of sedentary children decreased to 50% in the active group junior schools while the adolescents' self-assessment of their efficacy and the intention to change increased very significantly for girls (Simon *et al.*, 2004). More recent results confirm the very positive effect on excess weight.

International data

The Inserm collective expert review (2000) established an initial assessment of preventive studies targeting children. Like the studies in adults, most of the studies targeting children aimed to prevent cardiovascular risk and not obesity. An important finding, since confirmed, emerged: the maintenance of stable corpulence in children whose regular physical activity is increased and marked may mask a decrease in fat mass and cardiovascular risk parameters (Inserm, 2000). In adolescents, the few data generated by interventional studies have been published to date.

The review conducted by Wilson *et al.* (2003) stressed 2 studies out of 8 conducted in the school environment on adolescents in Canada and the United States. The number of participants included was low. Conclusions are difficult to draw. Three studies out of 17 targeted changing family behavior in families including obese adolescents. In 3 studies, significant results were obtained at time point 1 year. The authors of the review also stressed the methodological imperfections of the studies and the difficulty of transposing from one continent to another, since most of the interventional studies are North American.

In 2004, the IOTF also conducted a worldwide exhaustive review of the ongoing studies (Lobstein *et al.*, 2004). Several original interventions were identified: the University of Minnesota demonstrated the impact of food offer to adolescents aged 12 to 16 years in junior school canteens and vending machines. Foods beneficial to health were introduced and their price markedly reduced (10, 25 and 50%). This induced increases in purchasing of 9, 39 and 90%, respectively. When the prices returned to the usual level, purchasing of healthy foods collapsed.

Megalopolis-scale programs (Sao Paolo, Singapore) mobilizing the whole population and the city's communication resources but targeting children and adolescents had a favorable impact on the degree of physical exercise and, in Singapore, enabled a reduction in the prevalence of obesity.

A review of all the interventional studies published since 2000 (including the Cochrane review of prevention trials and the Hamilton review) enabled the following conclusions to be formulated: schools are the preferred intervention sites. However, the community and family scales are also of value and to be incorporated in programs since important changes in behavior can be elicited at those levels. Environmental changes, taking into account recent changes in behavior and food consumption in the region involved, and management of the time spent watching television are more important components than advice given in class.

Lastly, the study modalities have been criticized. A randomized study is rarely feasible on a population scale and may not be ethical or may lead to artificial conditions that cannot be maintained. Replacement solutions that are effective in demonstrating the impact of a program on a population are to be sought.

More recently, Austin *et al.* (2005) demonstrated that a correctly implemented intervention reduces the risk behaviors which result from attempting to lose weight at any price (vomiting, laxatives).

Curative treatments

The treatment of adolescent obesity is beset with several specific difficulties: the absence of effective medication having received regulatory approval for the age group, the risk of inducing or exacerbating an emergent eating behavior disorder, and the danger of adverse effects of serotonin reuptake inhibitors, which are effective on food cravings but would appear more hazardous for adolescents.

In addition, obesity, particularly when it is severe, gives rise to peer stigmatization necessitating accentuation of the social and psychological management. Adolescence is now a period of very severe obesity onset whose complications have clinical repercussions and require appropriate management (Frelut, 2001).

Treatment assessment in France

The published data for France almost exclusively cover adolescents admitted to medium-stay pediatric centers for obesity. In those establishments, management is multidisciplinary and prolonged: from 3 to 12 months. The results at discharge are very positive but relapses are frequent (Frelut, 2001; Dao *et al.*, 2004a; Rolland-Cachera *et al.*, 2004; Lazzer *et al.*, 2005). There is a marked improvement in physical exercise capability (Dao *et al.*, 2004b; Deforges *et al.*, 2005; Lazzer *et al.*, 2005).

These results raise several questions: the severity of the cases of obesity makes the above type of management the ultimate recourse before bariatric surgery, which is restricted to adults. No medication whose efficacy is greater than that of bariatric surgery is accessible in France or abroad at the current time. The management methods are heterogeneous since the adolescents are admitted to centers that are frequently isolated and without links with the reference teaching hospitals, which are not very numerous. Coordination of the action of those centers is ongoing. A working group (coordinated by ML Frelut) has been set up at the Directorate of Hospitalization and Care Organization (Dhos). A consensus document is to clarify the processes.

The Anaes recommendations clearly stipulate that cases of severe obesity are to be referred to specialized pediatric departments and confirm the prohibition in France of very low calorie diets and bariatric surgery while calling for compliance with the potential indications of any medications. Like other pediatric diseases, the treatment of obesity in adolescents is liable to have to rely on the published pharmacological data on adults.

Assessment of treatments abroad

Outpatient treatment has been reviewed (Bauer *et al.*, 2002). The authors insist on what has become a fundamental principle: multidisciplinary management. This presupposes that the practitioner has acquired the skills necessary to implement management alone when the case is simple and call in other specialists when the case is more complicated (Lobstein *et al.*, 2004).

A recent US study formulates recommendations for physicians, nurses and dietitians (Barlow *et al.*, 2005). The recommendations are derived from a survey which showed that each of the professions considered that it had need of training outside of its normal fields of competence.

When the above recommendations are implemented, the authors report that the benefits persist 1 year after the end of treatment (Nemet *et al.*, 2005). However, screening for eating behavior disorders, which particularly affect adolescents is necessary (Decaluwe and Braet,

2003; Isnard *et al.*, 2003) even though those disorders do not fully meet the most widely used international classification system (DSM-IV).

The introduction of cognitive and behavioral therapy techniques, initially in the United States (Wisotsky, 2003), where they are widely and successfully used, and, more recently, in Europe (Frelut *et al.*, 2002b), has shown their value, particularly for adolescents who have acquired sufficient intellectual maturity to fully benefit from those techniques.

Pediatric medium-stay residential centers for adolescents are beginning to develop in Europe given the general worsening of the situation. The management principles are very close to those established in France (Frelut, 2002b). Recent Belgian (Deforges *et al.*, 2003 and 2005) and Italian (Sartorio, personal communication) data confirm the foregoing.

In conclusion, adolescent obesity calls for appropriate screening and management. The methods currently available are only fragmentary in that respect. Moreover, few adolescents still consult a pediatrician or consult their doctor for the problem. It is therefore imperative to extend the access to basic training and, in the event of complex cases, to enable access to truly multidisciplinary teams.

The two main preventive programs in France (Val-de-Marne and Bas-Rhin) have got off to a very promising start. Their extension, in the same form or with variants, to all the region involved, then to other regions, seems good sense from all points of view. So doing would have the noteworthy value of proposing an action of known quality while allowing the public services to play their role and shortening the setup of the interventions. Moreover, the whole of the country could be covered rather than conducting fragmentary interventions limited by the good will, interest and investment capability of a few cities or associations.

The World Health Organization (technical report 894, 1997) and the IOTF (Obesity in Europe, 3rd International Obesity Task Force, March 2005) rightly stress the need to extend preventive actions to the whole of society and particularly adolescents, who are one of the most vulnerable subpopulations and must be rapidly assisted with effective measures.

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10

Management of adults in France

Assessment of the strategies and programs for obesity management in adults in France is problematic given the absence of specific data. As is the case elsewhere, treatment of the disease has a poor image and the medium-term results are generally considered disappointing (Ziegler and Debry, 1997; WHO, 1998). It is true that, hitherto, good quality studies were rare. But the most recent studies have shown that adapted treatment strategies may yield probative results (Tuomilehto *et al.*, 2001; DPP, 2002; Torgenson *et al.*, 2004; Wing *et al.*, 2005).

It is necessary to review the main principles of the management of obese or overweight patients, since most of the failures are at least in part linked to strategic errors. The way in which the healthcare system organization plays an important role will also be considered.

Data sources and conceptual bases

For the last 10 years, expert groups have met under the auspices of the International Obesity Task Force (IOTF) to propose a consensus and good clinical practices (SIGN, 1996; NIH, 1998; WHO, 1998; WHO, 2003; EASO, 2004). An immense amount of work on a synthesis has thus been implemented. The recommendations issued by the expert groups have been validated for France by Anaes (Alfediam *et al.*, 1998). Numerous meta-analyses and reports have also been published (McTigue *et al.*, 2003; Avenell *et al.*, 2004a; Li *et al.*, 2005).

Primary objectives

WHO indicates (WHO, 1998) that obesity management has four objectives of increasing importance: weight loss, treatment of concomitant diseases, weight stabilization and prevention of weight gain.

Weight loss of 5 to 15% vs. baseline is both realistic and sufficient (SIGN, 1996; NIH, 1998; WHO, 1998; table 10.I). However, greater weight loss may be advisable in cases of massive obesity or when the seriousness of the concomitant diseases necessitates a greater weight loss. Halting weight gain is already a valuable objective for failures or people who are only a little overweight.

Preventing relapse is of capital importance. Weight regain after weight loss is the natural course. This is difficult for patients and physicians to accept. There are in fact numerous resistance factors with regard to weight loss. Those factors are physiological, genetic, related to environmental pressure, psychological and behavioral.

The management of concomitant diseases is one of the priority objectives. The control of diabetes, hypertension and other vascular risk factors, the alleviation of osteoarthritic pain and the treatment of sleep apnea syndrome (SAS) should not be neglected to the advantage of weight loss alone. Weight loss is not always sufficient in itself (Ziegler and Quilliot, 2005).

A last objective is the patient's quality of life in its three dimensions: somatic, psychological and social. Enhancing well-being, self-esteem and social integration do not necessarily require massive weight loss.

Table 10.I: Theoretical benefits of weight loss of 10 kg (after SIGN, 1996)

Parameters	Effect assessment
Mortality	Greater than 20% reduction in total mortality
	Greater than 30% reduction in diabetes-related mortality
Blood pressure	10 mm Hg reduction in systolic blood pressure
	20 mm Hg reduction in diastolic blood pressure
Type 2 diabetes mellitus	50% reduction in fasting plasma glucose
Plasma lipids	15% reduction in LDL cholesterol
	30% reduction in triglycerides
	8% increase in HDL cholesterol

Two very different treatment phases

It is of value to separate the two phases of treatment since the phases obey different logics (Basdevant *et al.*, 1998; NIH, 1998; WHO, 1998; WHO, 2003; EASO, 2004). The first is the weight loss phase. Weight loss is obtained when the energy balance is negative over a sufficient duration. This involves reduction in energy intake and/or an increase in energy expenditure. The weight stabilization phase is totally different (Basdevant *et al.*, 1998; WHO, 1998; WHO, 2003). Irrespective of whether the energy deficit results from dietetic, medicinal or even surgical treatment, the weight curve ends in a plateau. Body weight and composition do not change any more when the energy balance and lipid balance have been equilibrated: the subjects consumes as many calories as he/she can expend as a function of mean mass and physical activity and as much lipids as the subject is able to oxidize. In fact, three measures are essential: practicing sufficient daily physical exercise, controlling the calorie density of the diet and beverages, and weighing oneself regularly (Wing *et al.*, 2005).

Personalized strategy based on the risk associated with obesity

Two anthropometric parameters are used to evaluate the risk related to excess adiposity: body mass index (BMI) and waist measurement (tables 10.II and 10.III). BMI is closely correlated with fat mass while waist measurement is a more simple index enabling evaluation of the central or android character of the obesity, which is associated with an increase in the risk of cardiovascular disease, type 2 diabetes mellitus and certain forms of cancer. Concomitant diseases obviously constitute an additional argument for effective management.

Early intervention is recommended. Obesity is a chronic, serious and recurrent disease. It is logical to detect people and situations at risk in order to act the most effectively and as early as possible.

Table 10.II: Definitions of obesity and overweight in adults as per the International Obesity Task Force (after WHO, 1998)

Classification	BMI (kg/m ²)	Risk
Thin	< 18.5	
Normal	18.5-24.9	
Overweight/pre-obese	25.0-29.9	moderately increased
Obese	≥ 30.0	markedly increased
Class I: moderate or common obesity	30.0-34.9	markedly increased
Class II: severe obesity	35.0-39.9	markedly increased
Class III: massive or morbid obesity	≥ 40.0	markedly increased

Table 10.III: Waist measurement cutoffs associated with a risk of concomitant diseases (cardiovascular disease, type 2 diabetes mellitus, dyslipidemia, certain forms of cancer) (after ALFEDIAM, 1998; WHO, 1998; IDF, 2005)

	Waist measurement cutoffs (cm)		
	IOTF	France	IDF*
Men	102	100	90
Women	88	90	80

* International Diabetes Federation, Caucasian subjects

Therapeutic resources

There are a number of therapeutic resources: dietetic treatment, promotion of physical exercise, psychological and behavioral management, medication and surgery.

Nutritional counseling

The choice of therapy is a two-stage process. The magnitude of the energy deficit conditions the magnitude of the weight loss, irrespective of whether the calorie restrictions target lipids, carbohydrates or protein. The qualitative choice, i.e. the 'type of diet', considerably influences the initial acceptance and long-term compliance, which are obviously decisive.

Quantitative aspects

Broadly speaking, three categories of diet may be distinguished on the basis of the calorie deficit proposed (Basdevant *et al.*, 1998; WHO, 1998; WHO, 2003).

Little-restrictive personalized diets are preferred in the good clinical practice recommendations. The diet is prescribed for a few months (3 to 6 months). The energy deficit is 300-600 kcal/d, i.e. 15 to 30% of the energy requirements, and leads to a loss of 1 to 2 kg per month.

Low-calorie diets (LCD) procure 800 to 1200-1500 kcal/d. They thus impose a considerable reduction in energy intake, which may exceed 50% relative to the subject's requirements. Compliance over the long term is difficult. LCD are also associated with a risk of multiple nutritional deficiencies. In consequence, the duration is not to exceed a few weeks.

Very low-calorie diet (VLCD) (≤ 800 kcal/d) are only to be used under strict medical

supervision for periods not exceeding 4 weeks (Basdevant *et al.*, 1998; WHO, 1998; WHO, 2003). VLCD are very effective causing average weight loss of 4 to 8 kg per month or even more. The principal risk is weight rebound in the weeks following the end of treatment. The loss of lean mass, which is almost inevitable, seems to be more marked the less the patient is obese. The serious complications (hypokaliemia, dehydration, arrhythmia, malnutrition, etc.) are rare when the diets are correctly implemented in compliance with the conditions, particularly the contra-indications, such as, for instance, heart disease, type 1 diabetes mellitus, advanced age or progressive disease.

Qualitative aspects

Dietary macronutrient intakes are expressed as a percentage of the total energy intake (TEI). In most diets, 45 to 65% of the TEI is derived from carbohydrates (C), 20 to 35% from lipids (L) and 10 to 35% from protein (P). Maintaining the nitrogen balance is indispensable for preservation of lean mass. The minimum daily intake is 70 g for men and 60 g for women. The proteins are to be of good quality and contain the essential amino acids (Ziegler *et al.*, 1997). The more severe the diet, the more the proportion of protein (P %) increases. Balanced diets which are moderately low-calorie diets have the following C-L-P breakdown: 50-35-15% of the TEI. The tactical choice bears on the proportion of carbohydrates and lipids (Ziegler *et al.*, 2005).

Low-fat diets are diets in which fat food consumption is restricted and a proportion of the missing calories is replaced by high carbohydrate or protein foods. Lipid intakes range from 30 to less than 15% of the TEI (C-L-P: 55-30-15 to 70-15-15% of the TEI).

In high-protein diets, the protein-rich foods are preferred to carbohydrate-rich foods (C-L-P: for example 40-30-30% of the TEI) and/or lipid intake (C-L-P: for example 45-25-30%). In practice, it is difficult to promote protein intake without increasing the lipid ration.

Protein diets are a variant of the VLCD which use dietary preparations (liquid or solid) that have a very low lipid and carbohydrate content and whose micronutrient content is regulated. Protein-sparing modified fast (PSMF) diets consist in foods that are naturally rich in good-quality protein and particularly low in fats (chicken breast, egg white, ham, cottage cheese). Potassium (2-3 g/d) and vitamin supplementation is then necessary.

Low-carbohydrate diets are currently encountering a degree of success since they appear simple and easy to follow. Dieters are advised to avoid consuming foods with a high carbohydrate content (bread, starchy foods, legumes, confectionery). Diets with a moderately low carbohydrate content (low-carb diet) supply less than 45% of the calories in the form of carbohydrates. The C-L-P distribution is thus close to 40-30-30%. Very low-carb diets restrict carbohydrates to less than 50-100 g/d, i.e. less than 10% of the TEI. The reduction (< 50 g/d) is drastic in ketogenic diets. Dietary carbohydrates may be replaced by foods with a high protein or lipid content whose consumption is not restricted (C-L-P: 15-55-30%). Several studies have shown that the latter diets induce enhanced control of hypertriglyceridemia and low HDL cholesterol levels than the usual low-fat approach. However, those diets are difficult to observe over a long period, considerably reducing their value.

It should be noted that the various 'high this or low that' diets have not demonstrated their value. Their promotion is not devoid of financial interest. Even the concept of diets is open to debate. Personalized nutritional counseling (table 10.IV) is widely used in France in the context of programs including various measures.

Table 10.IV: Nutritional advice (after Basdevant *et al.*, 1998; Gougis *et al.*, 2004; Ziegler *et al.*, 2005)

Limit intake of high-energy density foods with a high lipid or simple sugar content and sweetened or alcoholic beverages
Chose low-energy density foods (fruit, vegetables), drink water
Control portion size
Diversify the choice of foods by eating a little of everything to ensure a balance between the macronutrients and a sufficient micronutrient intake
Eat sufficiently during meals; do not eat standing, but eat sitting at a table, if possible in a convivial environment
Structure food intake into meals and snacks on the basis of your lifestyle (in general, 3 main meals and possibly a snack); do not skip meals in order to avoid snacking between meals due to hunger
Detect fast eating which the subject may not be conscious of, but of which his entourage will be aware
Detect and discount the food taboos, the incorrect ideas, sources of frustration and disinhibition: pretending that you never eat chocolate when you like chocolate is an illusion ...
Reassure the subject that he/she has the right to take pleasure in his/her food; eating with others is advisable

Physical exercise

Physical exercise has multiple beneficial effects: maintaining lean mass, increasing the mobilization and oxidation of lipids derived, in particular, from the visceral adipose tissue, improving appetite control, positive metabolic effects on insulin sensitivity, blood glucose control and plasma lipid profile, without overlooking self-esteem and well-being. The main value of exercise is nonetheless to restrict weight gain after weight loss (NIH, 1998 and 2000; WHO, 1998). In fact, little energy is expended in most sports and recreational activities and the effect on weight is moderate.

Combating sedentariness consists in increasing the level and duration of physical exercise in everyday life. At least 30 minutes of non-sedentary activities every day is recommended. From the energy point of view, it is naturally more effective to take scheduled physical exercise in the form of 45- to 60-minute sessions 2 to 3 times per week. The exertion is to be moderate or intense. However, very few people comply with that regimen for very long.

Psychological and behavioral approaches

Cognitive and behavioral approaches, while little developed in France, are of value in elucidating the determinants of eating behavior and helping the subject modify any inappropriate behaviors. The self-assessment diary is used to detect those behaviors and their emotional or cognitive consequences (Basdevant *et al.*, 1998; Foster *et al.*, 2005).

Other forms of psychotherapy may be proposed when psychological difficulties are dominant.

Obesity medication

Anorexic medication and pancreatic lipase inhibitors are currently the two therapeutic classes available. The only representatives in France are sibutramine and orlistat, respectively (Ziegler and Guy-Grand, 2004). Other drugs such as cannabinoid-receptor blocker CB1 are, however, under development (Van Gaal *et al.*, 2005). Numerous studies have shown that the risk/benefit ratio of the two marketed drugs, whose long-duration use

is authorized in France and most countries, is favorable (Avenell *et al.*, 2004b; Li *et al.*, 2005).

Sibutramine (Sibutral®) is a derivative of phenylethylamine and has a dual noradrenergic and serotonergic action. Sibutramine does not modify serotonin or norepinephrine release but decreases their reuptake at nerve endings. A slight increase in heat-generation has also been described. Orlistat (Xénical®) inhibits the hydrolysis of dietary triglycerides and hence the absorption of lipids by about 30%. A low-lipid diet is recommended in order to prevent the adverse effects of steatorrhea. Under those conditions, the drug induces an energy deficit of about 200 to 300 kcal/d.

It is, however, now admitted that obesity medication is not to be used in isolation but in the context of overall management. The role of the medication is to facilitate weight loss and, above all, to promote medium-term weight stability. The drugs are therefore prescribed for several months for responders. The rules for their use have been clearly defined by several consensus statements (SIGN, 1996; NIH, 1998; WHO, 1998; WHO, 2003).

Bariatric surgery

Gastric restriction procedures (calibrated vertical gastroplasty, adjustable gastric ring) consist in creating a small gastric pouch whose rapid filling gives the patient a feeling of early satiety (Anaes, 2001; Chevallier *et al.*, 2004). Mixed procedures combining gastric reduction with a bypass circuit give rise to a variable degree of maldigestion. Gastric bypass is the most widely conducted procedure. The biliopancreatic bypass enables biliopancreatic secretions to be diverted via a very distal anastomosis, at about 50 cm from the ileocecal valve.

Bariatric surgery is a good treatment, if not the best, for very severe obesity (Anaes, 2001; Basdevant, 2004; Chevallier *et al.*, 2004). However, the long-term outcome of patients who have undergone very great weight loss is uncertain. The risk of micronutrient deficiencies are marked. The benefit with respect to mortality has yet to be elucidated. The short- and medium-term complications are not negligible. This type of treatment is therefore restricted to patients presenting with massive obesity (class 3; BMI ≥ 40 kg/m²) or severe obesity (class 2; BMI ≥ 35 kg/m²) associated with concomitant diseases threatening health (Basdevant, 2004). Good quality medical and surgical follow-up is thus necessary, and for life.

Results and evaluation

The efficacy of obesity treatments would seem easy to evaluate and numerous literature reviews have addressed the subject. However, that is not the case for many reasons, mainly methodological. The protocols are rarely comparable. For instance, the grouping of studies of differing durations in certain meta-analyses seems debatable. Moreover, long-term studies are rare and few involve determinations addressing dietetics, physical exercise and counseling to modify general behavior (McTigue *et al.*, 2003). Only the positive studies are published. The debate is thus not always free from bias.

Older studies showed that only 5% of patients were able to lose weight and maintain the loss for 5 years. However, that pessimistic conclusion has been challenged by recent studies (McTigue *et al.*, 2003; Avenell *et al.*, 2004; Li *et al.*, 2005). Moreover, even if the results in terms of body weight are modest, they may be sufficient to have positive effects on quality of life and concomitant diseases (NIH, 1998; WHO, 1998; Tuomilehto *et al.*, 2001; DPP, 2002).

Nutritional counseling

Dietetic protocols frequently yield excellent results over the first few months but disappointing results beyond 6 months (Avenell *et al.*, 2004). The weight loss may be moderate overall, i.e. about 3 to 5% of the initial weight, after 1 year (Ziegler *et al.*, 2005). Good responders are infrequent: 10 to 20% of patients lose at least 10% and 20 to 40% lose at least 5%. Treatment compliance, a process which is difficult to analyze, depends, at the start of the treatment, on the patient's idea of the efficacy of the diet and, as time passes, on the restrictions the diet imposes.

Low-calorie and low-fat diets are still preferred by the experts since they have been the most studied and are the most satisfactory with regard to nutritional equilibrium. Low-carbohydrate diets appear very effective over the first few months but give the same results at time point 1 year as those of other dietetic treatments. Similarly, protein diets induce spectacular weight loss over the first few weeks (from 5 to over 15 kg depending on the duration of treatment) but after 1 year the results are similar to those of other studies (Avenell *et al.*, 2004; Basdevant *et al.*, 1998). A meta-analysis of the US studies (Anderson *et al.*, 2001) showed that the mean weight loss was 6.3% with 5 years of follow-up. In all, the ultimate success of weight loss depends on the magnitude of the energy deficit, the duration of treatment and, obviously, compliance. The C-L-P makeup does not clearly influence the final result (Ziegler *et al.*, 2005).

Physical exercise

Physical exercise cannot be used as the only therapeutic means of combating obesity. The results observed are modest: weight loss is frequently less than the theoretical forecasts. In fact, the subject tends to become more sedentary during the time when he/she is not actively exercising. However, physical exercise is the most important prognostic factor during the weight-maintenance phase (SIGN, 1996; NIH, 1998; WHO, 1998).

Cognitive and behavioral approaches

The short-term positive effects of cognitive and behavioral therapies do not carry over completely into the long term (Basdevant *et al.*, 1998). At time point 18 months, the weight loss was about 8% in the US studies (Foster *et al.*, 2005). Patients gradually return to their baseline weight in the 5 years following the end of the program. Nonetheless, the positive effects on self-esteem, body image and interpersonal relationships may last.

Obesity medication

Obesity medications all currently have similar efficacies, which are limited (Ziegler *et al.*, 2004; Li *et al.*, 2005). In the absence of comparative studies, it is difficult to go any further. Medication is more successful with accompanying measures (dietetic, physical exercise, behavioral approaches) that are carefully applied. The mean weight loss is 8 to 10% at time point 1 year, i.e. 3 to 5% more than that in the untreated group. Responders (weight loss greater than or equal to 10%) are 2 to 3 times more numerous in the medication group than in the placebo group (Scheen, 2002; Ziegler *et al.*, 2004).

Two studies are noteworthy in that they validate new concepts. In the first study, the Storm' study (James *et al.*, 2000), sibutramine enabled weight stabilization at a plateau for 18 months after loss of 12 kg in the preceding 6 months. On placebo, weight regain was almost total. The second study, 'Xendos' (Torgerson *et al.*, 2004), with the longest published follow-up,

clearly shows that the effect of the drug was maintained for 4 years. The effect was undoubtedly less good at the end of the study than during the first year but the mean weight loss was nonetheless 6.9 kg for the patients on orlistat who completed the study vs. 3 kg for the placebo group. In all, 45% of the patients lost 10% of their baseline weight. The effect on type 2 diabetes mellitus risk was major: the relative risk reduction was 37% in the orlistat group but 45% for the subjects classified as glucose-intolerant at baseline.

None of the obesity medications is reimbursed while surgery is.

Multifocal programs

Two types of programs will be considered as examples. The programs variably associate various measures described above. The first program targeted prevention of type 2 diabetes mellitus risk in subjects at high risk because of glucose intolerance. The second program was a general practitioner program.

Targeted overall management: DPS and DPP

The marked success of the type 2 diabetes prevention programs changed the opinion that most clinicians had with regard to the 'lifestyle-dietetic' approach. In about 5 years, the incidence of the disease fell 50% in the pre-diabetic subjects who underwent counseling on a change in lifestyle and appropriate therapeutic follow-up and education. The five essential objectives of the Finnish Diabetes-prevention study (DPS) (Tuomilehto *et al.*, 2001) were as follows:

- weight loss of at least 5% (success rate: 43% in the intervention group vs. 13% in the control group);
- lipid intake reduction of at least 30% of the TEI (47 vs. 26%);
- increased fiber intake (25 vs. 12%);
- reduction of saturated fat intake to less than 10% of the TEI;
- moderate physical exercise for more than 4 hours per week (86 vs. 71%).

The US Diabetes-prevention program (DPP) (DPP, 2002) was much more expensive than the Scandinavian version but achieved the same result.

General practitioner intervention: the Counterweight program (CWP) example

In order to enhance general practitioner commitment, the CWP proposed 4 stages based on the practice audit method:

- select the priorities together;
- draw up recommendations;
- measure 'performances';
- improve them (Laws, 2004a and b).

The results of the assessment were edifying: only 8% of the physicians considered they could spend more than 10 minutes setting up a personalized strategy after having conducted the initial evaluation of the patient and disease. UK physicians' offices have the advantage of having nurses working in them. The CWP gave those nurses an essential role in patient management. The therapeutic choices were multiple (dietetic, physical activity, behavioral approach, obesity medication, individual or group therapy) and adapted, first, to the patient's motivation and, second, to the risk level associated with the obesity.

The patients recruited presented with severe obesity (mean BMI of 36 kg/m², concomitant

diseases in 75% of cases). The preliminary results were encouraging: the weight loss at 1 year was 4.7 kg for the compliant subjects and 43% of the those subjects had lost more than 5% of their baseline weight (Laws, 2004a and b).

Bariatric surgery

The weight loss may exceed 40 to 50 kg after 1 year (Anaes, 2001; Basdevant *et al.*, 2004; Chevallier *et al.*, 2004). There is a major improvement with respect to concomitant diseases and quality of life. The effect on diabetes incidence is particularly marked. Efficacy varies depending on the surgical technique. Biliopancreatic bypasses induce the greatest weight loss but complications are probably more frequent. Gastric bypass seems more effective than gastroplasty with respect to weight loss and perhaps certain concomitant diseases. The gastric ring raises the problem of the fate of the ring over time. The repeat surgery rate appears high.

The only reference study, the SOS study (Sjöström *et al.*, 2004), generated contrasting results after 10 years of follow-up. The weight loss, spectacular in the first year, fell over the course of the study from 37 to 23% for the gastric bypass, from 25 to 16% for the calibrated vertical gastroplasty and from 20 to 13% for the adjustable gastric ring. Certain effects, such as those on blood pressure, were not maintained.

Risk/benefit ratio

The results of the diets are overall far from excellent (Avenell *et al.*, 2004a and b). Their adverse effects thus have to be as limited as possible. For very low-calorie diets, the risk of acute complications necessitates close medical surveillance. The risk of chronic complications is difficult to evaluate. Any diet procuring less than 1500 kcal/d is associated with a high probability of multiple nutritional deficiencies (Ziegler *et al.*, 1997). It is important to approximate the recommended dietary intakes, irrespective of the dietetic strategy selected. Diet repetition exacerbates the risk

The adverse effects of obesity medications, well analyzed during the trials, are not to be underestimated post-marketing, particularly since long-duration use is envisaged (Li *et al.*, 2005). Pharmacovigilance is thus of the greatest value.

The complications of bariatric surgery should receive the same assessment (Basdevant, 2004). Numerous patients having undergone surgery have had no specific follow-up. The cases 'lost to follow-up' are probably even more numerous in practice than in the published studies.

Reflections on the evaluation

The above results suggest that it is necessary to conduct practice evaluation studies in France.

Attending physicians' requirements: the UK example

The vast majority of UK physicians interviewed in the National Health Service study (Bourn, 2001) considered that the management of overweight and obese patients was their responsibility and that they were well placed to promote a healthy and appropriate lifestyle. However, they had doubts: 73% stressed the lack of evidence with regard to evaluation of appropriate treatments and 64% indicated that the treatments available were, in their opinion, not very effective. The physicians wanted better practical training, quality information on the treatments available, and, above all, instruments and algorithms for therapeutic decision-making. Only 4% of the physicians used the existing protocols. There is

no reason to think that the situation is any better in France.

Cnamts study of bariatric surgery in France

Bariatric surgical procedures have considerably increased in France as they have in other countries: 2000 in 1995, 16,000 in 2001, 20 to 30,000 in 2003. The Cnamts (2004) conducted a survey of the practices addressing patients undergoing surgery between December 1, 2002, and January 31, 2003 (1,138 procedures) and the 1003 patients seeing an advisory physician in the context of their prior health-insurance agreement application. The main technique used in France is celioscopic implantation of an adjustable gastric ring (96.1% of procedures). In all, 72.9% of the procedures are conducted in the open-care private sector. The report states that there are few short-term complications: 5% during hospitalization, 0.2% deaths. The indications are sometimes debatable: 16% of the patients should not have undergone surgery (incorrect indications or non-compliance with the contra-indications). The study concluded that compliance with the reference system is far from perfect (Cnamts, 2004).

Prospects and orientations

In the field of obesity, medicine has markedly evolved over the last 20 years. The strengths are worthy of note. A French culture is developing as shown by the publication of the first medical treatise on obesity in 2005 (Basdevant and Guy-Grand, 2004). French specialists have contributed to the international consensuses. Recommendations were proposed in 1998 and subsequently validated by the Anaes. Bariatric surgery has also attracted considerable interest. The PNNS has clearly described the major options in the field of promoting health. There is thus a degree of national consistency, which now needs to be put into practice.

However, a number of weaknesses also deserve attention. The training given to physicians and paramedical personnel could be improved since obesity is a complex disease and poorly understood. Treatment failures often result from tactical errors: unrealistic objectives, excessively severe diets, absence of response to the patient's expectations and not taking the patient's motivation into account.

It would appear necessary not only to increase the care offer but also to organize the healthcare system better to promote enhanced access while promoting development of the new skills indispensable for control of the epidemic.

Increasing the care offer

The French care system seems little adapted to the management of the obesity epidemic that is occurring, even though the system is evolving (Basdevant *et al.*, 2004; Ziegler *et al.*, 2005).

Medical offer

The attending physician is naturally the pivot of the system (table 10.V, Ziegler *et al.*, 2004). Since the attending physician knows the patient and his/her family, he/she is generally the best placed to ensure the coordination of screening and care. But that requires a personal involvement and time, new resources and recognition of a preventive and educational action.

The second line of defense involves physicians with experience in obesity medicine (physicians qualified in nutrition, endocrine disease and diabetes specialists, internal medicine specialists) or organ specialists. Serious eating behavior disorders, severe or very early obesity, complicated obesity (sleep apnea syndrome, diabetes, respiratory insufficiency, heart failure, etc.) require specialists.

Other healthcare professionals

The conventional role allocated to dietitians, whose importance is recognized by all the expert consensuses, is clearly inadequate in France (Krempf, 2003). The healthcare system ignores dietitians at the hospital and in open-care. Their practices are not included in the official nomenclature and not reimbursed for patients who consult in open-care.

Psychologists could also play an important role. Cognitive and behavioral approaches are rarely used since there are no positions in the hospital environment and setup is difficult in open-care.

The promotion of physical exercise and the combat against sedentariness are essential. Physiotherapists could be called on more to get sedentary people moving, as a function of their handicap, their functional capabilities and the risk factors. Physical education teachers and trainers could also contribute to the actions of prevention and promotion of health through physical exercise. New professions are to be created in that field.

Open-care and hospital nurses are currently little or not at all involved. They could nonetheless fulfill a great number of functions in the long-term follow-up of patients, as is the case in certain countries such as the United Kingdom.

Pharmacists are well placed to promote the attention of the overall population and that of subjects at risk with respect to nutritional diseases. Pharmacists constitute an information relay with regard to both care and prevention that is not sufficiently exploited.

Midwives could be more involved in the prevention of excessive weight gain during pregnancy and in the control of a balanced diet given the antenatal programming of metabolic diseases.

Healthcare system organization

The current organization does not achieve a sufficiently high performance since the prevention and treatment strategies are set up as a function of offer and demand with no overall policy. Broadly speaking, a better coordinated system (table 10.V) should aim at improving the state of health of subjects at risk at three levels:

- body weight and composition;
- quality of life;
- complications of overweight and concomitant diseases.

Two types of structure (reference centers and networks) are gradually being set up (Ziegler *et al.*, 2004).

Table 10.V: Organization of the healthcare system to deal with the obesity epidemic (after (Ziegler *et al.*, 2004))

Actions	Objectives	Players	Targets
Primary prevention	Modifying lifestyle	Politicians, local decision-makers, business, consumer associations, media Physicians and other healthcare professionals	Society
Screening	Acting as early as possible	Physicians and other healthcare professionals: Maternal and Infantile Protection (PMI), school medicine, occupational medicine, general practitioners	Subjects at risk Young children
Treatment			
1st line	Early assessment and treatment	Attending physician	Common overweight and obesity
2nd line	Severe concomitant diseases	Nutrition specialists and other specialist physicians	Serious, recalcitrant and early-onset obesity
3rd line	Recourse	Reference centers Pluri-disciplinary team	Failures and serious cases
Follow-up	Preventing relapse Screening for complications	General practitioners or referral physician	All patients

Reference centers

The reference centers newly created (circular Dhos/E4/2005/82) in the form of 8 'inter-regional centers specializing in obese subjects' enable pluri-disciplinary teams to be built up (dietitian, psychologist, psychiatrist, physiotherapist, etc.). The circular states in detail the equipment plan and the operating flow-chart of an inter-regional center, which should also have a nutrition-teaching consultation service targeting prevention. Massive obesity and complicated or recalcitrant forms are to be managed in that type of structure. The number will undoubtedly need to be increased. We can but hope for the development of private and public structures accredited for the surgical management of very severe obesity.

Networks

The care network enables a partial response to the failings described above. The medical project linking the professionals is designed as a function of requirements and possibilities as assessed locally. Care coordination enables greater interaction of the various healthcare players who can all have appropriate training. Assessment is included in the specifications. An essential advantage of the networks is that of ensuring financing by exemption of certain services such as those of dietitians, providing that the predefined care protocols are fulfilled. These experimental structures have been growing in France over a few years, but more frequently target diabetes mellitus.

Skill promotion

Obesity treatment requires special skills which range from organ-specialized medicine to the humanities, psychology, sociology, etc.

Obesity medicine and therapeutic education

Obesity medicine is medicine centered on a person for whom the caregiver-care receiver relationship is of the greatest importance. That medicine has now been developing in France for a few years but the specialized hospital departments remain few in number while the requirements in terms of initial and in-service training of the medical profession are immense. By way of an example, the initial assessment of the patient and his/her disease in context does not simply consist in plotting the subject's weight curve and listing the risks or concomitant diseases. It is also important to elucidate the determinants that have resulted in the subject having an inappropriate high-calorie or high-fat diet and a sedentary lifestyle, and to determine the resistance factors with regard to weight loss.

Evaluation of the patient's motivation and ability to change is essential. The objectives are to be negotiated with the patient as the case is managed. Therapeutic education is a sort of contract which leads the care recipient to find solutions to change his lifestyle himself with support in the form of the empathy and 'technical' skills of the caregiver.

The promotion of group management is necessary for both economic and pedagogic reasons. Exchanges with others enables the obese subject to elucidate his own problems better. Interpersonal relationships have potent therapeutic effects. More generally, the development of cognitive and behavioral approaches is still insufficient in France due to a lack of trained personnel and financing.

Delegation of functions

The Berland report (2003) affords new and interesting prospects in this context. Clearly, there are not enough physicians to deal with the demand for care. Numerous functions could be delegated to paramedical personnel, including, in the first line, dietitians. As previously indicated, nurses could play a 'coaching' role and thus greatly enhance the patient follow-up under the responsibility of the attending physician.

Physicians qualified in nutrition

It appears necessary to define the scope of nutritional medicine and define the nutritional physician more clearly. The college of nutrition teachers is working on this subject. The only 'true' specialists on the subject are physicians holding a diploma of complementary specialized studies (DESC) in nutrition. The diploma was created in 1988.

Dietitians

The dietitian profession is the victim of an unjust and incoherent situation. Rules of good practice are to be defined as soon as possible. Reimbursement of dietetic practices in the context of the activities of a network or on the prescription of a 'physician qualified in nutrition' would be a judicious solution whose cost could be controlled.

Longer training (currently 2 years) is indispensable in order to enable dietitians to obtain enhanced status and superior professional training, as is the case in psychology and, more generally, in the humanities.

Improvement in the access to care

Access to care is problematic for many reasons. The number of skilled professionals involved is insufficient, particularly in the North and East of France. France already has two-tier medicine since most of the means to be implemented are not financed by the Social Security system. Lastly, obesity is a disease which particularly affects subjects with the lowest incomes.

Hospital department equipment

Equipment adapted to obesity in terms of dimensions and admissible loads are necessary in order to manage the morbid obesity which affects 0.6% of the adult population. The number of massively obese adolescents is also increasing sharply. An accurate assessment of the situation was recently conducted by the Paris Public Hospital Authority (AP-HP) pluridisciplinary working group (AP-HP report, 2004). The group's proposals were included in the circular: Dhos/E4/2005/82 (2005).

With regard to the hospital and medical equipment of the hospitalization departments, the following are involved:

- accommodation and medical and surgical equipment (specialized beds, anti-decubitus ulcer mattresses, etc.);
- care equipment (examination tables, care and examination chairs, scales, patient hoists);
- stretchering equipment (wheelchairs, stretchers, gurneys);
- sanitary equipment (baths, shower carts);
- bedroom, consultation room, waiting room and relaxation area furniture: chairs, tables.

For medical-imaging systems, the same problems arise with regard to the acceptable load for radiology tables or CT, MRI or γ -camera examination beds. The abdominal diameter of massively obese patients restricts their access to the MRI or CT-scan tunnel.

For conventional radiology, the examinations may be conducted on a gurney fitted with a radiolucent top in a specially-adapted polyvalent 'bones-lungs' room.

Sectional imaging (CT-scan and MRI) is associated with technical problems that have yet to be resolved (AP-HP, 2004). The same applies to digital angiography and nuclear medicine.

It is thus important to inventory hospitals' needs in the context of a policy of reference centers and set up a national policy for purchase of specific equipment.

The AP-HP report (AP-HP, 2004) also recommends creating pools of easily moved equipment that could be provided to non-specialized departments for the management of obesity.

Care reimbursement

The services of dietitians and psychologists are not reimbursed. However, those services are frequently indispensable. Obesity medications, which are of value in facilitating body weight stability after the initial weight loss phase, are hardly used since they are expensive and the patient has to pay for them. In practice, the mean duration of treatment does not exceed 2 to 3 months, which is in contradiction with all the learned societies' recommendations.

Obesity: a social disease

The access to care of the obese subjects who most need it remains problematic. Obesity has become a social disease which more severely affects the lowest income groups and people in precarious situations (Basdevant *et al.*, 1998; WHO, 1998). We will have to find new means of action since the traditional medical approaches are not very effective for families experiencing great social difficulty.

Identification of priorities

The magnitude of the public health problem and the difficulties encountered in dealing with it provide the rationale for defining realistic priorities.

Prevention and weight stability

Prevention of overweight and obesity in children and adolescents should be a national priority if we are to halt the epidemic in time. The epidemic is affecting France 10 years later than other countries such as Germany, the United Kingdom and the United States.

The prevention of additional weight gain by overweight or already obese subjects is also an objective worthy of the greatest attention. However, it is rather negatively viewed by the medical profession and the patients involved.

Identification of obesity cases at risk

The approach which is applied to dyslipidemia could also be applied to obesity since the two diseases share numerous features. The objective is to take long-term therapeutic decisions on the basis of the overall risk assessment. Abdominal forms, severe obesity (classes 2 and 3), and forms with concomitant diseases deserve special attention. The higher the risk, the more intensive the treatment must be.

Quality of life and obesity stigmatization

Obese subjects have a poor quality of life comparable to that of subjects presenting with cancer or a serious handicap. The obese are the victims of social stigmatization since they are considered guilty of gluttony and sloth. The medical profession has a tendency to use the same reasoning when it considers that obese subjects are alone responsible for the treatment failures.

In conclusion, the therapeutic choices are proposed on the basis of the recommendations of good clinical practices and in accordance with the rules of evidence-based medicine. It is important to develop the care offer for obese subjects who ask for it so that they can benefit from appropriate treatment programs both in the initial phase of treatment and during the weight-stabilization phase. Prevention of relapse should be systematically incorporated. This means that the attending physician must be involved throughout the approach and that the educational aspects must be promoted. The creation of reference centers with appropriate equipment is to be encouraged.

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11

International research

Given the growing epidemic of obesity, its health consequences and its economic impact, some countries have mobilized their research potential using various modalities and calendars. The strategic plan of the US National Institute of Health (NIH) constitutes the most advanced and largest-scale approach. In parallel, the Institute of Medicine of the National Academies has defined a plan for the prevention of childhood obesity which includes a research component. In Europe, various initiatives have been taken at national level, in particular in Great Britain and France, or at community level through the projects of the 5th and 6th FPTRD¹⁵. This chapter does not attempt to exhaustively describe the programs but rather, through an analysis of certain programs, to define guidelines that could contribute to the thinking on the measures to be developed in France.

US initiative: 'Strategic plan for NIH obesity research'

For the NIH¹⁶, obesity research has become a priority. The first condition was to combine basic research, clinical research and population-based research with the objective of transferring knowledge for the benefit of individual and collective interventions. The aim was to elucidate and respond to a particularly complex public health issue. Only an interdisciplinary approach enables elucidation of a system resulting from the complex interactions of behavioral, environmental, socioeconomic and cultural factors and revealing predisposing biological factors, particularly underlying genetic factors. The combat against the spread of obesity thus called for a national collective effort, involving not only the NIH but also other government agencies and other players (academics, politicians, economists and associations). The NIH plan of action, while essential, is thus only a component of a national effort.

Design of the strategic plan

The process which led to design of the plan is worthy of attention. In April 2003, the director of the NIH decided to set up the NIH Obesity Research Task Force to impart impetus to obesity research in the various institutes of health. The working group was to be led by the Director of the National Institute of Diabetes and Digestive and Kidney diseases (NIDDK) and the Director of the National Heart, Lung and Blood Institute (NHLBI). The guideline was mobilization of all of the NIH institutes in an interdisciplinary perspective. The objective was to identify the research fields and emergent issues in order to define a concerted and consistent research policy. The program was to distinguish between the short-, medium- and long-term objectives in the basic sciences, clinical research and epidemiology together with interventional strategies in the field of public health. Program design resulted in a vast in-

¹⁵ Framework program for technological research and development in Europe

¹⁶ The Strategic Plan for NIH Obesity Research. <http://www.obesityresearch.nih.gov/About/strategic-plan.htm>.
Weight-control Information Network 1 WIN Way Bethesda, MD 20892-3665. Email: win@info.niddk.nih.gov

house and outside audit of the NIH through a series of meetings, workshops and presentations to civil society (consumers, patients' associations), learned societies and healthcare professionals. The NIH is also attentive to the opinions of the Clinical Obesity Research Panel (CORP) which combines leading researchers and clinicians in the field. The draft program has been repeatedly submitted to experts outside the NIH. The program construction process is in itself worthy of detailed analysis since it is rich in information on the methods of collecting information, analysis and the synthesis of academic and societal points of view. Finally, before being definitively closed, the document was submitted to public opinion on the Internet. The plan was designed as a dynamic process which evolved as a function of emergent opportunities.

Mobilization and coordination of research forces

The strategic plan is based on the mobilization and coordination of a large set of research forces in a transdisciplinary perspective enabling development of pertinent studies on the biological, behavioral and environmental determinants of obesity, on the molecular and cellular bases and on the economic foundations. The aim was to promote constitution of interdisciplinary programs and/or teams and to contribute to the circulation and transfer of knowledge. While the NIDDK and NHLBI are the keystones of the program, numerous other institutes are contributing: National Cancer Institute, National Human Genome Research Institute, National Institute on Aging, National Institute of Alcohol Abuse and Alcoholism, National Institute of Arthritis and Musculoskeletal and Skin Disease, National Institute of Biomedical Imaging and Bioengineering, National Institute of Child and Health Development, National Institute of Dental and Craniofacial Research, National Institute on Drug Abuse, National Institute of Environmental Health Sciences, National Institute of Mental Health, National Institute of Neurological Disorders and Stroke, National Institute of Nursing Research, National Center Complementary and Alternative Medicine, National Center on Minority and Health Disparities, National Center for Research Resources, Office of Science Policy, Office of Dietary Supplement, Office of Disease Prevention, Office of Behavioral and Social Sciences Research, Office of Women's Health.

Objectives and subjects

Four main subjects were selected for the strategic plan.

Prevention and treatment of obesity by modifying lifestyles

The definition of preventive and therapeutic strategies involves identification of the behavioral and environmental factors contributing to the development of obesity in children and adults, the design and assessment of interventional strategies, study of the effects of specific modifications of diet and physical exercise, and the role of the environment inducing excessive calorie intake and sedentariness. It is also important to study how the recommendations are perceived and applied by healthcare professionals and individuals. The plan encourages the study of conceptual models of change in behavior and the study of factors influencing beliefs, perceptions, attitudes and motivations. The work is also to address different populations at various ages and to address the genetic factors determining individual susceptibilities. The latter not only involve energy expenditures but also other dietary behaviors.

Short-, medium- and long-term objectives were defined for the various studies (table 11.I).

Table 11.I: Objectives of the short-, medium- and long-term studies

Short-term objectives

Determining the impact of nutritional messages and physical exercise messages on the current weight control strategies in various populations
Determining the knowledge and know-how of the healthcare personnel involved in clinical practice
Determining the behavioral and environmental determinants of malnutrition and sedentariness in children and the obstacles to physical exercise and a balanced diet
Defining parental knowledge and attitudes towards physical exercise and diet
Determining the subpopulations (gender, age, race, etc.) in terms of dietary behavior and physical exercise
Determining the influence of low-income, dietary insecurity and other economic factors

Medium-term objectives

Determining the respective contributions of the various socioeconomic, familial and cultural factors involved in the development of obesity and determining the obstacles to prevention
Situating the impact of advertising on food preferences and sedentariness in children and adults
Studying the impact of the urban environment on eating habits and physical exercise
Developing and testing strategies for maintaining children in good nutritional health through individual, interpersonal and population-based interventions in various contexts
Comparing various strategies designed to increase physical exercise (as a function of intensity, duration and frequency)
Determining alternative approaches (internet, groups, telemedicine)
Evaluating the impact of qualitative modifications of macro- and micronutrients on energy metabolism, food intake and body composition
Determining the efficacy and persistence of the effects of discrete modifications in intakes and expenditures
Evaluating the determinants and progressive characteristics of food preferences
Elucidating the relationships between psychological factors and obesity
Elucidating preventive strategies for eating behavior disorders

Long-term objectives

Determining the gene-environment interactions in specific populations as a function of genetic variants, taking into account the various behavioral factors
Identifying the predictors of weight loss in response to interventions on lifestyle
Identifying the factors predicting compliance with preventive actions and treatments
Defining and analyzing the results of preventive strategies in various populations, at various ages, based on various approaches (exercise, nutrition, environmental changes)
Determining whether the benefits of the campaigns are proportional to the pressure exerted
Determining the factors that constitute obstacles to the setup of preventive measures
Studying the potential impact of information and prevention campaigns on the development of eating disorders, stigmatization and discrimination
Ensuring the transfer of the scientific knowledge to those in the field

The plan of action gave rise to a series of subsidies to ongoing studies on: the effects of changes in macronutrient composition on food intake and body composition; the molecular and behavioral mechanisms involved in weight gain after weight loss; interventions in school and occupational settings; prospective follow-up of a cohort of 100,000 children over 21 years; impulsive and addictive eating behaviors; the relationships between obesity and cancer; the effects of modifying the environment (architecture, urbanization policy, transport system, etc.). Support has also been given to studies of economic factors.

Prevention and treatment of obesity by pharmacological, surgical and other approaches

Control of food intake is a complex process involving a biopsychological system in which multiple internal and external determinants intervene. A neurohormonal set acts as the medium for transmission of information on digestive, absorptive and post-absorptive status, the level of energy reserves and, more generally, nutritional status. Homeostatic, metabolic, hormonal and nervous signals are sent from the peripheral tissues to all of the body, in particular the brain. The central nervous system is responsible for integrating the messages

from the periphery and triggering the appropriate adaptational responses, which do not simply consist in the immediate metabolic aspects but also take into account learning, conditioning and memory, together with sensory and affective factors. On that neurohormonal system are superimposed psychological and social factors soliciting memory, pleasure and many other functions. The two-level integration results in food intake fitting individual requirements. The start and end of the meal result from the balance between the stimulatory and inhibitory factors. The triggers for food intake are external (sensory perceptions) and internal (energy reserve status). The inhibitors are digestive and post-ingestive, triggering the suppression of hunger, then fullness, then satiety. The relative contributions of the many factors triggering food intake are under debate. The contributions vary from one individual to the next and depending on the situation. Elucidation of the biological bases of energetic homeostasis by means of molecular and genetic studies should enable definition and evaluation of pharmacological and surgical treatments. The approach above all targets treatment, but in certain clearly identified circumstances of weight gain (e.g. weight gain on neuroleptics, after brain surgery or after quitting smoking) pharmacological preventive strategies may be envisaged.

The forms of genetic obesity in animals and man constitute models enabling identification of the role of certain molecules or neurohormonal systems and also constitute a series of experimental models. Once again, there is an imperious need to develop models enabling analysis of gene-environmental interactions. The underlying hypothesis, which has yet to be proven, is that preventive strategies are to be oriented as a function of genetic status.

In the field of prevention, short- and medium-term objectives consist in identifying the genes predisposing to behavioral and environmental factor effects in various well characterized populations. In the longer term, the objective is to analyze the factors resulting in weight regain after dieting in order to develop strategies to prevent body weight rebound. Another major objective is to elucidate the biological, behavioral and environmental factors which induce weight gain during critical periods for body weight status during life: fetal and neonatal period, adolescence, pregnancy and menopause. Once again, targeted prevention strategies would appear feasible. Those strategies would be based on behavioral and/or pharmacological actions targeting subjects known to be predisposed on the basis of the studies cited above.

With that aim, the NIH provides support to programs in the following fields: integrative approach to energy homeostasis, obesity genetics and genomics, intrauterine and neonatal factors, role of antipsychotic drugs.

Links between obesity and its complications

Elucidation of the pathophysiology of the various complications of obesity (particularly type 2 diabetes mellitus, cardiovascular diseases, hepatic steatosis, cancer and osteoarthritis) necessitates, among other things, study of the molecules secreted by adipocytes and responsible for inflammation, hypertension and insulin-resistance, and study of the cellular and biological characteristics of the various adipocyte deposits. The prevention of complications should be based on the identification of molecular biomarkers, molecular signatures enabling elucidation of the risk or initial stage of complications in various populations. From that point on, preventive strategies targeting the complications could be envisaged.

In the short and intermediate terms, the objectives of the research program in that field are: defining methods for data collection in order to develop epidemiological studies enabling identification and evaluation of the various complications in various populations; identifying new biomarkers using genomic and proteomic approaches; elucidating the

relationships between obesity, inflammation and the development of complications; and determining the predictive value of the biomarkers. In the longer term, the objective is to determine the variations in genetic susceptibility in order to optimize preventive and therapeutic strategies and test new preventive strategies.

The NIH strategic plan is providing particular support to studies applying proteomic methods to the identification of biomarkers, studies of adipose tissue heterogeneity and transdisciplinary studies on energy metabolism and cancer.

Other subjects

The NIH strategic plan includes a series of other measures of a different nature. The question of social inequalities is central. In the United States, the social disparities in health are particularly marked, amplifying what is also observed in Europe. The objective is to differentiate the public health actions and messages. The program, in all those facets, insists on the priority targets, i.e. the populations particularly affected by obesity for ethnic and socioeconomic reasons, the elderly or handicapped and extremely obese subjects. The strategic plan incites development of new methodologies for investigation of eating behavior, energy expenditure and body composition and the development of investigator training. Setup of multi- and interdisciplinary research teams is strongly encouraged. The strategic plan recommends developing an interdisciplinary approach by combining the study of behavioral and environmental determinants in a culturally sensitive manner with the study of biological and genetic factors. It is thus recommended that the interdisciplinary research structures include clinical investigators experienced in phenotyping obesity and in metabolic and endocrine investigation, psychobiology specialists, experts in functional imaging and biology researchers. Similarly, it is considered important to develop translational research moving from basic research toward clinical research and from clinical trials toward population-based interventions. Thus, the need for research on the modalities of transferring knowledge and information to healthcare professionals and the public is stressed. The NIH has also launched partnerships with other governmental agencies, professional organizations and private organizations in order to tackle the questions and their strong implications for society.

The short-term objectives are: to identify the methodological obstacle restricting research progress (e.g. instruments to assess the energy balance); to increase the efforts to create truly interdisciplinary structures; and to identify research and transfer networks. In the medium term, the objectives are: to develop information collection technologies enabling evaluation of behavior and environmental exposure; and to test the utility of the new markers in the evaluation of the impact of preventive and therapeutic measures. The objective is also to evaluate medical practices with respect to nutritional and physical exercise counseling and to identify the obstacles to transmission and implementation of recommendations. Particular attention is to be paid to evaluating the impact of public health campaigns and to the scope for preventive partnerships with political, economic and social players. The question of preventive behavioral counseling has also been tackled, together with that of delegating skills. Research is also investigating the modalities and impact of information for the public, decision-makers and public organizations.

Report of the Institute of Medicine of the National Academies

In 2001, the US Surgeon General published a 'Call to action to prevent and decrease overweight and obesity'. At the request of the US Congress, the Centers for Disease Control and prevention (CDC) asked the Institute of Medicine to develop a plan of action for the

prevention of obesity. The action mobilized 19 multidisciplinary committees. The full report is available online¹⁷. Although the investment in the research was USD 379 million at the NIH, the Academies have pleaded for further investment. Three priority subjects have been selected: assessment of prevention programs, research on behavior and research on community actions (economic, environmental). A table of priority actions has been compiled and states the players (table 11.II).

Table 11.II: Priority actions (after the report by the Institute of Medicine of the National Academies)

Federal government

Setup of working groups and coordination of preventive actions; development of nutritional recommendations; support of research on the nutritional and behavioral aspects; development of recommendations on communication and advertising for foods; strengthening of epidemiological monitoring and public health monitoring

Industry and media

Developing research on healthier foods and innovation on the presentation of foods; improving nutritional communication; supplying informative and reasoned messages

State policy

Developing and promoting physical education; developing incitements and partnerships to enhance the quality of foods

Healthcare professionals

Enhancing the screening and counseling in the field of obesity

The report insists on cost-effectiveness evaluation of the studies. Effectiveness cannot be separated from profitability. The CDC are currently working on the Move project which is calculating the cost-effectiveness of an intervention targeting physical exercise. The following assessment of the studies ongoing and expenditures committed in the United States has been reported: Food stamp program USD 20 billion; WIC USD 4.3 billion; National school lunch program USD 6.9 billion; School breakfast program USD 1.6 billion; Child and adult care food program USD 1.9 billion.

Canadian initiative

In Canada¹⁸, a large share of the national research on obesity is financed by the Institute of Nutrition, Metabolism and Diabetes (INMD), one of the 13 institutes of the Canadian Institutes of Health Research (CIHR). In 2001, the INMD launched a strategic initiative entitled 'Excellence, innovation and progress in the study of obesity and healthy body weight'. The INMD is looking to attract scientists working in various disciplines to obesity research. The INMD supports projects on the complications of obesity, on indigenous people communities and preventive actions and programs on health promotion. The 'Canada in movement' program, a preventive program financed by the INMD and its partners, encourages adult Canadians to evaluate their physical exercise using pedometers and to upload the data on their personal activities to an online research instrument.

The program supports various partnerships such as the Canadian Heart Disease Foundation, the Canadian Diabetes Association, the Canadian Kidney Foundation, Canada Health and

¹⁷ Institute of Medicine of the National Academies. Preventing childhood obesity. Health in balance. The National Academies' Press, Washington, DC. <http://www.iom.edu/report.asp?id=22596>

¹⁸ Obesity Research in Canada. <http://www.cihr-irsc.gc.ca/e/20406.html>

several other institutes of the CIHR, including the Cancer Institute, the Institute of Women's and Men's Health, the Institute of the Musculoskeletal System and Osteoarthritis, the Institute of Circulatory and Respiratory Health, the Institute of Aboriginal Peoples' Health and the Institute of Human Development, Child and Youth Health. In Canada, the subject of obesity is a priority for the CIHR, the main subsidizing organization. In 1999-2000, \$ 4.2 million were invested in obesity research. In 2004, the subsidies increased three-fold to \$ 15 million.

European Community

In January 2003, under the auspices of the European Community, experts met at the Rowett Research Institute in Aberdeen to analyze the conditions under which European research on obesity could progress¹⁹. The initial recommendations were as follows: promoting pathophysiological studies incorporating human and animal genetics; setting up interventional studies on management and the effects of early nutrition.

It was suggested that the programs should be conducted in the context of a European institute for obesity research, a virtual institute, or an excellence network in the context of the 6th framework program for technological research and development (FPTRD). The objective was to harmonize the methodologies, manage common resources, coordinate training and increase the visibility of the research. Subsequent to the initial meeting, various initiatives were taken to advance the definition of the subjects and projects under the guidance of Wim Saris (The Netherlands), Arne Astrup (Denmark), Jon Arch (United Kingdom), Bert Koletzko (Germany) and Dominique Langin (France). Considering the stakes for society, the experts insisted from the outset on a series of proposals to be taken into account when considering the political choices for public health and research (table 11.III).

Table 11.III: Proposals of the European Community expert group

Obesity is to be considered a disease in itself
The care system does not meet the needs
New modalities of multidisciplinary approaches are necessary
Primary prevention strategies are to be particularly oriented toward children and adolescents, while secondary prevention is to address high-risk groups
The food industry can increase the quality and functionality of foods, improve its communication for children and act on portion size
Social inequalities require specific actions
The needs of the population may be in contradiction with those of industry and business
European research is to consider and exploit regional and cultural diversity

The questions facing the care system and which must be elucidated by research consist in the origins of the obesity epidemic and the definition of realistic preventive strategies, effective therapeutic strategies, and an integrative approach. In this context, it seems essential to improve the definition of the natural history of the disease, inter-individual variations in susceptibility and the reasons for treatment failures. Progress depends on enhanced elucidation of the molecular and cellular mechanisms underlying the development and chronicity of the disease as a function of the behavioral, psychological and environmental determinants. Special attention is to be paid to perinatal determinants. The ambition is to decrease the prevalence of adult obesity and reduce the current progression of childhood prevalence. This calls for enhanced understanding of the early determinants of the disease.

¹⁹ Increasing the Impact of European Obesity Research. <http://obesity.rowett.ac.uk/obesity/>

In order to respond to that situation, the experts recommended developing research and training excellence networks that can incorporate animal and human studies, and run studies at the molecular, clinical and population levels, in the context of multidisciplinary teams drawing on clinical centers and research centers including specialists in behavior, economics and social sciences. The structures are to promote the setup of shared methodologies and standardized procedures and enable implementation of large-scale quality studies using appropriate infrastructures. The research teams are to have access to biological resources (DNA and tissue banks).

The immediate issues may be divided into 3 categories:

- genetics and biotechnology: characterizing the genetic bases (gene expression and proteomics), biomarkers, gene-environment-physiology interactions, genetic susceptibility factors for obesity and its complications, pharmacological targets, genetic studies;
- lifestyle modification: multicenter, randomized studies on weight loss strategies including study of predictive factors (biological, genetic, behavioral) and definition of assessment and validation criteria;
- early nutrition: in this field, the key questions are: the effects of perinatal early nutrition on the risk of obesity; determining the critical periods and analyzing the program mechanisms; the respective effects of the environment and genetics on the development of obesity in children; the impact of nutritional information, dietary habits, sensory factors and physical exercise on obesity; the determinants of adiposity rebound in children; the development of obesity complications in children; the epidemiology of obesity in Europe and the regional differences.

The technologies to be developed in order to implement the scientific projects are: genomics, proteomics, bioinformatics, molecular imaging and all the genetic approaches. Considerable clinical resources are also required. This supposes the setting up of competitive, high-performance clinical research centers and sharing databanks. One technical problem to be resolved consists in the miniaturization of tissue specimens, particularly adipose and muscle tissue specimens. Lastly, food and nutritional phenotyping (energy balance, body composition) remains a difficulty for large-scale studies. Cooperation with the specialists in food behavior, sociologists and economists will undoubtedly be essential. Expertise in the human and social sciences is an essential element of the interdisciplinary approach to the field of obesity.

The ethnic, cultural and social heterogeneity of the European population is considered a considerable strength for obesity research in Europe. The heterogeneity gives rise to marked differences in forms of eating habits and, more generally, lifestyle, which add their effects to those of the genetic variables.

In order to implement the European obesity research policy, the constitution of a virtual institute has been proposed. The institute would act as a coordinating center for the research, build and administer a biobank, define quality criteria, constitute a source of information on European obesity research, constitute an interface for political decision-makers, and promote debate between associations, consumers and industry. The institute would standardize the investigation procedures, monitor study quality, monitor resource optimization, monitor databank management and monitor the setup of interdisciplinary research platforms. It is essential to ensure investigator training and mobility. A similar approach was developed in the content of the Nugenob project.

European programs

A few ongoing or pending European projects are cited below as examples.

Nugenob consortium

The Nugenob project²⁰ was designed to elucidate the interactions between a fatty diet and the genetic predisposition to obesity. In 8 European centers, 750 obese subjects and 115 controls have taken part in the study and complied with the 10-week dietetic intervention program (reduction in intake of 600 kcal/24 h; 25 or 45% lipids). The objectives were to: identify and characterize new candidate genes for obesity sensitive to the effects of nutrients; evaluate the effect of acute lipid intake on gene expression in adipose tissue; and study the expression in response to a prolonged, low-calorie diet containing different lipid levels. The responses are to be analyzed as a function of genetic variants. The objective is also to identify the predictors of weight change on diets with variable fat contents. The scientific managers of the study have formed a consortium which operates as could a virtual institute at European level.

Diogenes project

The Diet, Obesity and Genes (Diogenes) project is currently under study in the context of the 6th FPTRD (priority 5, food quality and safety). The objective of the consortium is to study the effects of macronutrient composition on weight gain and more particularly the influence of the glycemic index and protein content. The study includes detailed analysis of genetic factors, including genetic expression and peptidomics. The studies will be completed by behavioral and psychological analyses. The project includes research on food technology. Diogenes is designed to define how behavioral factors and genetic factors contribute to weight loss and/or regain. The study is being conducted in 8 countries and there are a considerable number of participants: Maastricht University (NL), The Royal Veterinary and Agricultural University (DK), Medical Research Council, Human Nutrition Research (UK), National Medical Transport Institute (Bulgaria), University of Crete (GR), German Institute of Human Nutrition (DE), University of Navarra (Spain), Nestec S.A. (CH), Charles University (Czech R), Inserm (F), Danone (F), IntraGen (F), BioVisioN AG (DE), Copenhagen Hospital Corporation, Bispebjerg Hospital (DK), Budapest University of Technology and Economics (H), National Institute of Public Health and the Environment (NL), Centro per lo Studio e la Prevenzione Oncologica (It), University of Helsinki (Finland), Epidemiology Unit (UK), Rowett Research Institute, Bucksburn (UK), University of Leeds (UK), University of Surrey (UK), Hochschule für angewandte wissenschaften Hamburg (Germany), Stichting technologisch topinstituut voedselwetenschappen (NL), NIZO Food Research (NL), The Norwegian Food Research Institute (Norway), Unilever Nederland BV (NL), NetUnion (CH), CortecNet (F).

Transnational study: PorGrow project

The project: Policy options for responding to the growing challenge from obesity (*PorGrow*)²¹ is a transnational study designed to compare health policies with regard to the prevention of obesity. The PorGrow project is designed to collect and review the viewpoints of the various academic, political and economic players with respect to preventive strategies. The

²⁰ nugenob project. <http://www.nugenob.com/>

²¹ PorGrow project. Policy options for responding to the growing challenge of obesity. <http://www.sussex.ac.uk/spru/1-4-7-1-8.html>

methodology is innovative: it enables definition of how the decision process operates in the field of obesity prevention. The study is being coordinated by SPRI-Science and Technology Policy Research, University of Sussex, Brighton, United Kingdom. The study involves France (Institut de Recherche pour le Développement), Cyprus (Research and Education Foundation of Child Health), Finland (The UKK Institute for Health Promotion), Greece (University of Crete), Hungary (Semmelweis Medical School), Italy (Institute of International Sociology), Poland (Instytut Zywnosci I Zywienia) and Spain (University of Alicante).

Pediatric programs

The diet over the first few months of extrauterine life and even, at the fetal stage, the impact of the future mother's diet on prenatal nutrition, trigger a metabolic programming process which marks the human being for life. Research in this field is a very important area of preventive medicine. Combined in the Infant Nutrition cluster, three European projects are addressing the 'programmed' relationships on the basis of the diseases of fetal growth, infantile obesity and insulin-dependent diabetes mellitus. Various European programs are tackling the question. The program: 'Childhood obesity: early programming by infant nutrition' is worthy of special note. Financed by the European Commission, the € 2 million program began in 2002 and is scheduled to last 3.5 years. The objective is to analyze the effects of early diet (breast-feeding, quality of infant formulas, lipid and protein content) on nutritional status. In other words, to what degree can breast-milk and infant formulas be compared? The European project will monitor two groups of babies fed with formulas containing different protein contents while breast-fed babies will constitute a control group. The children will be followed up for 2 years in order to elucidate the relationships between diet, growth and risk of obesity.

Medical Research Council program

In 2003, in the United Kingdom, the Medical Research Council (MRC) launched a large-scale research program (GBP 4 million) on obesity, diabetes and osteoporosis. The objective was to deploy integrative research exploring the genetic and environmental determinants before birth and throughout life. The research program is being conducted by the MRC Epidemiology Unit at Cambridge and the MRC Epidemiology Resource Center at Southampton.

In conclusion, while the various international initiatives to promote research on obesity differ in terms of their structure and implementation processes, they share strong options and orientations, reflecting a common dual preoccupation: the need to develop interdisciplinary research and research data transfer toward action in the fields. Only the United States have defined an overall strategy with precise objectives and a precise schedule. The special feature of the NIH strategic plan is that it mobilizes all of the institutes in a concerted manner. Elsewhere, the initiatives, although sometimes strong, remain dispersed. The impetus given to obesity research is recent, including in the United States, dating back to 2001-2003. It is therefore not possible to assess the results of the research policy other than on the basis of the calls for projects and the subsidies granted. In that respect, the NIH strategic plan is the only one to have undergone significant effective translation.

A distinction is to be made between multidisciplinary and interdisciplinary research. The former is a form of juxtaposition of specific subject interests in a field; the second looks to strengthen the links between disciplines and to inspire and enrich the respective research by confronting different analyses, methods and approaches. It is striking to observe how much

the NIH institutional research managers are insistently attentive to the human and social sciences in the broad meaning of the terms, and to early events. At the risk of forcing the issue, it could be said that the great difference between the state of development of obesity research in the United States compared to France or even Europe is due to four components:

- the first component is the strength of the conviction invested in the research with a translation in terms of the mass of investment: for the United States, obesity is not a secondary or esoteric field but a major priority (Europe has long been spared but the situation is changing rapidly and France, through the recent calls for projects, has begun to invest in the field);
- the second component is the commitment to developing interdisciplinary research including the human and social sciences (economics, environment, behavioral sciences, communication and public health) while heavily wagering on the 'hard' sciences; none of the programs has yet addressed the difficult question of interdisciplinary evaluation and its modalities and criteria;
- commitment to partnerships, including with associations and the food industry;
- another distinctive point is the position of preventive research in the strategic plans.

12

Research in France

Obesity research is the subject of various initiatives in France: first indirectly through various nutritional research programs, particularly those initiated by Inserm and Inra, and more recently through a specific call for projects from the National Research Agency (ANR). Before reviewing those programs, human nutrition and obesity research in France will be succinctly reviewed.

Research in the National Nutrition Health Program (PNNS)

France made nutrition one of its priorities during its presidency of the European Union. A resolution on the subject was adopted when the Council of European Ministers met on December 14, 2000. In 1999, The Directorate General for Health (DGS) requested the opinion of the various national experts. Launched in January 2001, the National Nutrition Health Program (PNNS) is coordinated by the Secretariat of State for Health and the Handicapped in liaison with the National Education, Agriculture, Research, Youth and Sports and Consumer Affairs. The major orientations, based on the work of the High Committee for Public Health, the National Council for Food and the technical managements of the various ministries involved, in liaison with the Assembly of French Departments, the French Agency for the Safety of Health Products, the Institute for Health Monitoring, the National Insurance Organization, the National Federation of French Mutual Insurance Organizations, scientific leaders and consumer representatives, have been defined. The PNNS associates all the public and private players involved in the fields of intervention defined: research, training and monitoring, actions in the field, promotion, prevention and care, food offer, distribution and control. The main objective of the PNNS is to improve the state of health of the population as a whole by acting on one of the major determinants, namely nutrition. The PNNS has stated that only research-based data enable a scientific basis, the wish of all the players, for orienting the objectives and strategy of nutritional policy. The research is one of the six strategic avenues: 'developing human nutrition research: epidemiological, behavioral and clinical research'. The objective is to develop nutrition research oriented toward public health, particularly through inter-institutional networking. The PNNS first recommended setting up the European reference diet network (Rare) under the auspices of the Ministry of Research. The technological research network's objective was to develop large-scale research actions associating public research with agricultural socioeconomic partners, the food industry, the distribution industry and consumer representatives. Organized in consortia or complementary scientific program groups, the network is to have different components covering the fields of microbiological safety, food science and human nutrition. The latter, the Nutrialis action, was oriented toward the study of eating behavior and the prevention of major diseases (cancer, obesity, cardiovascular diseases) by nutrition. Secondly, the network recommended promoting the development of public health nutrition research in the form of clinical research actions implemented by the teaching hospitals and with contributions from public organizations (Inserm, Inra) with the aim of significantly

increasing the consistency of the national commitment to public health research. Lastly, the network recommended promoting the activity of the Human Nutrition Research Centers (CRNH) and developing research areas not yet covered and consistent with the objectives of the PNNS. Economic studies relating to immediate cost-benefit analyses (for example reduction in prescriptions for additional investigations, medication and number of consultations by preventive actions) together with cohort interventional studies were also to be promoted. The PNNS is to be assessed at the end the program (2006).

Research on nutrition and obesity in France

Nutritional research draws on many teams from the EPST research organizations (Inserm, Inra, CNRS) and the universities. A review of the nutritional research forces in France was compiled by Inserm in 2003. A detailed report is available from the Inserm website²². By way of an example, Inserm nutritional research occupies 60 laboratories, 106 researchers, 89 technicians, 9 clinical investigation centers (CIC) and the human nutrition research centers (CRNH) in Lyon, Ile-de-France, Nantes and Auvergne. The budget dedicated to nutrition accounts for 4.8% of Inserm's total budget. The Human Food department of Inra employs 32 teams, 137 researchers, 278 engineers, technicians or administrative agents (ITA) and 110 lecturer-researchers. Several CNRS teams are committed to nutritional research. The term nutrition is included in the subject index of 9 CNRS units. Three of those units have a specific interest in obesity.

The ISI study, a world bibliometric study of obesity conducted in 1991 to 2000, provides more specific information on the subject. An evaluation by the Inserm bibliometric unit²³ enables French nutrition research for the period 1998-2002 to be situated.

ISI study on obesity

In all, 19,961 articles (2,045 different journals) were retrieved. There were over 42,000 authors and strong international participation (134 countries). The four journals most cited were: International Journal of Obesity, American Journal of Clinical Nutrition, Journal of Clinical Investigation and Nature. Nature's rank in 4th position shows the scientific community's interest in the subject. The ISI study also enabled ranking by country and number of citations (table 12.I). Two French studies published by Nature are among the 25 articles most quoted worldwide on the subject.

²² <http://www.inserm.fr/fr/inserm/programmes/nationaux/atc/nutrition2.html>

²³ Directed by N. Haeffner-Cavaillon

Table 12.I: Ranking by citation and by country of obesity research, after the ISI study

Rank	Citation	Number of articles	Citation/article
United States	96,663	9,147	10.5
Great Britain	10,869	1,248	8.7
Sweden	8,741	677	12.9
Canada	8,107	901	9.0
France	7,268	807	9.0
Italy	6,818	1,066	6.4
Japan	5,175	799	6.4
Denmark	4,382	343	12.7
Australia	4,081	573	7.1
Switzerland	4,025	329	12.3

None of the French structures was included among the most productive obesity research centers worldwide: Harvard University, Rockefeller University, University of Texas, Thomas Jefferson University, University of Minnesota, Columbia University, Eli Lilly and Co., Niddkd, University of Pittsburgh, Gothenburg University. In Europe, only Gothenburg University was included among the 10 leading centers.

Nutrition research in Europe, 1998-2002: Inserm study

The results of the Inserm bibliometric study enabled France to be ranked among the European countries (table 12.II). The detailed results are available from the Inserm website²⁴. In short, France ranks second. In terms of excellence (top 1%), France ranks third.

Table 12.II: Nutrition publications in Europe (after the Inserm bibliometric unit study)

Country	Number of articles	Citation/article	Impact factor	Top 1%
Great Britain	3,723	8.4	2.56	59
France	2,224	6.7	2.38	19
Germany	1,999	5.9	2.00	14
Italy	1,589	7.3	2.52	22

The Inserm publications mainly addressed obesity, insulin-resistance, adipogenesis, cardiovascular disease and epidemiological studies. The number of articles in the top 1% was 1.33% for Inserm articles, while for all French articles the percentage was 0.9%. Again, for the Inserm articles, 60% were associated with the hospital environment and less than 10% were conducted without a university or hospital. The Inra articles addressed eating behavior, preventive nutrition, cancer risk and food safety. The subject profile of the publications is shown by country in table 12.III.

²⁴ Inserm bibliométrie nutrition: www.eva.inserm.fr/Bibliometrie/Frameset.htm

Table 12.III: Subject profile of nutrition publications for the various European countries, 1998-2002 (after the Inserm bibliometric unit study)

Country	Publication field			
	Epidemiology	Studies	Genetics	Behavior
Great Britain	26.0%	16.0%	0.9%	15.0%
France	20.0%	11.0%	1.5%	9.0%
Germany	20.0%	15.0%	1.5%	8.0%
Italy	26.0%	15.0%	0.4%	11.0%

The Inserm bibliometric study also enables the subject obesity to be situated for the citations (table 12.IV).

Table 12.IV: Nutrition study subjects for the European countries, 1998-2002 (after the Inserm bibliometric unit study)

Country	Subject			
	Obesity	Childhood	Adolescence	Aging
Great Britain	14.7%	15.5%	3.3%	13.0%
France	15.8%	11.1%	1.7%	10.7%
Germany	14.0%	15.4%	4.8%	7.7%
Italy	21.6%	14.7%	2.8%	10.3%

The international cooperations were ranked, using the Clémentine software package (SPSS). For France, the main cooperation was with the United States, followed by Great Britain and Italy.

Human Nutrition Research Center (CRNH)

In France, human nutrition research is organized into Human Nutrition Research Centers (CRNH). The centers are mixed structures consisting in partnerships between the teaching hospitals (CHU), Inra, Inserm, universities and other partners. The structures are designed to enable development of research on healthy subjects and patients. Located in Auvergne, Rhône-Alpes, Ile-de-France and Nantes, the centers concentrate a critical mass of researchers in the field of nutrition. The CRNH associate basic research with clinical research and constitute an interface between the EPST research units and hospital departments. The CRNH play a role with respect to the food industry in that they have the ability to evaluate the nutritional quality of the products developed by the industry. Given the skills of the CRNH researchers, they constitute a major pool of expertise in the field. The networking between the centers and other French teams with which the centers cooperate enables complementary coverage of the major fields in nutrition research.

Research on obesity in the call for nutrition projects

In 2001, Inserm and Inra gave renewed impetus to human nutrition research via the various calls for projects and programs in addition to the recurrent support of the research teams engaged in the field. The initial aim was to define, through the national and foreign expert working groups, research avenues and calls for projects enabling mobilization of French research with regard to priority public health subjects, the promotion of multidisciplinary

and inter-organization network constitution, attraction of teams involved in other fields toward nutrition and identification of the competitive teams and fields at international level. The medium-term objective was to design and set up a national nutrition research program.

Inserm/Inra Nutrition ATC

The first programmed subject action (ATC) in nutrition was initiated by Inserm in 2001. The subjects were: eating behavior and eating disorders; infantile development and growth; nutritional impairments secondary to disease (cancer, inflammatory and infectious diseases, injuries); and metabolic yield. For the 5 projects, the financing amounted to € 1 million. The second call for projects, in the same amount, was jointly launched by Inserm and Inra in 2002 and addressed the following subjects: foods, eating and the gastrointestinal tract; evolution and determinants of food consumption and behavior; physical activity, muscle and nutrition; sensory aspects and food intake. The second call enabled 13 projects to be selected.

National Human Nutrition Research Program (PRNH)

The National Human Nutrition Research Program (PRNH) was launched by Inserm and Inra in 2004²⁵ in order to support human nutrition research. The aim was to promote studies of the influence of evolution on eating behavior, foods and lifestyle on health and nutritional status at individual and population level. The program was jointly financed by Inserm and Inra to support projects demonstrating excellence in one of the following three fields:

- 'Nutritional adaptation/non-adaptation to evolutions in food and the environment': study of the effects of foods and diet on physiological functions and their regulation; and study of the factors influencing the formation and evolution of eating behavior;
- 'Diet, nutrition and prevention': analysis of the impact of nutrition on wellbeing and disease prevention; research on early events and their determinants in nutritional physiology and pathology;
- 'Dietary risks and nutritional information': study of the quality and safety of foods, including the toxicological aspects, and the disorders related to eating behavior; research on formulation, perception and compliance with nutritional information.

The 2004 call for projects was as follows: out of 54 initial letters of intent, 18 dossiers were selected and 6 were finally financed. Three dossiers addressed the subject 'Nutritional adaptation': study of the orointestinal perception of dietary lipids; genetic predictors of dietary responses; and physical activity and the use of food substrates. Two dossiers addressed the following subjects: 'Diet, nutrition, prevention': nutrition of pregnant women and infantile development, and early development of preferences and aversions. One dossier addressed the perception and management of the nutritional risk associated with eating fish.

Research Program on Diet (PRA)

The research program on diet (PRA) was one of the aspects of the Inra diet federation program. The PRA launched an initial call for projects in 2005 in order to support, in France, research enabling responses to the challenges constituted by understanding consumer behavior, risk assessment and prevention, and the construction of food and diet quality. The program, financed by Inra, supports scientific projects with identified socioeconomic ends and with applicable repercussions in one of the following four subject areas:

²⁵ Inra: http://w3.inra.fr/les_recherches

- 'Consumer behavior': dietary decision mechanisms, integration of biological and social consumption determinants, impact of the various players, case of precarious populations, quality perception by the consumer, sensory image determinants and formation process, effects of the environment, physiological status and learning, etc.;
- 'Quality construction in the food industry': pertinent improvement of the nutritional quality of food for overall improvement of the diet, articulation of nutritional policy with agricultural policy;
- 'Dietary risks': economic and social impacts of recommended measures, risk perception by consumers and society and modalities for decision-making;
- 'Elucidation of microorganism ecosystems'.

In 2005, the Inra specific program was endowed with € 1.5 million. It enabled support of 7 financed projects: 3 in food behavior sciences (€ 500 K), 3 in quality improvement (bread/fibers, allergies/wheat, salt) and 1 in food safety (*Listeria*).

Obesity research at the National Research Agency

The creation of the National Research Agency (ANR)²⁶ triggered evolution of the PRNH. Inra, a member of the National research agency, is responsible for management of the 'National program for dietary and human nutritional research' (PRNA). The ANR entrusted Inserm with the operational implementation of evaluation and administration of the dossiers submitted in response to the call for projects: 'Cardiovascular disease, obesity and diabetes'. The ANR GIP program at Inserm was set up in the context of the principles adopted by the board of the ANR and stated on the ANR GIP website.

National Program for Dietary and Human Nutritional Research (PRNA)

The program finances research projects submitted by public teams and private teams, French or European, and teams working in public-private partnership. The objective of the program is to support innovation in the food industry and the acquisition of knowledge on food, the food chain including technologies, consumer behavior, dietary risks and the links between diet and health, including nutritional physiology. The program incorporates the subjects of the research arm of the National partnership for development of the food industries (IAA) initiated by the government with the objective of enhancing the competitiveness of the food industry, ensuring product quality and safety, maintaining the dietary culture and identity, improving consumer information, contributing to environmental protection and taking into account the interactions between the food industry (IAA) and agriculture. The program finances both academic projects and public-private partnership projects. The program is required to promote projects demonstrating scientific excellence and innovation in one of the 5 following subject areas:

- consumer behavior: phenotyping behaviors on an individual and population scale; factors influencing the formation and evolution of dietary behaviors; mechanisms of dietary decision-making, integration of biological, technological, economic, psychological, cultural and social determinants of consumption, and influence of prescriber information (public or private, including advertising); impact of the various players; case of low-income groups; consumer quality perception, determinants and process of sensory image formation, effects

²⁶ National research agency: <http://www.gip-anr.fr/>

of the environment, physiological status, learning and food characteristics; links between knowledge and cognitive acquired knowledge and effective behaviors;

- quality construction in the whole food chain, from the downstream toward the upstream: impact of food distribution, processing and production (genetic, agricultural and animal husbandry methods) conditions on the final quality of foods; role and control of complex microbiological ecosystems; interaction between quality and player strategy; cost of quality (how to maintain or improve margins throughout the food industry?); improving the nutritional quality of foods in a manner pertinent to overall improvement in diet; articulation of nutritional policy with agricultural policy;

- dietary risks: including perception of hazards and risks by consumers and society and modalities for decision-making and follow-up;

- clean and economic technologies for the food industry;

- diet, prevention and nutritional adaptation with respect to evolutions in diet and the environment: study of the effects of foods and diet on physiological functions and their regulation; effect of genetic polymorphism; analysis of the impact of nutritional well-being and disease prevention; effects of dietary models; research on early events and their determinants in nutritional physiology and disease; disorders related to eating behaviors; research on the formulation, perception and compliance with nutritional information; integration of those subjects in existing epidemiological cohorts or those being formed also constitutes a subject of the call for projects.

The objective of the program was to promote interactions and partnerships between structures: between various public organizations, higher educational establishments and universities and/or private partnerships and/or technical centers. Private-public partnerships were particularly encouraged. The interdisciplinary nature of the subject areas led to preference being given to projects combining several disciplines, including the social sciences, but the latter condition was not indispensable. The development of methodological instruments and conceptual objects was eligible in the context of an objective with socioeconomic applications. The selection criteria included: the pertinence of the socioeconomic, public health and industrial issues; the synthetic effort in favor of decision-making aids for projects with a finalized nature; the justification for the association of units for project implementation; the complementarity of the partners; the structuring nature of the network formed; the pertinence of the proposed interdisciplinary association; the modalities for profitable socioeconomic exploitation.

Call for 'Cardiovascular disease, obesity and diabetes' projects

Launched in July 2005 by the ANR, the National Program for Research on Cardiovascular Diseases, Obesity and Diabetes (PNR-COD) was designed to support high-level basic, clinical and therapeutic research in the three fields involved and to develop a cross-sectional axis in the three fields. The obesity field included the following key words: pathophysiology (adipose tissue biology), energy metabolism, genetics and genomics, behavioral and environmental factors, complications, therapeutic targets and strategies, biomarkers.

The cross-sectional axis of the three fields was 'Metabolism, inflammation and the cardiovascular system'. Adipose tissue accumulation, chronic hyperglycemia and early atherosclerosis are in fact characterized by low-noise chronic inflammation at least in part underlying the metabolic and cardiovascular diseases. Multidisciplinary approaches using cell models, animal models and clinical trials or population studies are necessary to elucidate the pathophysiological bases of the inflammatory processes involved in cardiovascular diseases.

In conclusion, obesity research in France has undergone a recent renewal of impetus through the encouragement programs initiated by Inserm, Inra and the ANR and by the recurrent support of the EPST teams (Inserm, Inra and CNRS) addressing the subjects. Various calls for projects have enabled research financing in the field to be significantly increased. Obesity accounts for an increasing but still minority part of the subjects subsidized. The programs are too recent for evaluation. France ranks 5th in obesity research worldwide. French teams are involved in the major European projects in the field. However, in France, there is no specific national research program comparable to that launched by the NIH in the United States. The French teams working on obesity are mainly addressing the epidemiological aspects, adipogenesis, genetics and energy expenditure and insulin-resistance. The most recent incitements and programs stress interdisciplinary approaches whose modalities of evaluation, which are complex, have yet to be determined. The humanities and social sciences retain a limited place among the projects despite the support of the calls for projects.

Principal findings and principles for action

The progression of obesity in children and adults in France has been confirmed by a series of concordant epidemiological studies. Preventive measures are necessary. The care system must respond to the new challenge.

Currently, the question is no longer whether public health programs to combat obesity are justified but how to design, apply, sustain and evaluate such programs.

Achieving consistency between the public health programs and public policies, particularly with regard to the food industry, urbanization and nutritional communication is essential.

Strengths and weaknesses of the French initiatives

The setup of the National Nutrition Health Program (PNNS), pursuant to consultation between several ministries, constituted an important advance in the societal awareness of the public health problem and the political determination to respond to it. Obesity is, in fact, only one aspect of the vast program. In the future, the PNNS should define more specific objectives and resources in the field.

Under the impetus of the PNNS, numerous initiatives were taken at national and regional level, reflecting strong reactivity and motivation on the part of the public health players in the field. Several regions initiated prevention programs by mobilizing not only healthcare professionals, the educational community and social players but also politicians and economic decision-makers.

The work of the National Consumer Council and the National Food Council contributed to the reflection on and proposals in the field of nutritional prevention.

With regard to the management of obesity, the recommendations for diagnosis, prevention and treatment (1998), and more recent recommendations on the management of obesity in children and adolescents (2003) received the Anaes label. Some of the French recommendations have been adopted by the European authorities. The Directorate of Hospitalization and Care Organization (Dhos) has defined reception units for obese people. Obesity screening instruments (particularly for children) that are simple to use have been forwarded to physicians and pediatricians by the Directorate General of Health (DGS). The National Health Insurance Organization for salaried employees (Cnam) has undertaken an assessment of obesity surgery.

In the research field, Inserm and Inra, and more recently, the National Research Agency (ANR) have launched nutrition programs including, in certain programs, research on obesity. All the French research teams hold leading positions in terms of the number and quality of the scientific publications on several subject areas at international level.

Despite the great achievements, weaknesses persist, in particular with regard to preventive actions.

The dispersion or even the fragmentary nature of the preventive actions is prejudicial to the overall legibility of the process and raises the question of the consistency of the strategies deployed and their optimization.

Local actions, largely based on voluntary work and dependent on support that is limited in

time, remain fragile. The sustainability of financing is a key question in order for the actions initiated to achieve a certain level of efficacy over time.

The insufficiency of rigorous assessment of most of the actions constitutes another weak point. An assessment methodology is to be developed in order to justify and orient resource allocation by the financing bodies.

Opportunities

A series of opportunities is emerging during this period of obesity progression. The opportunities result from scientific work which induced a marked progression in the concepts and practices and enabled definition of action principles. The opportunities are based on a dual community and individual approach and on the commitment of diverse players:

- the concept of prevention exploiting environmental modifications opens up a vast field of action. The prevention, qualified by certain authors as 'passive' prevention or 'effortless prevention', is based on actions not involving the individual in the first line. The aim is to reduce the environmental pressure by acting on the factors which generate increasing sedentariness and excess calorie intake. This prevention is additional to the preventive actions targeting the subjects at risk and aims to attenuate the constraints to which people who wish to avoid weight gain or reduce their overweight status are subject;
- society's awareness of the issues raised by the progression in the frequency of obesity has given rise to a significant commitment from politicians, healthcare professionals and economic decision-makers with respect to a series of institutional actions;
- the national initiatives are consistent with the European and international programs.

Obstacles

Obesity is greatly dependent on changes in lifestyle and environment. Obesity particularly affects vulnerable populations (children, low-income families, etc.). The obesity prevention and management policy is itself directly related to the socioeconomic and environmental determinants of the disease. The programs encounter obstacles in the form of the persistent and increasing effects of environmental pressure and the socioeconomic determinants which contribute to the development and maintenance of the obesity epidemic. It should also be noted that obesity and obese people are still frequently viewed negatively or even stigmatized.

Obesity prevention thus requires measures that have economic and social incidences. Examples include the question of accessibility, price and quality of foods, major determinants of calorie density and hence of food consumption. The fact that the foods whose consumption should be increased, fruit and vegetables, are the most expensive further increases the social inequalities of health. Similarly, the availability and accessibility of physical exercise facilities and the safety of playgrounds or footpaths for children and families are also associated with economic problems.

The prevention of obesity is clearly a question for health policy. However, the value of an institutional or economic player with respect to preventive policy is far from proportional to the player's influence in the decision-making processes.

Action principles

Obesity is a chronic disease. The preventive and therapeutic responses are to take into account a large variety of progressive and symptomatic situations. Prevention and treatment strategies involve interventions in numerous fields but also actions that are to be differentiated as a function of the stage of the disease. On the basis of that analysis, the working group would like to stress the following action principles:

- **earliness:** obesity is a progressive chronic disease that tends toward exacerbation through life. In the vast majority of cases, obesity begins in childhood and adolescence. Prevention and treatment are to be implemented early. Special attention is to be paid to the screening for and treatment of children and adolescents. Universal prevention (at population level) must promote education on good physical health (nutrition and physical exercise) as of early childhood;
- **overall approach:** obesity is a multifactorial disease. Taking into account a single determinant is a vain effort. In terms of public health, an isolated measure will not be sufficient. The actions must be multifocal and multi-sectorial and mobilize the institutional and non-institutional sector and the associations and economic players;
- **complementarity:** the convergence of the actions and the complementary nature of the interventions are essential. It is not appropriate to contrast 'individual' with 'collective', or to separate medical actions from societal actions, or to stress one at the expense of the other;
- **consistency:** the consistency of political actions in the dietary field is a central question. The most critical example resides in the question of the consistency between 'nutritional policy' and 'agricultural policy';
- **progressive nature:** the programs must adapt to the progression of the socioeconomic context and scientific knowledge;
- **respect for the individual:** the greatest vigilance is required in order not to reinforce the stigmatization of obese people through public health campaigns: 'act against obesity, not against obese people';
- **independence:** in such a complex and costly issue, the question of partnerships is crucial. The conditions for cooperation between the public and private sectors must be debated. The independence of actions within clearly defined partnerships must be ensured;
- **implementation:** the mass of recommendations and regulations in France is already considerable. Their enforcement would induce marked progress (e.g. the regulations on school canteens);
- **decentralization:** the national political impetus must be relayed at the level of the actions in the field by proximity players in order to adapt the measures to the specific context of the intervention site;
- **delegation:** new professions or new conditions of practice are to be defined, particularly for nurses and dieticians; promotion of health in schools calls for educational science training;
- **sustainability:** public health policies in the field of chronic diseases related to the environment call for actions that are sustained over a considerable duration (decades). The action calendars must distinguish the short-, medium- and long-term objectives;

- **program assessment:** given the lag time for impact on population health, the programs are to be evaluated initially on the basis of interim criteria: acceptance and application of the health promotion messages, durability of the action and its impact. The evaluator must be independent;
- **costing:** the financing for and cost of prevention campaigns must be clearly determined and known;
- **research:** the programs must include a population-based dimension and promote an interdisciplinary approach by including the humanities and social sciences. The programs are to link research, actions in the field and assessment. The need for a strategic research plan specifically on obesity needs to be analyzed. That option was adopted by the NIH.

Priority areas for short- and medium-term actions

The areas mainly consist in diet and physical exercise. The actions are to address (non-exhaustive) the immediate environment or 'ecological niche', school, care organization, workplace, food industry and communication. The following are to be impacted (non-exhaustive):

- **consumer information:** regulation of labeling and advertising, nutritional claims and institutional communication; adaptation of the messages and instruments for populations in difficulty and at risk;
- **food offer:** policy to support low-energy density food offer and targeted consumption subsidies (in catering settings in particular); application of the food regulations to collective institutions and particularly schools; food offer for populations in difficulty and at risk; nutritional quality of foods; portion sizes (food industry, marketing and distribution);
- **physical environment:** integration of the objectives of the combat against obesity in urban policy and transport policy; sports facility accessibility in schools, universities, the workplace and the urban environment;
- **health policy:** sustainability and adaptation of the PNNS;
- **care system organization:** promotion of new professions, reform of the status of dietitians, application of the Anaes, DGS and Dhos recommendations, improved access to care, acquisition of medical equipment suitable for the obese (imaging, etc.), healthcare professional training, reference centers, networks, therapeutic education;
- **health monitoring:** financing of repeated epidemiological studies on nutritional status at population level; review of screening facilities for, and access to, care for the various subgroups of the population;
- **research policy:** reinforcement of interdisciplinary research on the determinants and all the consequences of obesity in the calls for projects from the ANR and research organizations.

Communication

Developing national obesity prevention policies: an international perspective

France has clearly developed a great number of initiatives since the time of the last French Presidency of Europe when it attempted to support a new strategy for nutritional policies in Europe by convening the Eurodiet project with the EU Commission (Eurodiet, 2001). The senior French diplomats were initially in agreement with the concept of a collaborative effort being undertaken between a group of top nutritionists from different EU countries and the major representatives of the European food industries. The plan was to evaluate what was nutritionally best for public health and the future of all the populations of Europe whether living in the far North or in the Mediterranean area. Much was being made of the value of the Mediterranean diet and the fact that the Greeks, Italians and French in particular had a better health record than those populations living in other countries.

Developing public health analyses and policies: the importance of being independent of industrial interests

Unfortunately it soon emerged that the development of a coherent approach to specifying an optimum European diet in the Eurodiet project was becoming difficult to establish because of repeated objections from a couple of scientists who had been proposed as suitable contributors to the development of the public health analyses by the food industry. The rest of the group were well aware of the regular funding of these scientists by the food industry – and particularly by the soft drink, confectionary and sugar interests – but their numerous objections and alternative suggestions still had to be dealt with on the basis of reasoned, detailed and often extensive arguments.

The majority of the nutritional scientists and public health specialists were very clear that great efforts were needed to limit the amount of fat, particularly saturated fats, sugars and salt being consumed by Europeans, an analysis in agreement with all other major governmental and World Health Organization (WHO) reports (WHO, 1990, 2003). Once most of the analyses had been agreed a special conference was convened in Crete so that in an open public discussion the public health implications of the reports could be evaluated. Again, however, the French diplomats were dismayed to discover the intensity of the objections to the agreed analyses by industrial groups and how the conference was being misled about supposed official meetings of the Chief Dental Officers of Europe who seemingly had proposed a more benevolent approach to current national sugar intakes. In practice a meeting of some dental officers had occurred but this was a meeting funded by sugar interests and without any official status. Even more disturbing was the continued resistance of official EU representatives from the Commission's Directorate involved with trade to the then agreed official WHO policy on the value of a minimum of 6 months breast feeding. From this experience and the subsequent intense lobbying of the Commission to set aside the Eurodiet conclusions most governments and the Commission have now come to recognize that public health and nutritional analyses together with their policy implications need to be developed completely independently of industrial interests.

This conclusion has been reinforced by the experience of the Bovine Spongiform Encephalopathy (BSE) crisis with which I was completely involved as a scientific expert first

for the UK Prime Minister, Tony Blair (James and McColl, 1997) and then for the Commission. The BSE crisis at that stage was so serious that it led to the threat to sack the European President and his Commissioners. The Commission responded with a total reorganization of the Commission's approach to health and the development of DG SANCO with a clear mandate to put the interests of the population's health above the immediate concerns of trade and other powerful lobbies. In the case of BSE we in the Commission's Scientific Steering Committee were constantly under pressure with Chief Veterinary Officers complaining about our conclusions and sometimes seeking our expulsion from our job as we identified one after another EU country as probably having BSE and not taking adequate precautions. The Commission at that stage insisted on the value of our independent analyses and soon realized that their best insurance against charges of neglect was to automatically back our opinions. This approach was rapidly reinforced when we were repeatedly shown to be correct in our meticulously prepared analyses which contradicted most if not all the claims and counterarguments of farming groups and those involved in the distribution and processing of meat products.

This experience of BSE has led the EU Commission in DG SANCO to recognize that scientific analyses and options for policy development in relation to health or other consumer or general public interest need to be developed by a thoroughly independent group of experts. This does not mean, however, being anti-industrial – a common charge when the conclusions do not favor particular interest groups. Indeed industry has a major role to play in being involved in the policy implementation process and in highlighting particular options which would allow the least adjustment to their current practices but still meet the objectives of a new policy. Thus on March 15th 2005 the Commission announced the formation of a joint Commission/industrial/non-governmental organization (NGO) Platform for the prevention of the current alarming rates of obesity in Europe. All sectors of the European food industry are involved but the Commission is very clear that any nutritional policy needs to be developed by an independent group and not by those with a special financial interest. In keeping with this policy the decision of the French Parliament to commission an independent report from Inserm on possible new analyses of nutritional public health needs in France is to be welcomed.

Nutritional needs for combating obesity and their policy implications

It is only since 1997 that WHO and then many national governments have come to recognize that obesity is now a major public health problem affecting not only North America and Europe, but most of the developing world (WHO, 2000). The European Regional Office of WHO has also now established obesity as its top priority and this issue will be considered by all the Ministers of Health for the WHO European Region in Istanbul in November 2006. It is therefore clear that there has been very little time so far for major initiatives to be undertaken to combat obesity and policy makers should therefore not be surprised by the very limited information that we have on practical community developments which are known to be successful. Governments throughout the world are now exploring what best to do and it should be recognized that developing public health policies to combat obesity is a much more complex process than we originally expected. In the health field policy-makers have come to demand rigorous multiple double-blind trials of any intervention strategy, e.g. for changes in the use of drugs, when introducing new diagnostic tools or other initiatives. However, when we are dealing with the implications of obesity one has to take a much broader perspective. This broader perspective is dependent on recognizing that community intervention projects are much more difficult to conduct than simple drug trials. They also

involve many different factors and non-medical sectors which are not readily evaluated in a rigorous, experimental way. Therefore, as with most other aspects of Government policymaking e.g. for social and economic policy making, one has to work on the basis of understanding the causes of the problem, evaluate the primary drivers and then identify suitable options for changing the environment.

Individual or community approaches?

Too often governments and policy makers have considered obesity to be the responsibility of individuals. Surely, they argue, if somebody puts on weight, then they should themselves be able to identify this problem and to prevent any further weight gain and, indeed, return to their previous normal weight by simply eating less and exercising more. Whilst this is biological logical, it neglects the now overwhelming evidence that to assign the responsibility only to the individual is to neglect the huge pressures on the whole of society to put on weight. It is very clear from numerous studies over the last 3-4 decades that obese individuals have been trying desperately to reduce their weight unsuccessfully despite many major educational campaigns, numerous targeting articles in women's magazines and with the popular press focusing on the problem. Despite these efforts and the development of a multi-billion Euro slimming industry the proportion of individuals becoming overweight and obese has gone up inexorably.

Clearly, there are family associations in the propensity of individuals to gain weight. Thus the chances of child becoming overweight are far greater if the child's parents are obese. Whereas traditionally we assumed that this simply reflected bad parenting and the consumption of an inappropriate diet with too little exercise, it has now become clear that families on a similar diet and exercise pattern show very different propensities to weight gain and the genetic susceptibility of different individuals is now well accepted. Thus 20 years ago in France only the very genetically sensitive individuals tended to become obese, but now far more less susceptible people are also becoming obese. It is clear that the genetics of the French population has not materially changed in the last 50 years, so the overwhelming epidemic of obesity has to be of environmental origin. Therefore, to tackle the underlying causes of the epidemic, an environmental approach to prevention is needed and those who gain weight easily need to be in a better environment if they are going to cope effectively with their weight problem.

Why then do obese individuals find it so difficult to return to their normal weight? Under normal circumstances the brain regulates food intake extremely well and we subconsciously adjust our intake on a daily basis to take account of the variations in the level of physical activity. Thus when somebody puts on weight, this means that the pressures to gain weight have overwhelmed the appetite control system but with a steady 1 kg weight gain each year this still amounts on average to an excess intake of 20 kcal per day, i.e. only 1% of the usual 2,000 kcal daily intake. This small discrepancy highlights just how effective our normal appetite control system is unless we overwhelm it by taking foods which trigger a poorer response in the complex brain control system and this mechanism has to work even more effectively if we are inactive and therefore demanding that the brain mechanism should stop us eating. Thus when people put on weight it is not because they are foolish or unable to control their food intake - all of us have a sensitive and effective system but a system which we overwhelm by living in an inappropriate environment where there are constant inducements to eat and do very little physical work.

Once we begin to gain weight the brain in some unknown way adapts to the weight gain and then "resets" the normal brain control mechanisms so that the normal control of food intake

is geared to maintaining the excess weight. This is why very obese individuals who successfully lose weight only manage to keep their weight at a normal level by obsessively monitoring their intake and deliberately undertaking far more exercise than normal. A constant theme of these "post-obese" individuals is their constant hunger and desire to eat; they then have to go to very special lengths to stop themselves eating when there are so many temptations provided everywhere to eat and drink more than they need. They are also handicapped by their environment where we have all become used to using motor cars, computers, mechanical aids at work and at home. In fact, it is very unusual for anybody now to have to engage in heavy physical work: most of us can earn a very good living without having to be physically active at all.

Thus individuals who are genetically sensitive to obesity are now in particular difficulty because their whole environment is geared to promoting weight gain. This dilemma highlights the fundamental importance of taking a prevention approach to obesity and indicates that in obesity-prone families they will need to systematically develop their own micro-environment to resist the pressures to eat too much and to exercise too little.

The burden and health costs of obesity

In a recent analysis for WHO we assessed the health impact of excess weight gain in different parts of the world (James *et al.*, 2004). Figure 1 shows the burden in different parts of Europe, this burden being calculated in terms of Disability Adjusted Life Years (DALYs) lost and the reasons why overweight people either die early or become sick and disabled. Although there are over 50 complications of excess weight gain and obesity, we only had very clear data on the greater rates of ischemic heart disease (IHD) high blood pressure (HT), stroke, diabetes and 3 forms of cancer, i.e. colon, post-menopausal breast and endometrial cancer. We were able to add the problem of arthritis induced by weight gain, but could not take account of all the other disabilities that relate to excess weight e.g. backache, respiratory impairment and numerous other conditions. Figure 1 shows that in the Euro A region, which includes France, there are nearly 2 million lives lost or disabled each year in both men and women due mainly to the cardiovascular disease and diabetes induced by excess weight gain. In these calculations no separate national analyses were made, but it is clear that these estimates need to be looked at both in terms of the recognized huge increase in the health burden that is likely to occur in France and elsewhere over the next 20 years and, indeed, the economic costs of the health burden. So far we have failed to recognize the health costs of obesity which the UK National Audit Office (National Audit Office, 2001), the British Parliamentary Health Select Committee (House of commons health Committee, 2004) and, indeed, the UK government's own special economic advisor, Derek Wanless, have recently highlighted (Wanless, 2004). Indeed these costs are probably major underestimates because it is now becoming evident that we have failed to take account of just how much the escalating epidemic of diabetes will impact on the problem of kidney failure: there is going to be a huge increase in the demand for kidney dialysis. The cost of dialysis is estimated at 40-50 thousand Euros per year for the dialysis part of the medical care alone and already up to a half of all patients in dialysis units have diabetes as the underlying cause. Type 2 diabetes is now so closely linked to excess weight gain and obesity that the term "diabesity" has been coined to emphasize the intrinsic linkage. Our own analyses of the time when the burden from overweight and obesity is at its greatest shows that it is in the 45-59 year old group where the maximum disability is evident, i.e. during the economic working life of the population. Indeed, over 70% of the total burden is seen in those below the age of 70, so this is not a problem of the very old: it is a problem which is already

affecting the working capacity of the population. The UK government has very recently assessed the impact of obesity as already leading to an average reduction in the UK population's life expectancy of 2 years (Department of health, 2004).

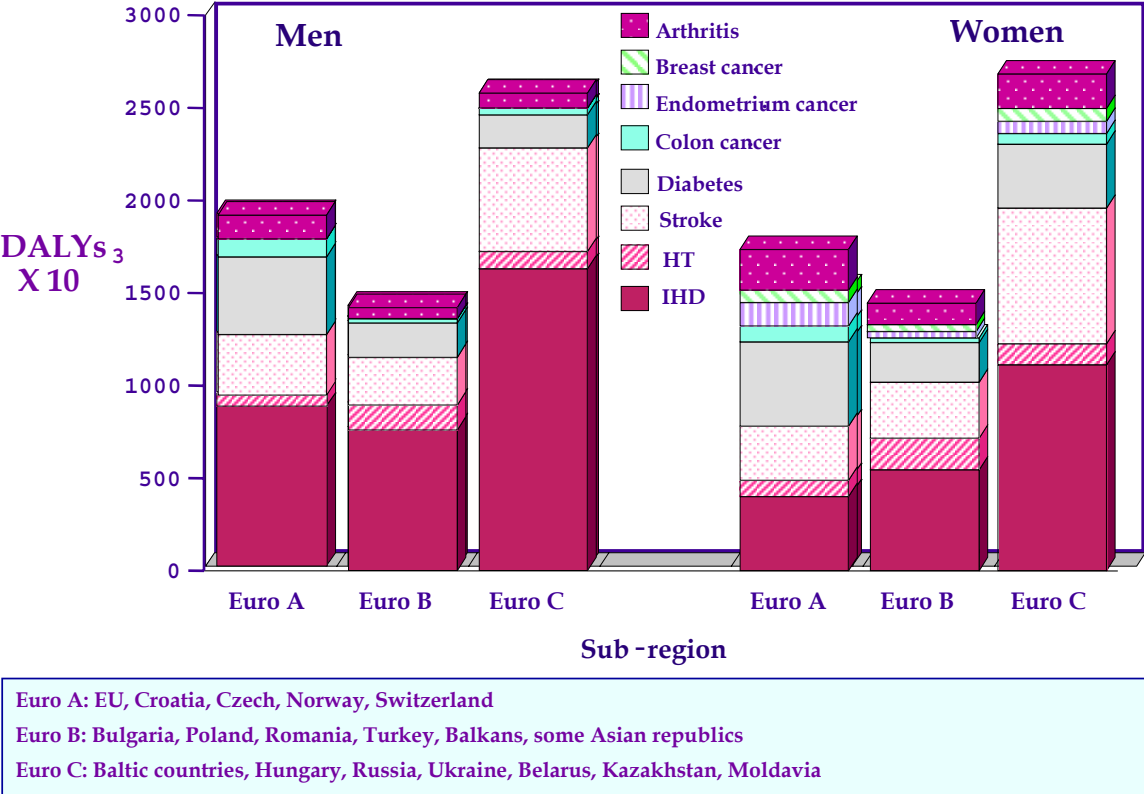


Figure 1: Disease burdens in Europe linked to increasing body weights

The DALYs are calculated on the basis of the years of life lost and the years of disability induced every year in that proportion of the population which is above the optimum average corresponding to a BMI of 21.0. The proportion of the specified diseases attributable to this excess weight gain is then derived from independent studies and in these calculations have been limited to the impact of weight gain on the development of ischemic heart disease (IHD) high blood pressure (HT), stroke, diabetes mellitus, cancers of the colon, endometrium (uterus) and breast in post-menopausal women together with the impact on arthritis.

Developing a physical activity prevention strategy: the need to redesign our towns and cities to allow routine walking and cycling as part of every-day activity

Developing a strategy depends on a clear analysis of the underlying causes of the obesity epidemic. First, consider the problem of physical activity where it is now clear that the old idea that we should engage in perhaps 30 min of moderately vigorous activity e.g. fast walking, 5 times a week does indeed help to reduce the risk of cardiovascular disease but to prevent weight gain, particularly after some weight loss, then 60-90 minutes extra walking is needed for the majority of the population (Food and Agricultural Organization of the United nations, 2001). Now the pressures to remain without physical activity are many including all the easy transport systems, the work environment and the inducements to stay at home, watching television or working with games and other internet systems.

Given these huge environmental changes no one would suggest that these developments be reversed but we need to recognize the billions of Euros of public and private investment in

the reorganization of the transport systems of all developed countries with a road and urban redesign which has been primarily to ease and speed the flow of motor cars. So how should we respond? There has already been an attempt to encourage people to exercise more, to engage in sports and other recreational activities. In response to this campaign it is clear that sub-groups within the better educated and wealthier sector in our societies do develop a new leisure time approach to physical activity. Special leisure centers have been constructed with appreciable numbers paying extra for the privilege of access. However, almost everywhere it is clear that the numbers actually engaging in routine physical activity are small and on a population basis there is no evidence of a systematic increase in physical activity patterns. Furthermore the emphasis on an educational approach to taking extra physical activity during leisure time impacts only on a minority; the main beneficiaries are those in the higher social class who have the ability and resources to alter their lives despite all the current constraints on routine physical activity in our daily life. Thus the routine demand to tackle the problem of obesity by educational campaigns will in practice increase the social divide and not help the poorer and more disadvantaged sectors of the population. It is therefore clear that in the modern world we need to recreate an environment where there is the opportunity to take physical activity routinely as part of daily living, not as an extra conscious decision which has to be made when there are so many other conflicting pressures.

The magnitude of the change in activity patterns can be seen in the steady collapse in physical activity with time and the almost routine fall in physical activity as people age. Some years ago we calculated that in the US there had been a fall amounting to 1,200 kcal per day in the energy used by men as they passed from a very active sporty life when they were 25 years old to the time when they were retired at 75 years of age (James *et al.*, 1989). During this time mechanization was in full swing so the secular decline of the whole population's activity was being amplified by the age related decline in spontaneous or sports related exercise. What this therefore means is that there will be an inevitable weight gain unless the same individuals - and indeed the total population systematically reduces their intake by many hundreds of kcal per day with a total drop for the elderly amounting to 1,200 kcal per day! It is not surprising therefore that as men and women give up sports in their early 20s then they gain weight progressively.

Urban design

Some cities, e.g. Copenhagen, Aarhus, Barcelona and many cities in the Netherlands are being maintained or redesigned to provide streets that are safe for children to play routinely outside the home, with special cycle paths and walkways for children to walk or cycle to school and where the elderly feel safe when they walk or cycle short distances to do their shopping. The design of cities with out-of-town supermarkets was an excellent idea for the interests of the supermarkets, but the public benefit was mainly felt by those with cars and the financial ability to shop once a week and store their food in large refrigerators. The poor with no transport and a family to feed found the small local shops disappearing or providing limited sources of food at higher prices. We need therefore to recognize that the decisions of local authorities on the development of congenial town centers with measures to facilitate local shops and with city centers for pedestrian and cycling only can be substantial contributors to an environment where physical activity is a routine rather than a special leisure time issue.

Workplace policies to facilitate cycling and walking to work rather than car use

The French government and French local authorities as well as the business community could encourage physical activity by providing facilities at work which make it easier for people to cycle to work, store their bicycles, if need be take showers, and also possibly engage in physical activity at lunch time or after work. If one calculates the number of people employed by the public sector, then it is clear that the public sector could take a lead in changing the whole culture relating to physical activity. The business community could also be engaged if studies were undertaken to demonstrate to them the economic benefits that would arise if their employees were more active. Thus it is clear from a number of studies that both men and women feel better if they have been physically active and they then find it easier to work. Furthermore, there is now very substantial evidence to suggest that one can make a major difference in limiting the effects of high blood pressure, the development of diabetes and indeed of some cancers if people are more active. There are also a few studies which suggest that by encouraging physical activity the absenteeism and need for leave from work for hospital appointments etc. can be reduced. Given the fact that the major burden on European societies from obesity comes before retirement age and that physical activity is now clearly demonstrated to be of benefit, we need to take a very different strategic approach to providing the facilities and environment which positively encourages physical activity and limits routine car use.

The issue of schools will be dealt with separately.

The dietary challenge in France and the rest of Europe

There have been a number of major studies conducted by French investigators showing the value of a Mediterranean diet. New studies on the elderly reinforce the benefits of the Mediterranean diet which was characterized by substantial fruit and vegetable intake, i.e. a minimum of 400 g/day for every man, women and child. Traditionally the meat, milk, fat and sugar intake in the Mediterranean area was very low. Only in Greece was there a higher olive oil consumption and this population was heavier than the rest of the Mediterranean community when originally studied by Ancel Keys and his colleagues in the 1950s (Keys, 1980). The French culture, with its emphasis on the quality of food and the importance of regular family meals has probably made a major contribution to why the burden of disease in France and the obesity rates of the French have been lower than in many other European countries. Now, however, as described elsewhere by Inserm there is alarming evidence of an increase in overweight and obesity rates and this is now particularly affecting children. It would appear, therefore, that the French cultural tradition is being systematically destroyed by those forces that benefit when they successfully market new foods and soft drinks which are rich in fat and sugar and are therefore very dense in energy. This energy density, particularly when snacks and drinks are eaten between meals makes it extremely difficult for the normal brain mechanisms to control the body weight by shutting down food intake (Drewnowski, 1998; Stubbs *et al.*, 1998; Raben *et al.*, 2002; Prentice and Jebb, 2003). We therefore have in France at present a population where the normal brain mechanisms are telling the French to eat less because they are so physically inactive whilst at the same time the supermarket, retailing and other food sector strategies are encouraging the consumption of very inappropriate foods and drinks which do not conform with the quality of the traditional French cuisine. Again, therefore, as with the problem of physical inactivity, the idea of simply telling people to return to the marvels of traditional French cuisine naively

neglects the huge pressures on society to "modernize" the French diet, this in practice meaning an encouragement to eat a far more obesity generating diet. The brain has particular difficulty in detecting fat in the diet and free sugars, especially if fats and sugars are taken between meals.

The price and availability of foods determines their consumption: implications of the Common Agriculture Policy

The evidence from behavioral studies on smoking, alcohol use and eating patterns all show that there are two fundamental factors which strongly influence the behavior of a population, i.e. the price of a commodity (French *et al.*, 2001) and the availability and marketing of these products. We must remember that the enormous benefits of the Common Agricultural Policy came when the needs of the poor farming community were matched with our original nutritional and health perceptions that children benefited from an ample supply of animal protein, e.g. in meat and milk, with sufficient energy being provided to ensure that even the poor could have enough to eat. The Post-War "cheap food policy" was introduced globally and the French government, as well as the other countries of the European community, have systematically subsidized the farming and food business in an effort to improve not only national food security but the well-being of the poorest in the community as well as the farming sector. As a result of many decades of huge subsidies for research and development and direct subsidies to encourage the production of meat, milk, cereal production (for animal feeding), oil and sugar production, France and the rest of the European community has an agricultural policy which is no longer geared to public health. Thus our agricultural colleagues recognized many years ago that farmers in the Mediterranean area would benefit from an increase in the price of fruit and vegetables and so they systematically funded from Brussels the destruction of most of the fruit and vegetables crops being grown in the Mediterranean (Robertson *et al.*, 2004). This led to an increase in price which benefited the farmers but the higher price is a well-documented critical factor in limiting the choice of fruit and vegetables, particularly by the poor.

This example is simply used to show that industrial policies have a huge effect on health whether we are discussing transport and urban planning policies in relation to physical activity or agriculture and food policies in relation to the nutritional quality of the diet.

Post-war food industrial strategies

One of the major features of the post-war era is the huge development of the food and soft drink industries in North America and Europe. They have developed brilliantly by using a series of strategies to promote their sales:

- lower prices;
- ensuring that as many as possible outlets are available to the public;
- developing brands to promote their marketing;
- super sizing;
- focusing on preschool children marketing to induce brand loyalty;
- selling their products in countries where they have low sales.

Originally food companies competed with each other by targeting the price of their

commodity and to this day supermarkets highlight the price advantage of people buying from their particular supermarket chain. The food industry then realized that they could gain extra marketing advantage by ensuring that their products were available anywhere. Thus McDonalds in the US developed a strategy where everybody should be within a 5 min drive of a McDonald's restaurant and the same strategy is evident for all the major food companies. Then the marketers recognized the value of developing special brands of food; the marketing of brands has become a major preoccupation of most western industries. Following this there was the idea that one could market more effectively by "super-sizing", i.e. providing 50 % more or even twice as much for only a small increase in price. It is now well-documented that the bigger the portion of food presented to children over the age of 4 and to adults, the more they will spontaneously eat. When super-sizing was having no more impact, food companies and their advertising agents marketed the brands to children because they discovered that children could have a profound influence on their parents' purchases and supermarkets learned the tricks needed to persuade their parents to buy particular food, confectionery and soft drinks.

Now the next industrial strategy for most big food companies is to target those areas of the Mediterranean and developing countries where their products are not yet being consumed. This has therefore led to a dramatic reduction in the quality of the Mediterranean diet with a marked increase in fat and sugar intakes. This has particularly affected children so that in many Mediterranean countries the children now have hamburgers, fried foods, soft drinks, sweets, chocolate and biscuits. They are being targeted with the idea that snacks and soft drinks and fast foods are an appropriate part of an enjoyable life and new evidence is emerging that children are no longer being brought up in the traditional environment where they would be exposed as a routine to set meals rich in fruit and vegetables with very few high fat foods and practically no added sugar. It is now well recognized that children need to be exposed to vegetables and fruits for up to 15 times before they accept these foods as a normal part of their diet. Fats, sugars and salt, however, are tastes for which we have primitive drives with special taste buds and mouth sensing systems geared in evolutionary terms to targeting these sources of energy and salt needs. Now, however, these primitive drives are being used to market products because taste panels routinely show the attractiveness of products rich in these ingredients.

Developing prevention strategies relating to the quality of food

Figure 2 shows a general scheme for providing a coherent approach to changing the environment both in terms of physical activity and diet. The emphasis so far has been primarily confined to the idea that an educational approach is all that is necessary, but the latest rigorous Cochrane analysis shows that advice to individuals, even given by doctors has, as a population approach, very little effect (Brunner *et al.*, in press). Thus we have to now focus on changing the environment at a physical, economic, political, i.e. legislative and regulatory level, as well as considering how best to change the accepted cultural perceptions of fast foods, snacking, soft drink consumption and eating on the move, all of which are conducive to weight gain. Table 1 provides an indication of how food pricing and availability policies could be developed progressively over a 5-10 years period. Indeed the French parliament, with its traditional concern for both the quality of French food, its cultural associations and the well-being of farmers could make a major contribution to spearheading a new approach to obesity prevention in the European Community.

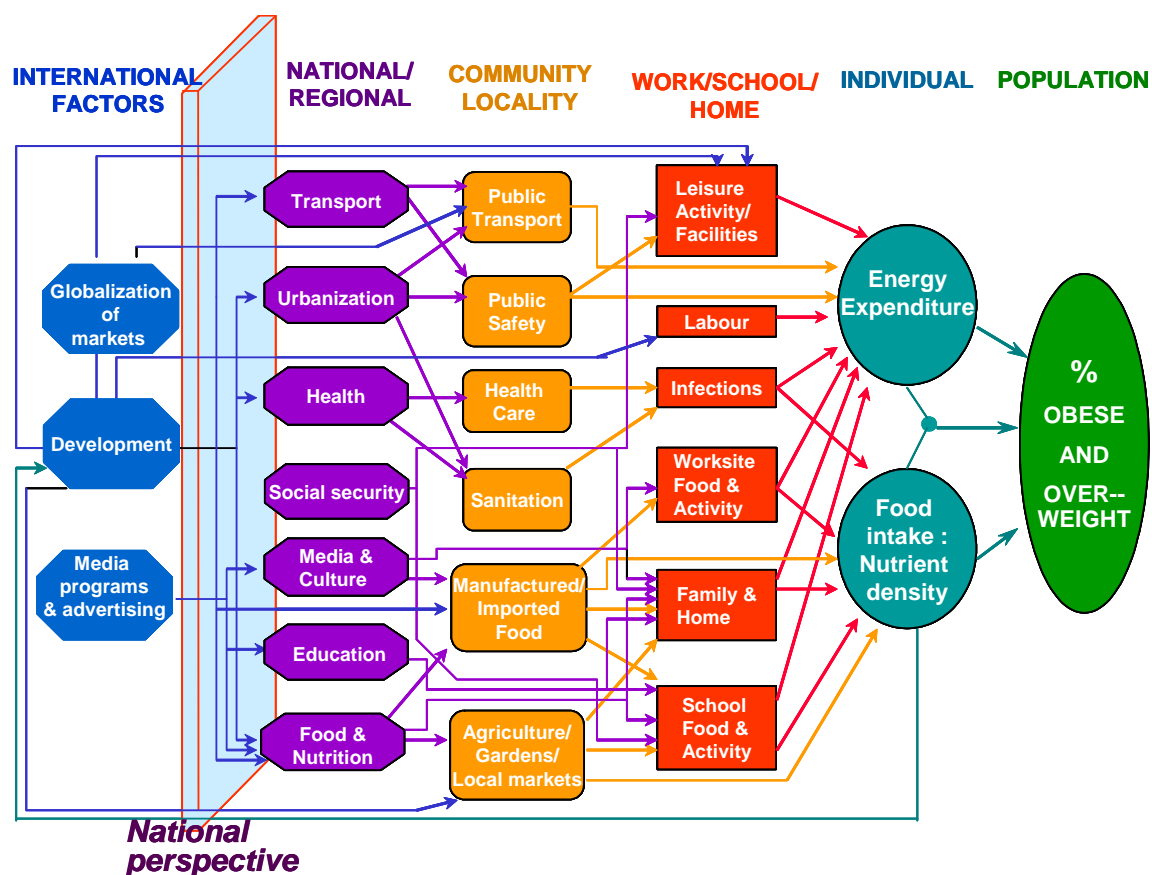


Figure 2: Societal policies and processes influencing the population prevalence of obesity

This figure illustrates the numerous factors and sites which in practice influence the choice of activity and foods by individuals. Therefore no one solution to the problem of excess eating and physical inactivity can be expected (Kumanyika *et al.*, 2002).

Modified from Ritenbaugh C, Kumanyika S, Morabia A, Jeffery R, Antipatis V. IOTF website 1999: <http://www.iotf.org>

Table I: Food "availability" and pricing policies

Clear evidence of need for training young children to eat fruit and vegetables: 10-15 exposures to food needed before acceptance assured. Food environment crucial

Implies major controls on marketing - not just advertising - to children. Overwhelming evidence that regulatory rather than voluntary controls needed to benefit respectable food companies

Weaning practices and pre-school food - not just nutrition standards now required to control total food availability to children as part of ensuring an appropriate environment

Total control of school premises and their surroundings now needed with a transformation of food practices in school - Chef Jamie Oliver in UK highlights value of no processed foods and involving children in origin etc. of food and enhancing the power, training and prestige of food organizers. The curriculum on food also needs transforming in the UK

All Government controlled or influenced food systems, e.g. hospital premises, should control junk food and soft drink availability, as for alcohol and tobacco

Criteria needed for quality of food served in all workplace initiatives

Major new initiative to define "Junk foods" and limit their availability in all town centers - i.e. like alcohol outlets and smoking: can use pricing policies as a mechanism also. Include environmental concerns - limit take away foods to reduce litter...

Limit fast foods and drink availability in town centers through planning policies or if need be by taxing the license for premises as a new policy

Fat and sugar taxes need to be assessed by economists using classic evidence on price flexibility

Need nutritional profiling in food labels relating to energy density with additional nutritional criteria as a

technique for setting new standards for food – targeting "junk foods" and energy rich drinks

Finnish development of incorporating the price of a salad bar and the choice of vegetables within the cost of the main meal dramatically increased national fruit and vegetable consumption 3 fold

Nordic country agriculture initiatives were used to lower prices of fruit and vegetable prices in more remote areas

Reconsider legacy of EU distortion of food prices: now promote local vegetable and fruit production and distribution/storage systems to facilitate cost effective help for Northern and poor communities

Regear tax policies on foods: needs novel political educative initiatives

Consider import taxes and role of phytosanitary regulations in World Trade Organization rules on free trade to ban or heavily tax health threatening imports of inappropriate foods. Appeals by US and others invoking reference to CODEX system will thereby require WHO and FAO to validate health issues – already specified in WHO 916 report

Food labeling

Food labeling is but one example where the idea that the public is able to discriminate the quality of food on the basis of the current labeling system has proven to be wrong. Repeated consumer surveys show that consumers cannot understand the labels which are set out in technical jargon and the idea of specifying what an average man or women needs in terms of energy is not only wrong and misleading, but ludicrous! The energy needs of children and adults can vary threefold and if the public, with great difficulty, managed to follow the advice implied by the need of women for 2,000 kcal and men for 2,500 kcal, then if these were the average need of French men and women, which I doubt, then by following the advice meticulously almost half the French population would start gaining weight, and almost half losing weight. This is why the British Parliamentary Health Committee on the basis of extensive consumer research and analyses by the Food Standards Agency of the UK (Rayner *et al.*, 2004), advocated the use of a traffic light type of signaling system whereby consumers could distinguish the overall quality of the food itself based on scientific analyses of the food's quality in terms of fat, sugar and salt. A red signaled food should be eaten sparingly, green labeled foods in abundance and yellow labeled foods in moderation. Currently the European Commission is considering the need to have some simple method which highlights the nutritional and health quality of a food but all too often food companies are only interested in marketing their good foods as "functional foods" of value, whilst ignoring the fact that many of their products should be eaten sparingly, if at all. The nutritional profile of foods is important and it is no longer possible for industrial interests to argue that there are no good foods or bad foods; by definition if one food is considered better than another for its nutritional and health properties, then it should be possible to develop a uniform and systematic labeling of foods, and certainly of particular dishes in canteens, the workplace, restaurants as well as in supermarkets.

Table 2 shows a proposed list of strategies for helping to prevent obesity in children and a list of policies in schools which have been proposed and/or tried successfully. There is ample evidence that children below the age of about 12 have not yet developed the ability to make an appropriate judgment where they can discriminate between a marketing message geared to their immediate desires and a more rational long-term and coherent view of the different opinions that one will encounter in everyday life. Thus experts in child psychology and pediatrics have emphasized the importance of creating an environment which is appropriate for a child's learning. Currently it seems to have been accepted that the unbridled marketing of products to children is acceptable when this in practice is manipulating children's behavior for the benefit of the marketer without regard to the long-

term welfare of the child. This is not a controversial judgment but was clearly set out in a special report which took account of the world's literature on the ability of children to understand the information that they receive on food. It became clear after consulting about 30,000 published references that the marketing of a brand not only enhances the demands of children for that selected item, but it also increases their desire for the category of products, e.g. soft drinks, which are being marketed. This in turn leads to a change in the categories of food consumed and a distortion of the nutritional quality of a young child's diet. It has been recognized for a long time that children brought up in a very organized and socially-advantaged environment are able to maintain their activity and food patterns much more effectively, despite external pressures to change, providing that they are protected from inappropriate influences before they go to school and throughout the primary school period. Only when they are going through their adolescent development does the normal interplay of the home environment and external influences become an issue. Therefore it is clear that we have, in the last two to three decades, failed to understand the fundamental importance of protecting our children from the inappropriate marketing of foods which are disadvantageous to their health. Overweight children already show the accelerated responses indicative of the early phases in the development of diabetes and high blood pressure. Thus the progressive increase in the rates of overweight and obesity in France should be of major concern. It is obviously completely inappropriate to blame the child and the idea that parents have complete control over the well-being of their children is no longer true when so many families have both parents at work. Table 2 summarizes the variety of initiatives which can be undertaken to change children's environment.

Table II: Strategies for combating childhood obesity

Protecting children aged up to 12 years	School environment
New evidence from WHO of the fundamental need for 6 months' breast feeding implies transformation of individual pediatric advice to mothers about overweight	No "choice" in food menus so that young children are trained in appropriate food selection!
Proper weaning practices	No vending machines
Overwhelming evidence of need to exclude children from "choice" option when young, e.g. <8 years (American Pediatric and Psychological Societies) or before 12 -14 years based on understanding of the biological development and mental processing capacity of children (Hastings <i>et al.</i> , 2003, UK)	Activities and sports for all: not just the very athletic - ensure the opportunity for after school activities
Regulated child minders: food and play	Defined high quality meals only should be served
Legislate on all forms of marketing: TV, radio, text messages, internet, food product labeling, games etc	Contracts with parents on food are needed in supporting high quality foods in school with no additional confectionary... allowed on school premises
School environment needs changing to prevent any inappropriate exposure	Food and activity committee with Governor, pupil and parent representation shown to transform school practices
Supermarket practices need to stop manipulating children to buy inappropriate foods	Nutrition education needs transforming with explicit messages and practical experience of foods such as fruits, vegetables, cooking techniques and the origins and biological effects of foods
Pricing policies: affect school aged children	Parental educational initiatives by children needed routinely as in Finnish salt experience
Availability policies: density of fast food outlets needs	School teachers eating with children plays major

to be limited where children frequently go	<p>role in modeling behavior</p> <p>Walk/bike to school: needs to be encouraged with suitable changing and bike and clothes storage facilities</p> <p>Traffic policies around school need explicit consideration</p> <p>Parental policies on transport to school needs to be considered - parents protect their children by driving them to school thereby making it more dangerous for other children!</p>
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Conclusions

It is no longer possible to argue that an educational approach to individual behavior is the answer to the obesity epidemic. French children need to be protected and the biggest drive in educational terms should be not simply to the school children but to policy makers in the areas of fiscal, agriculture, retailing, transport, urban design and education policies. Table 3 simply summarizes the fact that one should not only think of the Ministry of Health as responsible for the obesity epidemic: the other Ministries of Government have a far greater influence on the development of the obesity epidemic than the Health Ministry. The Ministry of Health is now trying to cope with the immensely deleterious effects of other government departments' policies over several decades. The French nation, like other western countries, will not be able to afford the escalating health costs. Without a new strategy approach with multiple interventions in many different sectors, it is unlikely that we can stem the obesity epidemic. There is no single magic bullet and a coherent plan is now needed with a careful monitoring and evaluation of the different initiatives. Other governments, e.g. Sweden, have just produced their new plan of action and France has an opportunity once again to lead the European Community in developing new strategies of benefit to even the poorest in society.

Table III: The Stefani model: a few examples of strategies for effective nutritional initiatives to illustrate the different dimensions of policy needed

	Ministry of Health Responsibilities	Other Ministry responsibilities
Physical	Dietary quality; physical activity Appropriately accessible health centers Promoting access to appropriate self-monitoring, e.g. weight, BP	Dietary quality; physical activity Ensuring playgrounds in schools, suitable cycling and road systems; urban planning; sports facilities. Designated urban areas for local food production
Economic	Primary health payments for specific targets in management	Re-evaluate taxation and subsidy policies
Policy	Baby Friendly Hospitals Dietary guidelines establishing fortification policies Establish policies on health claims, e.g. functional foods	HIA of CAP Food labeling with appropriate, understandable health related information
Socio-cultural	Health education	Promote physical activity in the workplace. Create breastfeeding time and space in the workplace with NGO help

BP: blood pressure; HIA: health impact assessment; CAP: common agriculture policy; NGO: non-governmental organization

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