

# Nutrition transition in Chile: determinants and consequences

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## Abstract

*Objectives:* The purpose of this study was to analyse the determinants and consequences of the nutrition transition in Chile and describe the related health promotion policies.

*Design and setting:* This is a descriptive, population-based study including data on demographic, diet, nutrition and biomedical related variables. Data came from the Food and Agriculture Organization (FAO), the National Institute of Statistics (INE), the Ministries of Planning, Health and Education surveillance systems, and national surveys.

*Results:* As malnutrition decreased during the 1980s, obesity increased rapidly in all age groups. In adults, currently about 25% of women are obese (body mass index  $>30 \text{ kg m}^{-2}$ ); particularly those from low socio-economic levels. Among pre-schoolers, obesity is now 10% while in 6-year-old children it is 17.5% (weight/height greater than two standard deviations ( $>2\text{SD}$ ) of the World Health Organization reference). Nutritional risk factors are prevalent, diet is changing to a 'Western diet' with an increasing fat consumption, and sedentarianism is constant in all groups. High blood pressure ( $>140/90$ ) is greater than 10% in adults. Diabetes is increasing in urban areas, including in the indigenous population, and more than 40% of adults have a cholesterol level of more than  $200 \text{ mg ml}^{-1}$ .

*Conclusions:* Promotion of healthy lifestyles is the main strategy to cope with this situation, particularly changing behaviour in food habits, physical activity and psychosocial factors. Changes in lifestyles will not only allow the prolonged life expectancy to be of better quality, but also will favour a decrease in the morbidity and mortality from chronic diseases, mainly cardiovascular diseases.

**Keywords**  
Nutrition transition  
Obesity  
Risk factors  
Chronic diseases  
Health promotion

The unique characteristic of the epidemiological transition in Chile has been its rapid progression. In 1971, Omran classified the country as a 'contemporary or delayed model'<sup>1</sup>; however, by the 1990s, it had changed to an 'accelerated model' similar to Japan. Chile was in the transition period in the 1970s but progressed to a post-transition stage by the end of the 1980s. Now, at the beginning of the 21st century, Chile has a life expectancy at birth (LEB) of 80 years for women and 73 years for men, and is facing a fourth phase of the process: the advanced mortality profile<sup>2</sup>, characterised by the delay of deaths caused by degenerative diseases<sup>3</sup>.

The main mechanisms involved in the Chilean epidemiological transition are the increase of risk factors for chronic diseases (characteristic of the urbanisation process) that has affected the incidence of chronic diseases, the fertility decline (which has changed the age structure of the population), and the improvement in case-fatality rates. Chile underwent rapid modernisation in the decade of the 1990s as a consequence of economic growth. This economic growth produced positive effects in relation to coverage of potable water and sanitation; decreases in infectious diseases, malnutrition and infant mortality rates; and increases in the access to education,

health and other community services<sup>4–6</sup>. On the other hand, this growth produced negative effects on lifestyle, such as the turning to a 'Western diet' and its predominance of fast food consumption<sup>7</sup>, and a decrease in physical activity. Additionally, an increase in alcohol and drug abuse and a sustained, high prevalence of smoking habit have been observed; air pollution has also increased considerably, particularly in big cities like Santiago, one of the most polluted cities in Latin America<sup>8</sup>.

Chile is simultaneously experiencing the demographic and epidemiological transitions, resulting in an ageing population and a shift from infectious to chronic diseases. The nutrition transition experience in Chile is related to demographic and socio-economic changes<sup>4–6,9,10</sup>, dietary changes, obesity and sedentary lifestyles, which in turn have affected blood cholesterol, diabetes and hypertension. This paper examines the determinants and consequences of the nutrition transition in Chile and their relationship with its health promotion policies.

## Mortality changes

With respect to general mortality, the proportion of cardiovascular disease has had a sustained increase from

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1970 (22.3% of total deaths) to 1992 (29%) and a posterior stabilisation<sup>11</sup>. This proportion is higher than the average observed in the developing world (19% of all deaths)<sup>12,13</sup>, also higher than the rate in Canada (22%)<sup>14</sup>. The proportion of deaths from malignant tumours also increased, from 12% to 21.6%, in the same period. At the same time, a reduction has been observed in injuries, and infectious and perinatal diseases (Fig. 1). Respiratory diseases have decreased in childhood, but in the general epidemiological profile of the country they are again a leading cause of mortality, mainly due to the mortality from these in persons aged 75 years and above.

According to the 1998 World Health Report<sup>15</sup>, the global burden of non-communicable diseases corresponds to 43% of all Disability-Adjusted Life Years (DALYs) lost. Cardiovascular diseases alone are responsible for 10% of lost DALYs in low-income countries whereas, in industrialised countries, the proportion increases to 23%. A disease burden study conducted in Chile in 1995, with mortality data from 1993, revealed that chronic diseases are the main cause of DALYs lost, accounting for 73% of the total<sup>16</sup>. Of this total, cardiovascular diseases were the highest cause of DALYs lost, accounting for 10.3%. Life years lost by premature death in the same years (1993–94) were mainly due to injuries (26.2%), followed by tumours (17.8%) and cardiovascular diseases (13.6%)<sup>9</sup>.

### Dietary changes

The nutrition transition brings significant dietary changes; increases in total fat, mostly saturated fat, is the most prominent. As income increases in transitional countries, so does the consumption of fat, including industrially processed hydrogenated fat<sup>7</sup>. The combination of the diet change and sedentary lifestyle is perfect to trigger increasing adiposity. Recent data from several urban centres, including data obtained in Santiago, demonstrate that TV viewing and a child's preference for certain TV commercials has a direct relationship with snack food consumption and other food purchased by children at school<sup>17</sup>. The progressive rise in overweight and obesity is especially prevalent in low-income groups who improve their income and subsequently buy high-fat/high-carbohydrate energy-dense foods. There is a marked consumer preference in the urban supermarket for sweet and salty, high-fat foods; intake of these increases to the detriment of grains, fruits and vegetables. Dietary factors are associated with the main causes of death: cardiovascular diseases and cancer. Dietary patterns have changed rapidly in Chile to the so-called 'Western diet', rich in saturated fat, as described in a previous paper<sup>6</sup>. Analysis of the Food and Agriculture Organization's (FAO) Food Balance Sheets demonstrates that the availability of total calories and calories from fat have increased in the last two decades, with a major increase in saturated fats (Fig. 2). In fact, in 1980, the average per capita availability for calories and fat

was 2667 kcal (21% from fat), increasing to 2844 kcal (28% from fat) in 1998<sup>18</sup>.

Existing data from studies done between 1960 and 1989 estimating food intake in Chile<sup>8</sup> show that the average caloric contribution of macronutrients in the Chilean diet consisted of 10–13% protein, 20–25% fat and 60–70% carbohydrates, without any relevant changes in the period. A recent comparative analysis of the National Household Surveys on Food Expenditure conducted in 1988 and 1998<sup>19</sup> has demonstrated that the main expenditure of the poor is for bread, meat and soft drinks, meaning that the preferences of the poor are in the first place for the staple food in Chile (bread) and then for food with a high proportion of saturated fat (meat) and sugar (soft drinks). Converted into energy and macronutrients, an increase of 22% in average total calories and an increase in average fat consumption of 26% are observed (Table 1). Additionally, a cross-sectional survey on food consumption, conducted in Santiago in 1995<sup>20</sup>, demonstrated that 70% of adults consumed less than two fruits and 59% consumed less than two portions of vegetables per day.

### Sedentary lifestyle

Sedentary behaviour is one of the main contributory factors to increasing obesity rates. The explanation for this increase has been attributed to inactivity, especially from spending more hours per week watching TV and the utilisation of more vehicles and activity-saving appliances<sup>21</sup>. In Chile, the number of cars by 1000 inhabitants was 38.9 in 1970, increasing to 136.6 in 1998, and TV appliances increased from 12 170 in 1970 to more than two million in 1998<sup>22</sup>. A survey carried out in 1998 on a representative sample of school children in Santiago showed that at least 90% watch an average of 2 hours of TV on weekdays<sup>17</sup>. Two surveys on risk factors for chronic diseases, conducted in the Santiago population over 15 years of age in 1988 and 1992<sup>23,24</sup>, indicated that about 60% of men and 80% of women performed less than two 15-minute periods of exercise per week. In another study conducted in 1997 on a representative sample (25–64 years of age) in urban Valparaíso, Chile<sup>25</sup>, 93% of women in 1997 were inactive in their leisure time; this was even higher (97%) in the low socio-economic group. The CASEN survey 2000, conducted in a national representative sample<sup>10</sup>, demonstrated that only 8.6% of the population >15 years performed more than 30 minutes of exercise three times per week and 71% did not performed any type of exercise. All of these data demonstrate the high level of sedentarianism in the Chilean population.

### Obesity

Trends demonstrate a progressive rise of obesity rates. Chile has evolved over the past two decades, from high

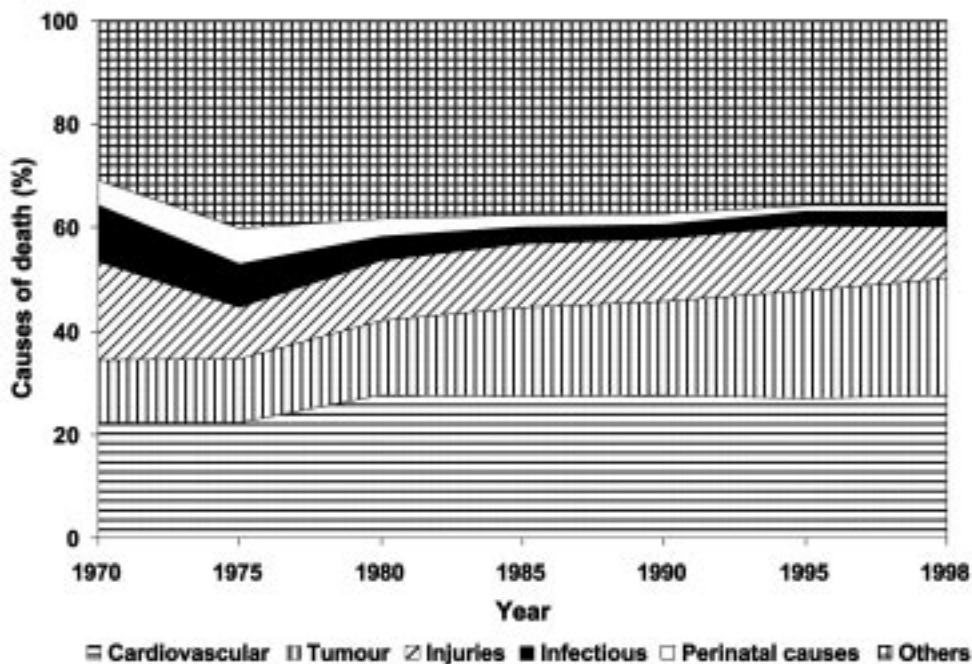


Fig. 1 Trends in relative contribution to causes of death, Chile 1970–1998

undernutrition and low obesity rates, to the virtual eradication of undernutrition and high obesity prevalence in all age groups. Concomitantly, a decrease in the rate of stunting has been observed as well as a decline in the prevalence of birth weight under 2500 g, currently about 5% of all births<sup>26</sup>.

Obesity prevalence has doubled in pre-school and school-aged children over the past decade<sup>27</sup> as shown in Fig. 3. The situation of pregnant women has also changed dramatically, with a decrease in undernourished mothers from 26% in 1987 to 14.1% in 2000, while obesity has increased from 12.9% to 32.7% in the same period<sup>26</sup>. In two surveys conducted in 1988 and 1992 among adults in

Santiago, obesity increased from 6% to 11% and from 14% to 24% in men and women respectively, over a four-year period. Obesity increased with age, was more prevalent in women than in men, and was higher in women of low socio-economic level<sup>23,24</sup>. In Valparaiso, the second largest city, obesity prevalence was also high and had a similar distribution to that found in Santiago<sup>25</sup>. Changes in the diet and sedentarianism are the most probable causes of the increasing trend of obesity in Chile.

**Blood cholesterol**

Studies indicate that serum cholesterol is affected by diet

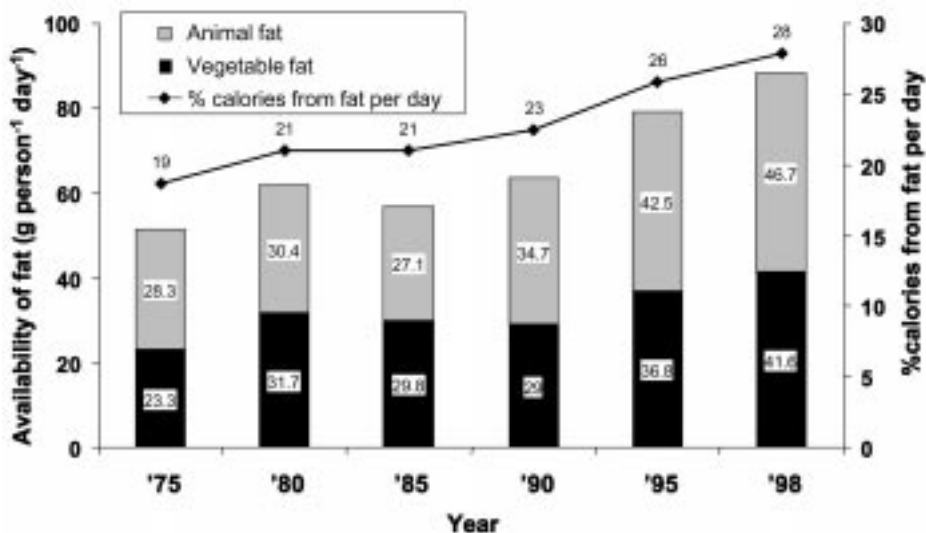


Fig. 2 Availability of fat per capita, Chile 1975–1998

**Table 1** Food expenditure and food converted into macronutrients by income quintile and year

|   | Income quintile and year |      |      |      |      |      |      |      |             |      |
|---|--------------------------|------|------|------|------|------|------|------|-------------|------|
|   | I (lowest)               |      | II   |      | III  |      | IV   |      | V (highest) |      |
|   | 1988                     | 1998 | 1988 | 1998 | 1988 | 1998 | 1988 | 1998 | 1988        | 1998 |
| Food (% of total expenditure)   |                          |      |      |      |      |      |      |      |             |      |
| Meat  | 9.4                      | 9.4  | 9.7  | 10.0 | 10.2 | 9.9  | 11.2 | 9.4  | 11.9        | 7.9  |
| Soft drinks   | 2.2                      | 7.3  | 3.1  | 9.3  | 3.3  | 8.1  | 3.4  | 7.5  | 3.0         | 5.2  |
| Bread   | 21.2                     | 15.0 | 18.6 | 12.2 | 15.1 | 10.4 | 11.9 | 8.1  | 5.9         | 4.4  |
| Chicken   | 5.5                      | 5.6  | 5.5  | 5.0  | 5.3  | 4.7  | 5.2  | 4.0  | 3.9         | 2.9  |
| Sausage   | 2.9                      | 3.8  | 3.2  | 3.7  | 3.2  | 3.7  | 3.2  | 3.3  | 3.3         | 2.8  |
| Away from home  | 1.9                      | 2.7  | 2.6  | 4.3  | 4.9  | 6.0  | 5.8  | 9.9  | 12.8        | 19.1 |
| All others  | 56.9                     | 56.2 | 57.3 | 44.5 | 58.0 | 57.2 | 59.3 | 57.8 | 59.2        | 57.7 |
| Total   | 100                      | 100  | 100  | 100  | 100  | 100  | 100  | 100  | 100         | 100  |
| Total food expenditure converted into calories and macronutrients (daily consumption) |                          |      |      |      |      |      |      |      |             |      |
| Energy (cal)  | 1640                     | 2010 | 1617 | 2070 | 1734 | 2129 | 1988 | 2269 | 2200        | 2492 |
| Carbohydrates (g)   | 231                      | 271  | 230  | 287  | 244  | 302  | 277  | 327  | 292         | 349  |
| Protein (g)   | 44.5                     | 55.7 | 43.3 | 59.3 | 47.4 | 59.8 | 55.5 | 64.1 | 65.0        | 74.0 |
| Fat (g)   | 42.2                     | 55.4 | 42.3 | 61.2 | 47.5 | 63.6 | 57.3 | 68.4 | 72.1        | 80.1 |
| % of energy from fat  | 23.2                     | 24.8 | 23.5 | 26.6 | 24.7 | 26.9 | 25.9 | 27.1 | 29.5        | 28.9 |

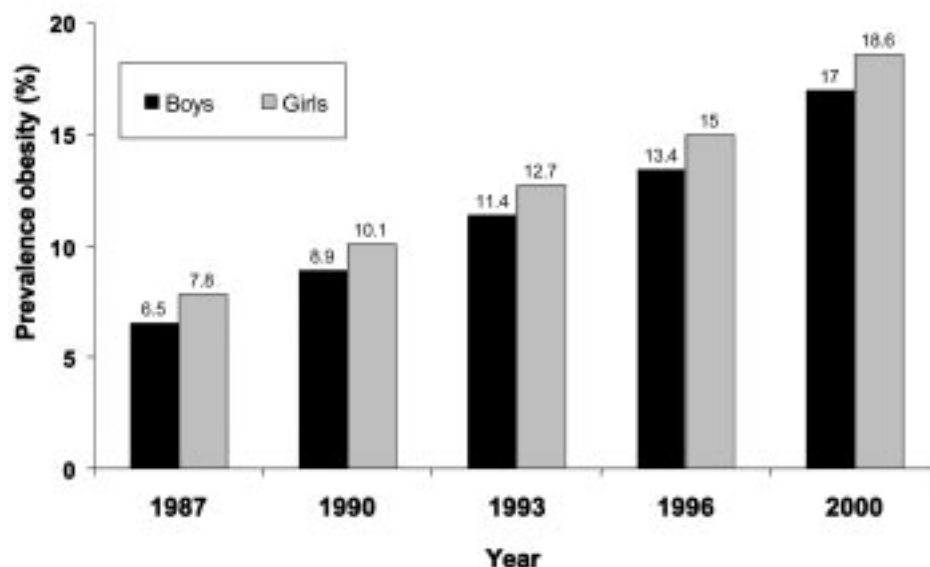
Source: INE National Household Surveys on Food Expenditure, 1988 and 1998<sup>19</sup>.

quality and quantity. In Chile a 1984 survey of outpatients from two large hospitals in Santiago<sup>28</sup>, which served a low-income population, found a median serum cholesterol level of 185 mg dl<sup>-1</sup>. At the same time, significantly lower levels of cholesterol were found in women of low socio-economic level (SEL) than in women of high SEL<sup>29</sup>. In 1987, a survey carried out in Santiago<sup>23</sup> found a prevalence of cholesterol greater than 200 mg dl<sup>-1</sup> in 32% of men and 33% of women, increasing with age and income. In 1992, the proportion increased to over 40% in both men and women<sup>24</sup>; in Valparaiso in 1997<sup>25</sup>, the values were 45.2% for men and 48% for women. The prevalence of cholesterol greater than 200 mg dl<sup>-1</sup> is more than 10% among children and adolescents<sup>30,31</sup>.

### Type 2 diabetes

The link between obesity and type 2 diabetes is one of the most powerful risk factor–disease relationships known<sup>32</sup>. As a consequence, diabetes rates are escalating rapidly and have an earlier onset, leading to major health problems and financial burden<sup>33</sup>.

The prevalence of type 2 diabetes was 5.3% in a representative Santiago sample in 1979<sup>34</sup> and 4% in Valparaiso in 1997<sup>25</sup>. Our studies over the past five years have examined the effects of the environment on the prevalence of obesity, glucose intolerance and diabetes in the indigenous population. In rural areas, where Mapuche (indigenous people of Chile) ethnic and cultural



**Fig. 3** Prevalence of obesity in first-grade school children, Chile 1986–2000<sup>27</sup>. Obesity is defined as weight/height greater than two standard deviations (> 2SD) of the National Center for Health Statistics (NCHS)/World Health Organization (WHO) reference

**Table 2** Prevalence of high blood pressure in the adult population of Chile (1978–1998)

| Author and year                              | Location          | Classification | Prevalence (%) |
|--|-------------------|----------------|----------------|
| Rodríguez and Dockendorf, 1978 <sup>42</sup> | Rural IX Region   | >160/95        | 18.4           |
| Berrios <i>et al.</i> , 1987 <sup>23</sup>   | Santiago          | >160/95        | 8.8            |
| Fasce <i>et al.</i> , 1989 <sup>39</sup>     | Urban VIII Region | >140/90        | 18.6           |
| Fasce <i>et al.</i> , 1991 <sup>40</sup>     | Rural VIII Region | >140/90        | 22.8           |
| Vega <i>et al.</i> , 1998 <sup>38</sup>      | Urban Valparaiso  | >140/90        | 11.1           |

distinctive characteristics are preserved, the prevalence of diabetes was 0.98% in 1985<sup>35</sup>; one of the lowest ever found. In 1995–1996, Mapuche of rural areas were compared with Caucasian subjects from the general population of Santiago and Mapuche living in Santiago<sup>36,37</sup>. The study revealed a higher prevalence of obesity and diabetes in urban Mapuche compared with rural natives. We found 4.1% of diabetics in rural Mapuche, compared with 9.8% in urban Mapuche and 5.3% in the Caucasian population of Santiago. Glucose intolerance was identified in 3.4% of the rural Mapuche and in 6.1% of the urban Mapuche.

### Hypertension

A high salt consumption and obesity have long been recognised as some of the strongest independent risk factors for the development of hypertension.

Several local studies carried out from 1978 to 1998<sup>23–25,38–41</sup> have examined the prevalence of hypertension in the country, as shown in Table 2. There is a high proportion of hypertensive people (11.1% to 22.8%), which is higher in rural than in urban areas. In the last risk factors study conducted in a representative urban sample, aged 25–64 years, in 1997 in Valparaiso<sup>25</sup>, the adjusted prevalence of hypertension was 11.1%, increasing with age, reaching 27.4% in the 55–64-year-old group. In the same study, 16.5% of those interviewed added salt to their meals before determining the need<sup>42</sup>. All studies have shown that at least a third of the people with the disease do not know of their condition, and among those diagnosed, at least a third are not controlled. Hypertension also constitutes the main cause for medical attention at the primary level in the public sector and 9.3% of the total consultations<sup>16</sup>.

### Conclusions

Chile is undergoing a rapid nutritional transition with a progressive increase in risk factors for non-communicable chronic diseases. The contributions of rising income, increased urbanisation, increase in apparent fat consumption and sedentary behaviour can probably explain this rise. All of these factors determined changes in lifestyle, especially diet and physical activity, which are similar to those observed in industrialised societies; the unique

characteristic in Chile is that the rate of change has been faster. In fact, Chile changed rapidly from a pre-transition to a post-transition situation (with an adequate preventive maternal and child policy, which decreased infant mortality and maternal mortality rates) in two decades. The same capacity that proved so effective in improving all of the biomedical indices related to poverty, can serve to attack the increasing prevalence in risk factors for chronic diseases through a health promotion policy<sup>5</sup>. In the past, Chile was able to decrease malnutrition in a relatively short period of time with the implementation of adequate policies. Presently, the challenge is different and more difficult; it requires an integrated effort to change the behaviour of the population regarding food, physical activity, tobacco consumption, stress, etc. This is not compatible with the principles of economic development and advertisement, which aim at increasing the intake of fast food and soft drinks, at using cars and electric appliances more frequently with minimal physical activity, and at increased consumption of tobacco and other addictive substances.

The health promotion policy focuses on food, nutrition, physical activity, tobacco, psychosocial factors and environment. These are addressed in an integrated way in the pre-school and school systems, at workplaces, and at the county and small community level. The government is committed to support these policies with funding and regulations<sup>43</sup>. If these health promotion policies succeed in producing positive changes in lifestyles, the quality of life over the prolonged life expectancy will be better and there will be a decrease in morbidity and mortality for chronic diseases, especially cardiovascular diseases.

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