Public Health Nutrition: 11(4), 405–412 DOI: 10.1017/S136898000700050X

Nutrition transition in Chile revisited: mid-term evaluation of obesity goals for the period 2000–2010

Fernando Vio*, Cecilia Albala and Juliana Kain
Institute of Nutrition and Food Technology (INTA), University of Chile, Nutritional and Genetic Epidemiology Laboratory, Macul 5540, Santiago, Chile

Submitted 13 November 2006: Accepted 25 April 2007: First published online 6 July 2007

Abstract

Objective: To analyse the nutritional status component of the nutrition transition in Chile in relation to the evolution of obesity rates in all age groups until 2005, comparing these with the goals established by the Ministry of Health for the period 2000–2010.

Design and setting: A descriptive study which includes data on the nutritional status of the Chilean population categorised by age. The data originate from: (1) institutions which administer nutritional programmes – the National Board for Day-Care Centres (JUNJI) and the National Board for School Assistance and Scholarships (JUNAEB); (2) the Ministry of Health and the National Institute of Statistics; and (3) epidemiological studies which include adolescents and the elderly.

Results: The prevalence of obesity in pre-school children attending JUNJI was 10.6% in 2005; by age group, it was 6% in 2-year-olds, 11% in 3-year-olds and 14% in 4-year-olds. Among schoolchildren in first grade, obesity prevalence was 18.5%. In pregnant women, obesity has increased from 12% in 1987 to 33% in 2004. For adults, the 2003 National Health Survey showed that the prevalence of obesity (body mass index (BMI) $\geq 30\,kg\,m^{-2}$) was 22% and of morbid obesity (BMI $\geq 40\,kg\,m^{-2}$), 1.3%. Obesity varied according to gender and educational level, being higher among women (25% vs. 19% in men) and adults from low socio-economic levels. In the elderly there was a high prevalence of obesity in the 60–64 years age group for both men (35.6%) and women (44.1%), decreasing to 18% and 26%, respectively, in those aged 75 years and older.

Conclusions: The goals for the decade (2000–2010) consider a reduction of obesity rates from 10% to 7% in pre-school children attending JUNJI, and from 16% to 12% in schoolchildren attending first grade. For pregnant women, the goal is to reduce the prevalence from 32% to 28%. Despite the implementation of initiatives in nutrition and physical activity, these have been insufficient to shift the rising trend in obesity. The explanation could be that after a rapid rise in obesity in children and pregnant women between 1987 and 2000, a stabilisation period or a 'plateau' is observed. In that situation, very effective interventions are required to reduce obesity, because it is extremely difficult to reverse the trend. Some positive experiences are being implemented in Chile, but government priorities are not focused in health promotion. A comprehensive State Policy in health promotion, that includes the public and private sectors related with obesity, is needed to reverse this trend.

Keywords
Nutrition transition
Nutrition policy
Obesity
Chile

The nutritional status of the Chilean population has changed rapidly from a high prevalence of malnutrition in the 1970s to almost its total eradication at the end of the 1980s. Malnutrition measured by the Monthly Consolidated Registry, which includes 1.2 million pre-school children attending national health-care centres, decreased from 15.5% to 5.0% between 1975 and 1993. Low birth weight (<2500 g) declined from 11.0% to 4.9% in the same period. In pregnant women and children, a decrease in the proportion of wasting along with a significant increase in the prevalence of overweight and obesity has been observed[1]. According to the theory of the nutrition transition, these shifts are due to modifications in the diet which in turn have been associated with demographic, economic, social and epidemiological changes. During the 1990s, Chile increased its per capita income twofold, from $US 2600 in 1987 to $US 5000 in 1997; however, an important proportion of this increase

**Corresponding author:* Email fvio@inta.cl

has been spent on processed foods, rich in fat, sugar and salt, television sets, appliances and cars. This has led to an increase in energy intake as well as a decrease in physical activity, impacting on obesity rates[2].

During the 1970s, malnutrition was a major problem in Chile, decreasing progressively until the 1980s, when an economic setback increased the nutritional deficit. However, at the same time, the prevalence of obesity in adults, particularly in low-income women, was high. This coexistence of obesity and malnutrition has been one of the underlying factors in transitional periods and occurred in Chile during the 1980s[3]. In the following years, this situation shifted rapidly to the eradication of malnutrition and a rise in obesity rates. Diets have become higher in fat (especially derived from animal products), refined sugar and salt, and lower in fibre. Presently, Chile is in a classical post-nutritional transition stage.

The current paper describes the changes in the nutritional status of the population in the nutrition transition process, analysing the trends in the prevalence of obesity in pregnant women, children, adults and the elderly until the year 2005, and comparing them with the goals established by the Ministry of Health for the period 2000–2010.

Methods

Design and setting

The trends in the prevalence of obesity presented here are based on secondary analyses of individual datasets from population-based studies and aggregate datasets collected routinely by Chilean national public institutions. The individual datasets analysed here originate from a large study of schoolchildren carried out by Muzzo *et al.*[4], the 2003 National Health Survey[5] and the SABE (Health, Well-Being, and Aging) Study[6].

The school-based study[4] is a cross-sectional serial survey conducted in Santiago (where 40% of the Chilean population lives), two regions from the South and two regions from the North, representing the country's diversity. The first study was carried out in 1987 and included 8536 schoolchildren from primary education; the second study was carried out in 1991 and included 3280 schoolchildren; the third one in 1994 included 244 schoolchildren; and the fourth one in 1998 included 1521 schoolchildren.

The 2003 National Health Survey[5] is a cross-sectional study aimed at estimating the prevalence of chronic diseases and nutrition-related risk factors among people 17 years and older. Data were collected between May and December 2003 from a national representative sample of 3428 subjects (1559 men and 1869 women).

The SABE Study[6] is a multi-centre survey whose goal is to investigate the health and well-being of older people in seven capital cities of Latin America and the Caribbean. In Santiago, Chile, the study included 1301 subjects aged 60 years and older (819 women and 411 men), selected from a random representative sample of older people, of whom 1230 had complete measurements.

Aggregate datasets emanate from the Ministry of Health, the National Board for Child Day-Care Centres (JUNJI) and the National Board for School Assistance and Scholarships (JUNAEB). The Ministry of Health collects aggregate data for all the population attending the national network of health services that covers approximately 70% of the national population aged 0–6 years. JUNJI collects data from approximately 70 000 children of low and middle–low socio-economic status attending day-care centres and JUNAEB collects data on approximately 220 000 children entering first grade (around 70% of the national population in this grade).

Variables

For children under 6 years of age, data for over 1 million children attending national primary health-care centres and 70 000 children attending day-care centres were analysed. At the health centres, weight and height were measured by nurses, twice a year, according to the national programme of children's health controls. At JUNJI, the measurements were done by pre-school teachers, twice a year (May and November).

The data on weight and height obtained from JUNAEB for about 220 000 children entering first grade (6–8 years) are obtained by classroom teachers in March (beginning of the school year). The nutritional status of pre-school children and schoolchildren entering first grade was analysed utilising the weight-for-height indicator and a cut-off point of >2 standard deviations to define obesity using the National Center for Health Statistics (NCHS) reference[7]. Prepubertal and pubertal boys and girls were classified as obese when their body mass index (BMI) was $\geq$95th percentile according to the Centers for Disease Control and Prevention/NCHS 2000 growth charts[8]. For pregnant women, aggregate data from the Ministry of Health for all Chilean pregnant women attending national primary health-care centres for routine pregnancy health control were collected. The nutritional status was determined using the Rosso-Mardones reference[9], which is based on weight/height. Although this criterion was changed in 2005 to one based on BMI[10], the data presented here correspond to the previous period (1987–2004).

The nutritional status of adults ($\geq$18 years) and elders was determined using the World Health Organization (WHO) criteria[11] for BMI categories: overweight, BMI$=$25.0–29.9 kg m^{-2}; obese, BMI$=$30.0–39.9 kg m^{-2}; morbid obese, BMI$\geq$40.0 kg m^{-2}.

Results

Prevalence of childhood obesity

It is well known that obesity is the result of interactions between genetic and environmental factors. Among

genetic factors, it is considered that there exists a hereditary predisposition to develop this disease. Several studies in identical twins have shown that despite living separately from each other, their BMI and percentage of body fat run in parallel[12]. When both parents are obese, a child has 80% likelihood to be obese, with this risk decreasing to 40% when only one parent is obese. It has been determined that interaction between inherited and environmental factors has led to increased obesity. Since no relevant shifts have been produced in the genetic constitution of the Chilean population in the last decades, it is clear that factors related to lifestyle have been responsible for the obesity phenomenon, particularly an increase in both energy consumption and sedentary behaviour.

Not only there has been a significant rise in childhood obesity, but it is also being observed at earlier ages. As a consequence, complications are affecting a growing number of subjects. Clinical studies have shown that obese children are at higher risk of suffering important physical and psychological problems. Among the first, a greater prevalence of asthma, insulin resistance, type 2 diabetes and hypertension have been observed. Among the psychological problems, which are probably more prevalent, we find poor self-esteem, stigmatisation and isolation, derived from social stereotypes and unfavourable attitudes towards obesity attributing to these children negative characteristics such as laziness, dirtiness and irresponsibility[13].

We show here the evolution of obesity prevalence in children based on available epidemiological data. The figures clearly demonstrate a remarkable increase in its prevalence in the last two decades.

Table 1 summarises the evolution in overweight and obesity from 1985 until 2005 in children aged between 0 and 5 years (0–2 years and 2–5 years) attending the national primary health-care centres. In the younger age group, the proportion with overweight has remained relatively stable, between 16% and 17%, while obesity has risen by 52% between 1985 and 1995 without further modifications until 2004, while a small decrease was observed in 2005. In the 2–5 years age group, the situation is similar with respect to overweight; however obesity has risen sharply from 5.0% in 1985 to 8.2% in 2005. We determined (using the test of proportions) if there was a significant difference between the prevalence of obesity in 1985 and 1995 and between 1995 and 2005 in both age categories. In both age groups, there was a significant increase between the obesity prevalence in 1985 and 1995, while between 1995 and 2005 it was significantly higher only in the 2–5-year-olds.

Another important source of data on the nutritional status of pre-school children (2–5-year-olds) comes from the National Board for Day-Care Centres (JUNJI). Anthropometric data for children attending these centres are collected by this institution. Figure 1 shows the evolution in the prevalence of overweight and obesity

Table 1 Evolution of overweight and obesity prevalence in the pre-school population under health control (1985–2005)

	Overweight (%)		Obesity (%)	
Year	0–2 years	2–5 years	0–2 years	2–5 years
1985	NA	NA	3.8	5.0
1995	17.2	15.1	5.8*	6.2*
2000	16.0	14.9	5.9	7.7
2003	15.9	15.3	5.9	8.1
2004	16.1	15.5	5.9	8.2
2005	13.1	15.3	4.8	8.2†

NA – not available.
*Significant increase in obesity prevalence between 1985 and 1995: $P < 0.01$.
†Significant increase in obesity prevalence between 1995 and 2005: $P < 0.01$.

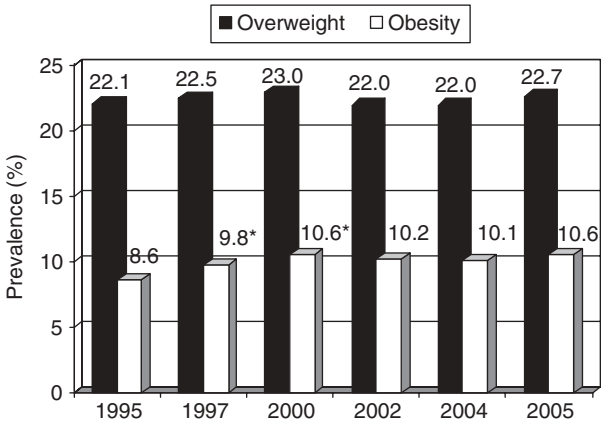

Fig. 1 Prevalence of overweight and obesity in 2–5-year-old pre-school children attending day-care centres (National Board for Day-Care Centres (JUNJI), 1995–2005). *Significant increase in obesity prevalence relative to the 1995 value: $P < 0.05$

between 1985 and 2005; overweight has remained stable at about 22% throughout the years, whereas the proportion of obesity has risen from 8.6% to 10.6% between 1995 and 2000, fluctuating between 10.1% and 10.6% in later years. We compared the percentage of obesity using the test of proportions relative to the 1995 value; these results indicate that there was a significant rise in the years 1997 and 2000 compared with the rate in 1995 ($P < 0.05$).

Figure 2 shows how the obesity prevalence has varied according to age in latter years. Two-year-old children have the lowest obesity prevalence, approximately 6%; in 3-year-olds it increases almost twofold while continuing to increase in the 4-year-old group, with a prevalence of 14%. These data confirm the picture shown in Fig. 1 that the percentage of obesity has remained relatively stable since the year 2000; however, a slight increase was observed in 2005 in the two youngest age groups. We tested if there were differences in the obesity prevalence within the same year according to age, using the test of proportions. The results showed that statistical differ-

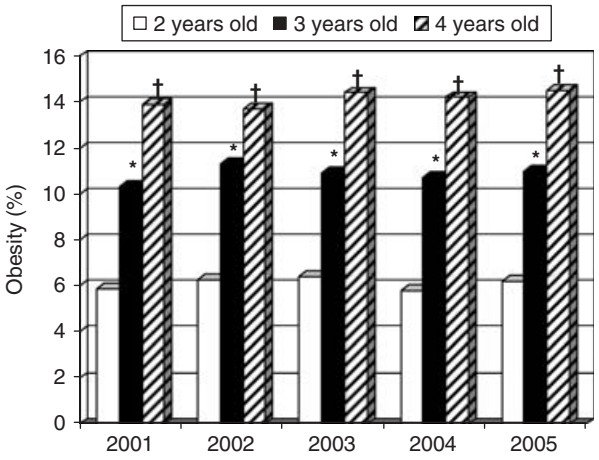

Fig. 2 Evolution of obesity prevalence according to age in 2–5-year-old pre-school children attending day-care centres (National Board for Day-Care Centres (JUNJI), 1995–2005). *Statistically significant difference between the obesity prevalence of 2- and 3-year-olds: $P < 0.01$. †Statistically significant difference between the obesity prevalence of 3- and 4-year-olds: $P < 0.05$

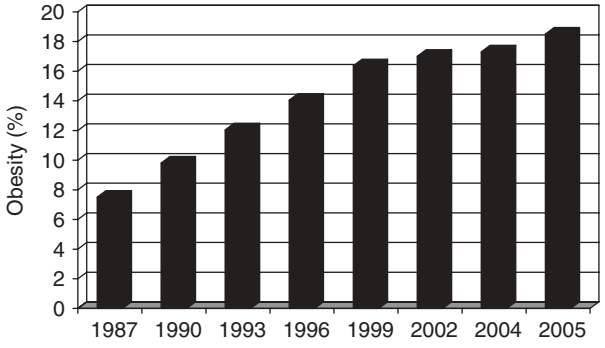

Fig. 3 Prevalence of obesity in schoolchildren attending first grade in public schools (National Board for School Assistance and Scholarships (JUNAEB), 1987–2005)

ences exist between the obesity prevalence of 2- and 3-year-olds and also between 3- and 4-year-olds in each of the years ($P < 0.01$ and $P < 0.05$, respectively).

In relation to schoolchildren, since 1987, weight and height data have been collected yearly by the National Board for School Assistance and Scholarships (JUNAEB) for approximately 70% of the schoolchildren entering first grade in the country; this represents approximately 220 000 children. This database has been essential to know the nutritional status of this age group in the last 15 years.

Figure 3 shows the prevalence of obesity in schoolchildren entering first grade between 1987 and 2005. It can clearly be observed that a marked rise in obesity occurred between 1987 and 1997, a period in which the proportion of obesity doubled. From 1997, obesity has risen slowly until 2001–2002, remaining stable thereafter with a small increase observed in 2004 and 2005 (17.3% and 18.5%, respectively).

Table 2 Obesity prevalence (%) in adolescents* from various Chilean cities (1986–1998)

	1986		1991		1994		1998	
	n	%	*n*	%	*n*	%	*n*	%
Males	47	1.6	18	3.6	18	3.8	50	14.6†
Females	82	2.3	44	4.8	65	9.2	82	17.6†

*Number of subjects – 2885 males aged 12–16 years and 3586 females aged 10–16 years in 1986; 497 males aged 12–16 years and 916 females aged 10–16 years in 1991; 478 males aged 12–16 years and 709 females aged 10–16 years in 1994; 343 males aged 12–16 years and 465 females aged 10–16 years in 1998.
†Significant increase in obesity prevalence between 1986 and 1998: $P < 0.0001$.

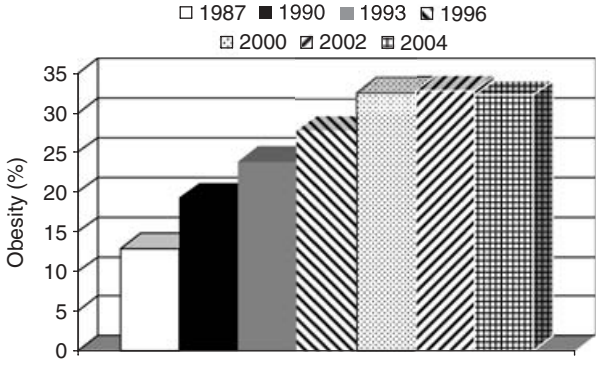

Fig. 4 Obesity prevalence in pregnant women (Ministry of Health, Chile, 1987–2004). In 2005, the Ministry of Health reference based on weight/height was changed to one based on body mass index; this resulted in an obesity prevalence of 20.3%

With respect to obesity prevalence in adolescents, published results from four cross-sectional descriptive studies carried out in various cities in the country[4] are summarised in Table 2. Statistical analysis of the trend of variations in obesity was calculated using the χ^2 test for tendency and odds ratios. Obesity prevalence increased significantly for both sexes, from 1.6% to 14.6% ($P < 0.0001$) for male students and from 2.3% to 17.6% for female students ($P < 0.0001$).

Obesity prevalence in pregnant women

In relation to pregnant women, the Ministry of Health issued a statistical series in 1987 when the Rosso-Mardones reference[9], which considers weight and height by gestational age, was first adopted. This reference categorises women attending prenatal check-ups in health-care centres into four groups: low weight, normal, overweight and obese. In this epidemiological series, a significant decrease in low-weight pregnant women was observed along with an important increase in obesity (from 12% in 1987 to 34% in 2002) with a slight decrease, to 32.6%, in the year 2004 (Fig. 4). In 2005, the Ministry of Health changed to a reference based on BMI by gestational age[10]. With this new reference, 20.3% of pregnant women were classified as obese in 2005.

Table 3 Prevalence of overweight, obesity and morbid obesity* in Chilean adults by gender

	Overweight		Obesity		Morbid obesity	
Age category (years)	Men	Women	Men	Women	Men	Women
17–24	14.0 (8.3–19.7)	19.6 (12.4–26.8)	10.0 (3.5–16.4)	7.1 (2.3–11.9)	0.3 (0.0–0.8)	1.1 (0.0–2.3)
25–44	50.0 (44.0–56.1)	34.9 (29.4–40.4)	18.0 (13.6–22.4)	23.4 (18.6–28.3)	0.1 (0.0–0.3)	2.7 (0.8–5.0)
45–64	52.0 (45.4–58.7)	35.2 (29.1–41.2)	24.4 (19.3–29.6)	36.3 (30.4–42.2)	0.4 (0.0–0.9)	3.0 (1.8–4.2)
≥65	46.5 (38.3–54.7)	39.2 (32.3–46.0)	27.8 (21.2–34.4)	29.8 (23.7–36.0)	0.1 (0.0–0.4)	1.2 (0.1–2.3)
Total	43.2 (39.3–47.0)	32.7 (29.3–36.1)	19.0 (16.0–22.0)	25.0 (22.0–28.0)	0.2 (0.1–0.4)	2.3 (1.4–3.3)

Values are expressed as % (95% confidence interval).
*Overweight – body mass index (BMI) = 25.0–29.9 kg m^{-2}; obesity – BMI = 30.0–39.9 kg m^{-2}; morbid obesity – BMI ≥ 40.0 kg m^{-2}.

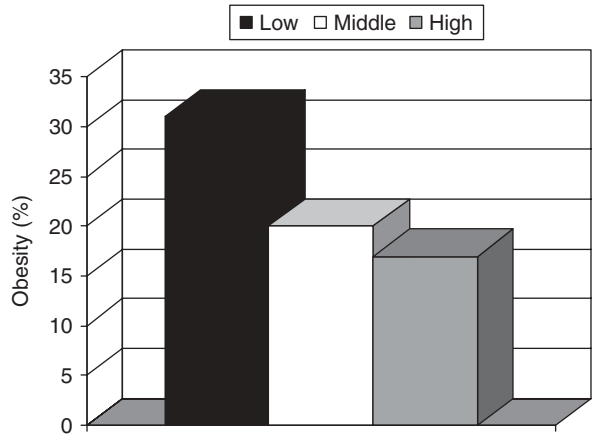

Fig. 5 Obesity prevalence in adults by educational level (National Health Survey 2003)

Obesity prevalence in adults

For adults, no follow-up system to assess nutritional status is available, as is the case for children and pregnant women. There are only cross-sectional studies including representative samples from Santiago in 1987 and 1992[14–16], where obesity prevalence increased from 6% in 1987 to 11% in 1992 in men and from 16% in 1987 to 24% in 1992 in women. A study carried out in Valparaiso in 1997 found a prevalence of 14% for men and 23% for women[17]. Only recently, with the 2003 National Health Survey[5], are representative data available for the country by region and by urban–rural categories, which evidence a prevalence of 22% for obesity (BMI > 30 kg m^{-2}), 38% for overweight and 1.3% for morbid obesity (BMI > 40 kg m^{-2}). The highest prevalences of obesity and morbid obesity are observed in women aged 45 to 64 years, as depicted in Table 3. Obesity prevalence varies according to socio-economic level, measured in this case by education as a proxy indicator, showing that subjects with low educational level have a twofold higher prevalence than those with a high educational level (Fig. 5).

Obesity prevalence in older people

The SABE Study has provided data on BMI in the elderly from Santiago and other five cities in Latin America and the Caribbean[6]. In Santiago, a high prevalence of obesity in both men and women was found, higher in women and in the younger group. The highest prevalence of obesity was found in the group aged 60–64 years for both men (35.6%) and women (44.1%), decreasing to 18.3% and 25.7%, respectively, in the group aged 75 years and older. On the other hand, a very low prevalence of underweight was observed, increasing with age (Table 4).

Discussion

On 21 November 2000, the National Board for Health Promotion (VIDA Chile) presented a six-year goal strategy (2000–2006) to the Chilean President[18]. These goals mandated a reduction in obesity prevalence among 2–5-year-old pre-school children attending day-care centres, from 10% to 7%; in 6–8-year-old schoolchildren admitted in first grade, from 16% to 12%; and in pregnant women from 32% to 28%. Thereafter, during the discussion of the national health reform, these goals for obesity were established as the Sanitary Goals for the decade (2000–2010)[19].

Five years later, at the end of 2005, obesity rates have not changed; in pre-school children this figure has remained stable at about 10.6%; in schoolchildren in first grade, it has increased to 18.5%; and in pregnant women the figure in 2004 was 32.6%. In children, the trend in obesity is similar to that in the UK, where the Government set a goal to stabilise childhood obesity prevalence at the level of 10%, but instead it increased from 9.9% in 1995 to 13.7% in 2003[20].

In the last five years VIDA Chile has continued to take actions and set clear regulations at central level in order to tackle obesity throughout the life cycle[21]. Educational materials on food and nutrition have been developed in order to be included in primary-school programmes[22]; however they have not been implemented yet by the Ministry of Education. Guidelines for Active Living[23] have been developed with clear messages to promote physical activity for all population groups[24]; but they have had little dissemination and application. Food education for the population has continued through media messages and delivery of booklets given to customers at supermarkets[25]. Food and Dietary Guidelines issued in 1997[26]

Table 4 Nutritional status of elderly Chileans by gender and age: SABE Study 2002

WHO BMI category ($kg\,m^{-2}$)	Men			Women		
	60–64 years	65–74 years	75 years and above	60–64 years	65–74 years	75 years and above
<18.5	0	0.73 (0.68–0.79)	1.87 (1.8–2.0)	0	1.0 (1.0–1.1)	3.8 (3.6–3.9)
18.5–24.9	20.6 (20.3–20.9)	27.4 (27.1–27.7)	36.7 (36.2–37.1)	19.4 (19.1–19.7)	21.9 (21.6–22.0)	34.0 (33.7–34.3)
25.0–29.9	43.8 (43.4–44.2)	46.2 (45.9–46.6)	43.1 (42.7–43.6)	36.5 (36.1–36.8)	44.1 (43.8–44.4)	36.5 (36.2–36.8)
≥30.0	35.6 (35.3–36.0)	25.6 (25.3–25.9)	18.3 (18.0–18.7)	44.1 (43.8–44.5)	33.0 (32.8–33.3)	25.7 (25.4–26.0)

WHO – World Health Organization; BMI – body mass index.
Values are expressed as % (95% confidence interval).

have been reviewed to include counselling on physical activity and tobacco, constituting Guidelines for Healthy Living[27]. Nevertheless, these efforts have been insufficient for decreasing the obesity prevalence in the country. In general, the population knows both what healthy eating means (as shown in different national surveys) and the benefits of engaging in physical activity, but there is persistence in eating foods high in fat, sugar and salt and also in leading inactive lives. Behaviour changes are difficult to attain and require strong political decision-making in order to set a national health priority involving the academic sector, the media, and public and private sectors.

Policy options

The question that arises is: Why have the goals set for obesity not been accomplished?

There are at least three answers. The first one is that the policies implemented have not been intense enough considering the magnitude of the problem, and that the application of a more efficient State Policy is required. The second possibility involves analysing the situation that would have occurred if any policy were implemented: in this case, the probable answer is that obesity would have continued to increase. The third answer is epidemiological: after a rapid rise in obesity in pre-school children (Table 1), school-age children (Fig. 3), adolescents (Table 2) and pregnant women (Fig. 4) between 1987 and 2000, a stabilisation period or a 'plateau' was observed. In that situation, very effective interventions are required to reduce obesity, because it is extremely difficult to reverse the trend.

Under this perspective, there have been effective policy options. For example, some interventions implemented in Chile have been effective in decreasing obesity rates in schoolchildren. A three-year intervention in public schools in a small city, Casablanca – which included educational activities in food and nutrition with materials developed by the Institute of Nutrition and Food Technology (INTA) and the Food and Agriculture Organization of the United Nations[22], and increased physical education time as well as improved quality of utilisation of this extra time – proved to be very successful. With this intervention, obesity decreased by 50% at the end of the second year, and remained stable thereafter[28]. This intervention, which was funded by a private company, is an example of a partnership between a university, the private sector and government to tackle the obesity epidemic. Presently, it is being replicated in one of Santiago's counties and, in addition, a new initiative based on the Casablanca experience and funded by private companies has been launched nationwide, based on the social responsibility of some enterprises. In addition, the Ministry of Health is implementing the Global Strategy against Obesity (EGO-Chile)[29,30], based on the strategy recommended by the WHO and Pan American Health Organization[31].

State policy in health promotion to prevent obesity

To accomplish change in the nutritional situation of the country, a global priority policy in health promotion to prevent obesity is needed. Presently, the priorities of government ministries are focused neither in health promotion nor in obesity prevention. The Ministry of Health is facing the urgent task to carry out health reform that includes the General Guarantees in Health (GGH) law, also called 'Plan AUGE' (Universal Access with Explicit Guarantees), based on a curative plan that initially tackles 40 specific diseases[32]. At the Ministry of Education, the most important goal is to improve the equity and the quality of education, measured by periodic tests that evaluate mathematics and linguistics skills. In the other ministries and governmental institutions, the situation is similar, with no integrated policy to cope with obesity and health promotion in order to improve the quality of life of the Chilean people.

A comprehensive State Policy, that includes the public and private sectors related with obesity, is needed. This policy, which requires special funding, should include: regulations for food advertisement and food marketing of unhealthy foods, an increase in physical education classes from two to at least four hours per week, and the provision of accessible places to engage in physical activity and recreation in the cities. A strong marketing campaign through the mass media (particularly television) is needed,

informing parents of the risks involved in childhood obesity, on the foods that are unhealthy and of the benefits of physical activity. An example of this type of marketing is the '5-a-day' campaign aimed to increase the consumption of fruits and vegetables in the population. Political decisions introducing initiatives to curb the sale of unhealthy foods should impact on changing long-established habits in the population. The healthy choices represent new challenges and also new opportunities and rules for the private sector. A successful association between public and private sectors requires not only sharing of goals but also sharing of ethics.

Conclusion

In conclusion, no effective actions to tackle the obesity epidemic will be possible without a clear priority strategy to prevent obesity at the national level, establishing synergy and alliances between the different actors: the scientific community, governmental and non-governmental organisations, legislators, health professionals, food industry and the media. Moreover, effective actions require local compromise at the pre-school and school levels in the counties; national commitment of the Government; compromises from the private sector; and Congress to enact laws and regulations against food marketing of unhealthy foods, while promoting physical activity.

Government and non-governmental organisations should play a role in promoting and protecting an environment that supports the growth and development of infants and children, monitoring food marketing, and facilitating community-based initiatives[33]. The successful Casablanca project, promoting healthy eating and physical activity in children and their families[28] that is being replicated currently in seven public primary schools in Santiago, should be an example to be followed in the near future by other public schools in the country.

Acknowledgements

Sources of funding: The work was funded by INTA, University of Chile.

Conflict of interest declaration: None.

Authorship responsibilities: F.V. was involved in the conception and design of the work, analysis and interpretation of the data, writing the article, and giving final approval of the version to be published. C.A. was involved in the conception and design of the work, analysis and interpretation of the data (in particular the data related to ageing), revising the article critically for important intellectual content, and giving final approval of the version to be published. J.K. was involved in the analysis and interpretation of the data (in particular the data related to infancy and children, including adolescence), and revising the article critically for the final approval of the version to be published.

References

1 Vio F, Albala C. Nutrition policy in the Chilean transition. *Public Health Nutrition* 2000; **3**: 49–55.
2 Vio F, Albala C. Epidemiology of obesity in Chile. *Revista Chilena de Nutrición* 2000; **27**: 97–104.
3 Albala C, Vio F, Kain J, Uauy R. Nutrition transition in Chile. Determinants and consequences. *Public Health Nutrition* 2002; **5**: 123–8.
4 Muzzo S, Burrows R, Cordero J, Ramirez I. Trends in nutritional status and stature among school-age children in Chile. *Nutrition* 2004; **20**: 867–72.
5 Ministry of Health& National Institute of Statistics. *National Health Survey (ENS) 2003*. Santiago: Ministry of Health, 2004.
6 Albala C, Lebrao ML, Leon Diaz EM, Ham-Chande R, Hennis AJ, Palloni A, *et al.* The health, well-being, and aging ('SABE') survey: methodology applied and profile of the study population. *Revista Panamericana de Salud Pública* 2005; **17**: 307–22.
7 World Health Organization (WHO). *Measuring Changes in the Nutritional Status of Children*. Geneva: WHO, 1983.
8 Centers for Disease Control and Prevention/National Center for Health Statistics. *CDC Growth Charts: United States* [online], 30 May 2000. Available at http://www.cdc.gov/growth charts. Accessed June 2004.
9 Rosso P. A new chart to monitor weight gain during pregnancy. *American Journal of Clinical Nutrition* 1985; **41**: 644–52.
10 Atalah E, Castillo C, Castro R, Aldea A. Proposal of a new standard for the nutritional assessment of pregnant women. *Revista Médica de Chile* 1997; **125**: 1429–36.
11 World Health Organization (WHO). *Obesity: Preventing and Managing the Global Epidemic*. WHO Technical Report Series No. 894. Geneva: WHO, 2000.
12 Lobstein T, Baur L, Uauy R. Obesity in children and young people: a crisis in public health. *Obesity Reviews* 2004; **5**(Suppl. 1): 4–104.
13 Barlow SE, Dietz WH. Obesity evaluation and treatment: Expert Committee recommendations. The Maternal and Child Health Bureau, Health Resources and Services Administration and the Department of Health and Human Services. *Pediatrics* 1998; **102**: E209.
14 Berríos X, Jadue L, Zenteno J, Ross MI, Rodríguez H. Prevalence of risk factors for chronic diseases. A study in the general population of the metropolitan area, 1986, 1987. *Revista Médica de Chile* 1990; **118**: 597–604.
15 Berríos X. Risk factors for chronic diseases: an example for epidemiological research. *Boletín Escuela Medicina Pontificia Universidad Católica de Chile* 1994; **23**: 73–89.
16 Berríos X. Time trends in risk factors for chronic diseases: is a new epidemic coming? *Revista Médica de Chile* 1997; **125**: 1405–7.
17 Jadue L, Vega J, Escobar MC, Delgado I, Garrido C, Lastra P, *et al.* Risk factors for non communicable diseases: methods and global results of the CARMEN program basal survey. *Revista Médica de Chile* 1999; **127**: 1004–13.
18 National Board for Health Promotion (VIDA Chile). *Strategic Plan 2001–2006. Intersectorial Goals for 2006*. Santiago: Ministry of Health, 2000.
19 Government of Chile/Ministry of Health. Sanitary Goals for decade 2000–2010. *El Vigía Especial* 2002; **5**: 1–2.
20 Cole A. UK government likely to miss its target to reduce childhood obesity. *Britisb Medical Journal* 2006; **332**: 505.
21 Salinas J, Vio F. Health promotion in Chile. *Revista Chilena de Nutrición* 2002; **29**(Suppl. 1): 164–73.
22 Olivares S, Moron C, Kain J, Zacarias I, Andrade M, Lera L, *et al.* A methodological proposal to include nutrition education in primary schools. Experience in Chile. *Archivos Latinoamericanos de Nutrición* 2004; **54**(Suppl. 1): 33–9.

23 Ministry of Education/Ministry of Health/Chiledeportes/ Institute of Nutrition and Food Technology, University of Chile; Vio F, Salinas J, eds. *Guidelines for Active Living*. Santiago: Andros Impresores, 2003.
24 Salinas J, Vio F. Promoting health and physical activity in Chile: a policy priority. *Revista Panamericana de Salud Pública* 2003; **14**: 281–8.
25 Domper A, Zacarías I, Olivares S, González D, Vio F. Delivery of nutritional information and food purchasing characterization in supermarkets. *Revista Chilena de Nutrición* 2005; **32**: 142–9.
26 Castillo C, Uauy R, Atalah E. *Food and Dietary Guidelines for the Chilean Population*. Santiago: Imprenta Diario La Nación, 1997.
27 Institute of Nutrition and Food Technology, University of Chile/National Board for Health Promotion (VIDA Chile)/ Ministry of Health. *Guidelines for Healthy Living, Food Guidelines, Physical Activity and Tobacco*. Santiago: Andros Impresores, 2005.
28 Kain J, Vio F, Leyton B, Cerda R, Olivares S, Uauy R, *et al*. School-based health promotion intervention for primary school children from Casablanca, Chile. *Revista Chilena de Nutrición* 2005; **32**: 126–32.
29 Government of Chile/Ministry of Health. *Global Strategy Against Obesity (EGO-Chile)*. Santiago: Ministry of Health, January 2006.
30 Government of Chile/Ministry of Health/Health and Education and Health Working Group. *A Proposal for an Integrated Approach for Infant Obesity*. MINEDUC-JUNAEB-JUNJI-INTEGRA-MINSAL. Santiago: Ministry of Health, December 2005.
31 World Health Organization (WHO). *Global Strategy Against Obesity*. Geneva: WHO, May 2005.
32 Letelier ML, Bedregal P. Health reform in Chile. *Lancet* 2006; **368**: 2197–8.
33 Caballero B. A nutrition paradox – underweight and obesity in developing countries. *New England Journal of Medicine* 2005; **352**: 1514–16.