The nutrition transition in South Korea

Soowon Kim, Soojae Moon, and Barry M Popkin

ABSTRACT
Background: An accelerating shift from infectious to noncommunicable diseases and concurrent shifts in diet, activity, and body composition are universal trends but are especially apparent in middle- and lower-income countries. A unique nutrition transition has occurred in South Korea, a country that modernized earlier than most Asian countries did.

Objective: The purpose of this analysis was to describe the South Korean nutrition transition, focusing on specific features that other countries might follow to retain the healthful elements of their traditional diets.

Design: We used secondary data on economics, dietary intake, anthropometry, and causes of death, including a series of comparable nationally representative dietary surveys (the National Nutrition Survey).

Results: The structure of South Korea’s economy, along with the country’s dietary and disease patterns, began an accelerated shift in the 1970s. Major dietary changes included a large increase in the consumption of animal food products and a fall in total cereal intake. Uniquely, the amount and rate of increase in fat intake have remained low in South Korea. South Korea also has a relatively low prevalence of obesity compared with other Asian countries with similar or much lower incomes.

Conclusions: The nutrition transition in South Korea is unique. National efforts to retain elements of the traditional diet are thought to have shaped this transition in South Korea in the midst of rapid economic growth and the introduction of Western culture. Am J Clin Nutr 2000;71:44-53.

KEY WORDS Nutrition transition, South Korea, economic growth, diet, National Nutrition Survey, anthropometry, causes of death, fat intake, obesity

INTRODUCTION
The epidemiologic transition, particularly the rapid shift in morbidity and mortality patterns toward much higher rates of noncommunicable diseases, is dominating the health profile of an increasingly large number of persons in middle- and lower-income countries. Concurrent shifts in diet, activity, and body composition also appear to be accelerating in many regions of the world (1). The concept of nutrition transition, a sequence of characteristic dietary and nutritional patterns resulting from large shifts in overall dietary structure, related to changing economic, social, demographic, and health factors (2) summarizes the universal trends. The purpose of this analysis was to provide an understanding of the multidimensional phenomenon of the nutrition transition in South Korea, a country that modernized earlier than did most Asian countries while keeping its unique features. Although other authors have discussed aspects of the South Korean transition (2–6), this article broadly reviews the transition to provide a thorough understanding of the transition and insights into directions other countries might follow to retain more of the healthful elements of their traditional diets.

Unlike the gradual transition that occurred in the United States and most European countries, the nutrition transition in many lower-income countries has been rapid. Information from Asian countries such as Japan, China, and Thailand and from South Africa and the Caribbean shows an accelerated change in the structure of diet after these countries attained dietary sufficiency at the national level (1, 2, 7). In Asia, the effect of economic factors on the nutrition transition has been particularly apparent (1, 8). Japan experienced a rapid shift in its dietary structure during its accelerated economic growth from 1950 to 1970 (2). China is experiencing an even more rapid shift in diet, especially among its urban residents (9, 10). Concurrent with these transitions, obesity is increasing in most Asian nations (11).

South Korea experienced earlier economic change than did most Asian countries. Its economy grew at an impressive rate during the past 3 decades, after its recovery from the Korean War (1950–1953). Concurrent changes in lifestyle included the rapid introduction of elements of what may be termed a Western lifestyle. Fast-food restaurants were introduced and became popular, especially with the younger generation. At the same time, however, movements arose to keep elements of traditional dietary patterns and staples. This combination of events, which resulted in the unique shape of the nutrition transition in South Korea, may provide important insights for many other countries.

SUBJECTS AND METHODS
We analyzed secondary economic, dietary intake, anthropometric, and cause-of-death data from published reports and articles.

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Received February 26, 1999.
Accepted for publication June 29, 1999.
Economic data

Data on work force structure were obtained from South Korea’s National Statistical Office (12). For economic trends, we used national income data from the official estimates of gross national product (GNP) per capita (Atlas method) from 1962 to 1996 as established by the World Bank (13). GNP per capita was expressed in 1996 US dollars adjusted for inflation on the basis of consumer price indexes (14) to allow for an easier comparison across the years. Urbanization data also came from the World Bank (13).

Dietary data

A series of comparable nationally representative dietary surveys was used to provide a more coherent picture of the nutrition transition in South Korea than we can find for most countries.

Most of the dietary intake data were obtained from the most recent published report of the National Nutrition Survey (15), which has been conducted annually by the South Korean Ministry of Health and Welfare since 1969 (16). All the surveys were conducted nationwide and included only independent persons who were not institutionalized. Surveys were carried out during a 1-mo period between August and November each year. Since 1975, sample households representative of the nation were selected by using a multistage stratified sampling, a multistage cluster sampling, or a sampling method with probability proportional to size, depending on the year. The number of households surveyed ranged from 543 to 2000 before 1988. The sample size was kept at 2000 households nationwide after that time. For dietary intake data, a trained interviewer weighed everything the surveyed household members ate at home for 2 consecutive days. Nutrient values were calculated by using a food-composition table from the Rural Development Administration and the Rural Nutrition Institute (15, 16).

The National Nutrition Survey has limitations (16), as does any nutritional survey. It is almost impossible to measure usual diet by a weighed method in a free-living population. Even though weighing eliminates the main problems inherent in dietary assessment methods, such as inaccuracy of recall and under- or overreporting, weighing is invasive enough to alter people’s usual intake. Also, estimation methods are inaccurate. Skipped meals or meals taken away from home were not included in the measure of total household consumption. Because men are the major group who eat out in South Korea, although weighing eliminates the main problems inherent in dietary assessment methods, such as inaccuracy of recall and under- or overreporting, weighing is invasive enough to alter people’s usual intake. Also, estimation methods are inaccurate. Skipped meals or meals taken away from home were not included in the measure of total household consumption.

Anthropometric data

Several studies in which adults’ mean height and weight were reported were available for analysis (25). We focused on the shift toward greater obesity and reported the distribution of body mass index (BMI; in kg/m²) from the National Nutrition Survey Report. However, information on the distribution of BMI was not included in the National Nutrition Survey Report until 1990. Data that incorporated international standards for measuring obesity were available only for 1995, when we had BMI distribution data for adults aged ≥20 y. Therefore, we chose to present only 1995 BMI data from South Korean adults and included comparable obesity data from other Asian countries to compare the prevalences of obesity. We followed the World Health Organization cutoffs to delineate obesity [BMI of 25.0–29.9 for overweight (preobesity) and ≥30.0 for obesity] (26). In lieu of published BMI data for children, we crudely approximated the mean BMI for 8- and 17-y-olds by using average weight and height data (27).

Cause-of-death data

We present cause-of-death trends as percentages of total deaths for 4 disease categories in which the death rates changed noticeably in South Korea during the past several decades (28, 29). Diseases were classified according to the Korean Standard Classification of Causes of Death (30), which was based on the World Health Organization’s International Statistical Classification of Diseases, Injuries and Causes of Death (ICD). The 4 categories chosen to illustrate major shifts in disease patterns from infectious to chronic diseases were 1) infectious and parasitic diseases (including tuberculosis), 2) diseases of the respiratory system (eg, pneumonia and bronchitis), 3) malignant neoplasms (eg, cancers of the stomach, liver, bronchus, and lung), and 4) diseases of the circulatory system (eg, rheumatic heart disease, hypertensive disease, ischemic heart disease, cerebrovascular disease, and diseases of the pulmonary circulation).

RESULTS

South Korean economy

We found that remarkable changes occurred in the South Korean economy and the structure of the work force over the past 35 y. GNP per capita increased dramatically from the early 1960s to the mid-1990s (Figure 1), with the rate of increase accelerating in the late 1980s. The GNP increased more than 17 times between 1962 and 1996. Such rapid economic growth increased national food availability and enhanced the purchasing power of the people, which accelerated the nutrition transition.

With this rapid shift in income, associated changes in the population and occupation distributions occurred. South Korea was only 27.7% urban in 1960; by 1996 this percentage was...
A shift from energy-intensive occupations in the rural primary-product sectors of agriculture, forestry, and fisheries to occupations in services and manufacturing came with the growth in South Korea’s GNP (Figure 1). The current occupational structure of South Korea is similar to that of most Western countries. As we noted elsewhere, this transition is linked to a major reduction in energy expenditure at work (1, 11).

**Diet**

The dietary transition in South Korea was accelerated by the importation of wheat from the United States to make up for food shortages that emerged after 1969 (3). Many processed foods made from wheat flour, such as breads and noodles (including ramen noodles), entered the food supply. The government encouraged the consumption of these foods and other grains. Exposure to the new foods altered people’s preferences. The government also helped to promote farming in the 1960s. In the early 1970s, a new, improved variety of rice was successfully developed to increase rice production. In 1979, fast-food restaurants first appeared (31). In the 1980s, new technologies were introduced widely from advanced countries and there was a noticeable expansion in the food-processing industry. More recently, the removal of trade restrictions related to the Uruguay Round of the General Agreement on Tariffs and Trade (1994) was important in opening up restrictions on the importation of meat. This series of changes in the food supply, brought about by industrial development and policy changes, is thought to be a direct cause of the shift in food intake in South Korea. The following 2 sections of this article describe trends in dietary intake in terms of food groups and nutrients.

**Food groups**

The total amount of food intake per capita per day, calculated from household food intake, fluctuated around 1000 g between 1969 and 1995 (Table 1). The fluctuation seems random, even though the trend since the late 1980s was a gradual increase in total food intake. A shift did occur in the sources of food; food intake from animal sources increased. This shift became especially apparent after the 1970s. In terms of grams of food, the percentage of plant-food intake decreased consistently, from 97% in 1969 to 79% in 1995. In contrast, the percentage of animal food intake increased 7 times during that period.

This shift can be clearly seen by examining the intake trends for each food group. Consumption of cereals and grain products, the major contributors to food intake of South Koreans, decreased significantly. In 1969, per capita intake of cereals accounted for 53% of total grams of food intake. In contrast, cereals accounted for only 28% of total intake in 1995. However, rice consumption did not change much throughout the survey period. Legume intake increased until the mid-1980s but decreased thereafter. The intake of potatoes and other starchy tubers decreased. Vegetable intake fluctuated over the whole period, but overall consumption changed little. An important shift occurred toward the consumption of more processed vegetables than fresh ones. This trend resulted from the shifts that occurred both in lifestyles and in the agribusiness sector. Increased residence in urban areas and a rapid increase in the number of apartments reduced home gardening remarkably. The increased percentage of women in the labor force (17.8% in 1961, 31.9% in 1980, and 40.6% in 1997) (32) reduced the time available to women to prepare food. Fruit intake increased gradually until the late 1980s but more rapidly after 1990. Seaweed consumption increased gradually.

Intake of all animal food products increased significantly over the past 35 y. Meat and poultry consumption increased 10-fold between 1969 and 1995. The rate of increase was highest starting in the early 1980s. Consumption of milk and dairy products increased even more rapidly: 4.3-fold during the 5-y period between 1980 and 1985. This increase was attributed to an increase in the importation of milk cows and the growth of the animal-feed industry. Consumption of fish and shellfish, particularly processed items, also increased rapidly during this period. However, the rates of increase for fish and shellfish were lower than those for meat, poultry, and milk. In 1995, intake of fish, meat, and milk products was balanced, each accounting for approximately one third of animal food products consumed. Although the rate of increase in fish and shellfish consumption was not as high as that of meat, poultry, or milk consumption, fish and shellfish were still the most significant....
source of animal food products for South Koreans. Egg intake increased until 1985 but stayed almost steady after that. During the transition, mass production of animal feed led to an expansion of the poultry industry and a subsequent reduction in egg prices. Lower egg prices enhanced the role of eggs as a source of higher-quality protein in the 1980s. Consumption of added fats and oils doubled between 1969 and 1995. As with the rest of Asia, this increase was predominantly from vegetable oil consumption, but the increase was very small relative to that of other Asian countries (8).

Intake trends for major food groups between 1969 and 1995 are shown in Figure 2. The figure illustrates the dramatic fall in total cereal intake with the significant rise in total animal food product intake. The transition coincided with the rapid increase in GNP in the early 1980s (see Figure 1).

**Nutrients**

Nutrient-intake data can be used to capture the South Korean nutrition transition. Total energy intake decreased gradually after 1940, when nutrient data were first available from a published journal article (17) (Table 2). Total energy intake was as high as 10.2 MJ (2446 kcal) per capita per day in 1940, fluctuated between 8 and 9 MJ until the beginning of the 1980s, fell below 8 MJ in the mid-1980s, and continued to decrease thereafter, as was expected with the rapid industrialization and mechanization that was occurring in the country.

In terms of individual nutrients, carbohydrates showed the same pattern as did total energy intake. The change in the proportion of energy derived from each nutrient shows the shift in nutrient intake (Figure 3). Carbohydrate intake decreased gradually after 1940 from 81% of total energy intake to 64% in 1995. Total protein intake was relatively constant throughout the period (Table 2). The source of the intake, however, changed significantly. In the past, Koreans obtained protein mainly from rice, with frequent consumption of soy products enhancing the overall quality of the protein source. Now, animal sources contribute substantially to protein intakes. Less than 10% of protein intake per capita per day came from animal sources in 1948. In 1995, almost 50% came from animal sources. These increases parallel the substantial increases in meat, poultry, fish, and dairy-food consumption during this period as described in the previous section. Protein-derived energy increased slightly until 1989 and has remained relatively constant since then.

Fat-derived energy intake increased gradually throughout the whole period, from 6.2% to 18.8%. However, this was still lower than the fat-derived energy intake of many other Asian countries and even lower than that of most of the Western countries (8). Trends in total dietary fat intake in China, Japan, and South Korea from comparable national household-food-consumption surveys are shown in Figure 4. Fat intake in South Korea is even lower than that in China, which had a GNP < 1/14th of South Korea’s in 1996 (13). China obtained > 20% of energy from fat starting in the 1990s. In 1995, South Korea still consumed < 20% of energy from fat.

The change in the ratio of energy from carbohydrate to protein to fat gives a broad picture of the transition. The ratio was

### Table 1

<table>
<thead>
<tr>
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<td>Cereals and grain products</td>
<td>558.8</td>
<td>516.8</td>
<td>473.8</td>
<td>495.3</td>
<td>383.7</td>
<td>344.0</td>
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<td>74.2</td>
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<td>142.0</td>
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<td>151.1</td>
<td>81.7</td>
<td>135.3</td>
<td>125.0</td>
<td>139.0</td>
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<tr>
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<td>301.1</td>
<td>272.9</td>
<td>281.0</td>
<td>286.2</td>
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<td>22.4</td>
<td>41.3</td>
<td>64.1</td>
<td>68.8</td>
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<td>2.4</td>
<td>1.9</td>
<td>1.5</td>
<td>3.2</td>
<td>6.0</td>
<td>6.6</td>
</tr>
<tr>
<td><strong>Seasonings, beverages</strong></td>
<td>41.0</td>
<td>16.9</td>
<td>17.7</td>
<td>36.6</td>
<td>21.7</td>
<td>34.7</td>
<td>47.6</td>
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<tr>
<td><strong>Vegetable oils and fats</strong></td>
<td>3.5</td>
<td>—</td>
<td>3.1</td>
<td>4.4</td>
<td>6.9</td>
<td>5.6</td>
<td>7.5</td>
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<tr>
<td>Others</td>
<td>—</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
<td>9.4</td>
<td>11.9</td>
<td>—</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1023.7</td>
<td>952.9</td>
<td>850.4</td>
<td>962.9</td>
<td>866.6</td>
<td>850.7</td>
<td>870.6</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Meat, poultry, and their products</td>
<td>6.6</td>
<td>19.8</td>
<td>14.3</td>
<td>13.6</td>
<td>38.9</td>
<td>47.3</td>
<td>67.0</td>
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<tr>
<td>Eggs</td>
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<td>8.8</td>
<td>5.1</td>
<td>8.3</td>
<td>20.6</td>
<td>19.5</td>
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<tr>
<td>Fresh</td>
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<td>32.0</td>
<td>38.8</td>
<td>57.3</td>
<td>52.5</td>
<td>51.9</td>
<td>—</td>
</tr>
<tr>
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<td>12.5</td>
<td>9.0</td>
<td>8.4</td>
<td>28.1</td>
<td>26.7</td>
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<td>47.8</td>
<td>65.7</td>
<td>80.6</td>
<td>78.6</td>
<td>75.1</td>
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<td>Milk and dairy products</td>
<td>2.4</td>
<td>4.9</td>
<td>4.7</td>
<td>9.9</td>
<td>42.8</td>
<td>52.2</td>
<td>65.6</td>
</tr>
<tr>
<td>Animal oils and fats</td>
<td>0.3</td>
<td>—</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Others</td>
<td>0.3</td>
<td>4.2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>32.0</td>
<td>82.2</td>
<td>72.0</td>
<td>97.6</td>
<td>183.0</td>
<td>198.0</td>
<td>229.6</td>
</tr>
</tbody>
</table>
| **Total (g · capita 

1 From reference 15.
2 Data no longer provided.
3 Data not available.
1940, indicating that energy intake was mainly from carbohydrate and that fat did not contribute much. After 55 y, the ratio shifted to 64:16:19, closer to what nutritionists would term an ideal ratio (33). Carbohydrate still contributed a great proportion of energy but to a much lesser extent. In 1992, the proportion of energy from fat began to exceed that from protein, but the difference was very small (3% in 1995). As will be discussed, the proportion of energy consumed from fat in South Korea was much lower than that in Asian countries with similar or lower income levels.

Anthropometric data

As one might expect, mean weight and height trends among South Korean adults showed an improvement between 1913 and 1994 (25). Although there is some value in examining changes in mean weight and height, the distribution of these changes and the increases in obesity and reductions in chronic energy deficiency are more important. The prevalence of adult obesity in South Korea was very low in 1995 (0.8% for men and 2.2% for women) (Figure 5). The prevalence of overweight in 1995 was close to 20% for both men and women. Because earlier data were not available, it was impossible to describe trends in the distribution of overweight. Instead, comparable adult overweight and obesity data for China, Japan, and other Southeast Asian countries are shown in Figure 5. The data were from the most recent large surveys that were representative of a region or country. The prevalence of overweight in South Korea was lower than that in many other Asian countries relative to South Korea’s level of income and development. The prevalence of obesity was much lower for South Koreans than for all other groups except Chinese females. The prevalences in South Korea were even lower than earlier prevalences in countries in which the national income remains lower than that of South Korea. Obesity rates are increasing rapidly in these countries and more recent data would show even higher prevalences than those presented here. For example, a recent report on Thailand showed that the prevalence of overweight and obesity (combined) in adults was 26.1% in 1995 (36), significantly higher than the prevalence in 1991.

What appears to be a relatively recent increase in overweight in South Korean adults was echoed by higher BMIs in younger children (Figure 6). Again, it is important to note that BMI data for children were calculated by using average weight divided by

![Figure 2](https://example.com/figure2.png)

**Figure 2.** Trends in daily intake per capita by food group in South Korea (15). Values are presented as a 3-y moving average between 1969 and 1995.

### Table 2

Changes in macronutrient and energy intakes

<table>
<thead>
<tr>
<th>Year</th>
<th>Carbohydrate (g)</th>
<th>Fat (g)</th>
<th>Protein (g)</th>
<th>Percentage of intake from animal foods (%)</th>
<th>Energy (MJ)</th>
<th>Energy (kcal)</th>
</tr>
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<tr>
<td>1940</td>
<td>494</td>
<td>16.8</td>
<td>79.7</td>
<td></td>
<td>10.2</td>
<td>2446</td>
</tr>
<tr>
<td>1948</td>
<td>484.4</td>
<td>18.2</td>
<td>83.6</td>
<td>-2</td>
<td>10.2</td>
<td>2438</td>
</tr>
<tr>
<td>1950</td>
<td>486</td>
<td>15.5</td>
<td>83</td>
<td>-2</td>
<td>10.1</td>
<td>2416</td>
</tr>
<tr>
<td>1960</td>
<td>482</td>
<td>17.1</td>
<td>73.9</td>
<td>-2</td>
<td>9.9</td>
<td>2378</td>
</tr>
<tr>
<td>1969</td>
<td>422.5</td>
<td>16.9</td>
<td>65.6</td>
<td>-2</td>
<td>8.8</td>
<td>2105</td>
</tr>
<tr>
<td>1970</td>
<td>434</td>
<td>17.2</td>
<td>64.6</td>
<td>-2</td>
<td>9.0</td>
<td>2150</td>
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<tr>
<td>1975</td>
<td>398.5</td>
<td>19</td>
<td>63.6</td>
<td>10.4</td>
<td>8.3</td>
<td>2052</td>
</tr>
<tr>
<td>1980</td>
<td>396.1</td>
<td>21.8</td>
<td>67.2</td>
<td>14.7</td>
<td>8.3</td>
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<td>1985</td>
<td>341.5</td>
<td>29.5</td>
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<td>20.6</td>
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<td>1990</td>
<td>316</td>
<td>28.9</td>
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<td>28.7</td>
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<td>1839</td>
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<td>1995</td>
<td>295</td>
<td>38.5</td>
<td>73.3</td>
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1 From references 15, 18, and 21.

2 Data not available.

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81:13:6 in 1940, indicating that energy intake was mainly from carbohydrate and that fat did not contribute much. After 55 y, the ratio shifted to 64:16:19, closer to what nutritionists would term an ideal ratio (33). Carbohydrate still contributed a great proportion of energy but to a much lesser extent. In 1992, the proportion of energy from fat began to exceed that from protein, but the difference was very small (3% in 1995). As will be discussed, the proportion of energy consumed from fat in South Korea was much lower than that in Asian countries with similar or lower income levels.

Anthropometric data

As one might expect, mean weight and height trends among South Korean adults showed an improvement between 1913 and 1994 (25). Although there is some value in examining changes in mean weight and height, the distribution of these changes and the increases in obesity and reductions in chronic energy deficiency are more important. The prevalence of adult obesity in South Korea was very low in 1995 (0.8% for men and 2.2% for women) (Figure 5). The prevalence of overweight in 1995 was close to 20% for both men and women. Because earlier data were not available, it was impossible to describe trends in the distribution of overweight. Instead, comparable adult overweight and obesity data for China, Japan, and other Southeast Asian countries are shown in Figure 5. The data were from the most recent large surveys that were representative of a region or country. The prevalence of overweight in South Korea was lower than that in many other Asian countries relative to South Korea’s level of income and development. The prevalence of obesity was much lower for South Koreans than for all other groups except Chinese females. The prevalences in South Korea were even lower than earlier prevalences in countries in which the national income remains lower than that of South Korea. Obesity rates are increasing rapidly in these countries and more recent data would show even higher prevalences than those presented here. For example, a recent report on Thailand showed that the prevalence of overweight and obesity (combined) in adults was 26.1% in 1995 (36), significantly higher than the prevalence in 1991.

What appears to be a relatively recent increase in overweight in South Korean adults was echoed by higher BMIs in younger children (Figure 6). Again, it is important to note that BMI data for children were calculated by using average weight divided by

![Figure 2](https://example.com/figure2.png)

**Figure 2.** Trends in daily intake per capita by food group in South Korea (15). Values are presented as a 3-y moving average between 1969 and 1995.

### Table 2

Changes in macronutrient and energy intakes

<table>
<thead>
<tr>
<th>Year</th>
<th>Carbohydrate (g)</th>
<th>Fat (g)</th>
<th>Protein (g)</th>
<th>Percentage of intake from animal foods (%)</th>
<th>Energy (MJ)</th>
<th>Energy (kcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940</td>
<td>494</td>
<td>16.8</td>
<td>79.7</td>
<td></td>
<td>10.2</td>
<td>2446</td>
</tr>
<tr>
<td>1948</td>
<td>484.4</td>
<td>18.2</td>
<td>83.6</td>
<td>-2</td>
<td>10.2</td>
<td>2438</td>
</tr>
<tr>
<td>1950</td>
<td>486</td>
<td>15.5</td>
<td>83</td>
<td>-2</td>
<td>10.1</td>
<td>2416</td>
</tr>
<tr>
<td>1960</td>
<td>482</td>
<td>17.1</td>
<td>73.9</td>
<td>-2</td>
<td>9.9</td>
<td>2378</td>
</tr>
<tr>
<td>1969</td>
<td>422.5</td>
<td>16.9</td>
<td>65.6</td>
<td>-2</td>
<td>8.8</td>
<td>2105</td>
</tr>
<tr>
<td>1970</td>
<td>434</td>
<td>17.2</td>
<td>64.6</td>
<td>-2</td>
<td>9.0</td>
<td>2150</td>
</tr>
<tr>
<td>1975</td>
<td>398.5</td>
<td>19</td>
<td>63.6</td>
<td>10.4</td>
<td>8.3</td>
<td>2052</td>
</tr>
<tr>
<td>1980</td>
<td>396.1</td>
<td>21.8</td>
<td>67.2</td>
<td>14.7</td>
<td>8.3</td>
<td>1936</td>
</tr>
<tr>
<td>1985</td>
<td>341.5</td>
<td>29.5</td>
<td>74.5</td>
<td>20.6</td>
<td>8.1</td>
<td>1868</td>
</tr>
<tr>
<td>1990</td>
<td>316</td>
<td>28.9</td>
<td>78.9</td>
<td>28.7</td>
<td>7.8</td>
<td>1839</td>
</tr>
<tr>
<td>1995</td>
<td>295</td>
<td>38.5</td>
<td>73.3</td>
<td>41.7</td>
<td>7.7</td>
<td></td>
</tr>
</tbody>
</table>

1 From references 15, 18, and 21.

2 Data not available.
average height squared, not the mean of the BMIs. Although a slight increase occurred in 17-y-olds between 1956 and 1993, the greater increase in the 1990s for younger children portends future increases in all age groups. Ideally, we would look at how the proportion of overweight children has increased; however, such data were unavailable for a systematic comparison.

Causes of death

The nutritional focus of South Korea shifted from dietary deficit and food insecurity to overconsumption; therefore, one would expect to see concurrent and possibly related shifts in the causes of death. Data from 1938 to 1942 indicate that food insecurity and malnutrition were major concerns (Figure 7). Infectious and parasitic diseases predominated. It was only in the early 1970s that this pattern reversed and cancer and cardiovascular-related deaths became predominant. Since 1970, except in the case of signs, symptoms, and uncertain conditions, diseases of the circulatory system have been the leading causes of death. Death from these diseases began to accelerate especially rapidly around 1965. In the late 1970s, cancer became another significant cause of death. Since then, cancer deaths have been accelerating even faster. The disease classification system presented here does not
distinguish individual diseases. For example, diseases of the circulatory system included rheumatic heart disease, hypertensive disease, ischemic heart disease, cerebrovascular disease, and other diseases of the pulmonary system. When the diseases were classified individually, malignancy became the leading cause of death in 1993, surpassing cerebrovascular disease for the first time (3).

Demographic changes cannot be overlooked. The dramatically increasing life span (from 22.6 and 24.4 y in 1910 to 69.5 and 77.4 y in 1995 for males and females, respectively) (37) and the subsequent increase in the relative size of the elderly population may have made the increasing trend in chronic diseases apparent. The elderly population (aged ≥65 y) rose from 3.3% in 1960 to 5.8% in 1996 (13).

FIGURE 5. Obesity patterns in adults in Asian countries as measured by BMI (in kg/m²): South Korea (14), China (11, 34), Japan (35), Thailand (36), others (11).

FIGURE 6. BMI trends among 8- and 17-y-olds, South Korea, 1956–1993 (27). BMI figures were derived from mean heights and weights.
DISCUSSION

South Korea is far along in its nutrition transition. Related to remarkable economic and sociodemographic changes, large shifts in the overall structure of diet and disease patterns became apparent in the 1970s. The change has been reflected in increased body size, especially among younger children, and in dramatic shifts in causes of death from communicable to chronic diseases.

The most noticeable feature of the South Korean nutrition transition is that the dietary shift was not linked with an increase of fat intake commensurate with the country’s increase in income. The relation between GNP per capita and dietary fat intake was studied in 88 countries (8) and recently updated to include 121 countries (38). On the basis of these studies, we expected that in 1996 the percentage of energy from fat in South Korea would be 35.5%; the actual percentage of energy from fat was 18.8%, 16.7 percentage points less than the expected level. When we calculated what the GNP should be on the basis of the fat intake in 1996, we got $311; actual GNP was $10,610. If we focused on South Korea’s food-disappearance data, on which this relation was based for both studies, we would have found that the predicted fat intake as a percentage of energy was 13.5 percentage points more in 1996 than the actual food balance data (22%) (39). Considering the current concerns about the worldwide increase in fat intake (8) and diet-related diseases, the low fat intake in South Korea is noteworthy. South Korea’s low fat intake may be part of the reason for the lower prevalence of obesity in South Korea than in many other Asian countries (8, 11).

Why is fat intake so low in South Korea?

There are several possible explanations for the low fat intake in South Korea. One may relate to the relatively high carbohydrate intake of South Koreans. Typically, increases in the GNP are associated with rapid declines in the proportion of energy from carbohydrates (8). South Korea is an exception, possibly because rice has been, and still is, the primary element of the Korean diet (40). The fact that the traditional Korean greeting “Have you eaten rice yet?” is roughly equivalent to the English “How are you?” (6) shows the deep psychologic connection to rice. The predominance of rice as a staple food may have helped keep fat intake relatively low.

The lack of effect of increases in GNP on fat intake in South Korea is explained partly by the style of cooking. With traditional Korean cooking, small amounts of sesame-seed oil are added to vegetables after they have been boiled or steamed, unlike with Chinese cooking, in which foods are frequently stir-fried. Stir-frying has a high potential to add oil when oil is readily available. Interestingly, however, other Asian countries that do not rely on stir-frying have also rapidly increased their fat intake (10). South Korea is different.

A more plausible explanation is that movements to retain the traditional diet have been strong in South Korea. These movements include mass media campaigns, such as television programs that promote local foods by emphasizing their higher quality and the need to support local farmers (eg, Korean Broadcasting System First station’s daily program Six O’clock My Village introduces famous products of South Korean villages and promotes consumption of traditional dishes). South Korea also promoted the concept of “Sin-To-Bul-Yi” (translated directly as “A body and a land are not 2 different things,” meaning that a person should eat foods produced in the land in which he or she was born and is living).

Part of this effort is reflected in a unique training program offered by South Korea’s Rural Development Administration. Beginning in the 1980s, the Home Management Division of the Rural Living Science Institute trained thousands of extension workers to provide monthly training sessions on cooking methods of traditional Korean foods such as rice, kimchi (pickled and fermented Chinese cabbage), and fermented soybean foods.
These sessions are open to the public in most districts of the country and the program appears to reach a large audience (41).

Studies confirm South Korea’s adherence to traditional dietary patterns. A small study revealed that most adults—young adults—consume a traditional breakfast (42), which typically comprises steamed rice, soup, kimchi, cooked or uncooked vegetables, and roasted or broiled meat or fish. In addition, there is stong support for the development of Korean-style fast foods, ie, traditional foods modified to be faster and more convenient to serve (43). The dietary shifts in South Korea, such as increased animal food intake, are not necessarily westernization (6). For example, Koreans especially like traditionally prepared meat dishes. Traditional foods continue to represent a major component of today’s Korean diet.

The household data contained potential measurement errors that might have led to underestimates of fat intake. The survey excluded the increasing number of meals eaten away from home, which potentially contain more meats and edible oils. The higher fat intake from these meals may have been ignored. The difference between the survey data and the food balance sheet may be related to the secular trend toward consumption away from home. Nevertheless, the food-balance data for South Korea also showed much lower fat consumption than expected. Failure to adjust for changes in the age composition of the population may have affected estimates of dietary intake, but it is unlikely that this would have affected the estimate of the proportion of energy from fat.

The unusually low fat intake in South Korea might change. The Uruguay Round of the General Agreement on Tariffs and Trade may produce further changes as South Korea is forced to allow increased international trade in food. It is impossible to predict the long-term effects of this agreement at this time.

Obesity prevalence is lower

Given South Korea’s level of economic development, the rate of obesity is lower than we might expect compared with other Asian countries (Figure 5) and especially compared with most Western countries (11). More thorough analysis of other determinants of obesity, smoking and physical activity in particular, is needed to better understand obesity trends.

Studies indicated that child obesity in South Korea was a concern (44–46). A report on the prevalence of child obesity from 1979 to 1996 in Seoul showed that the increase in the prevalence of obesity [≥95th percentile of the first National Health and Nutrition Examination Survey (47)] was even greater than that of overweight (90–95th percentile) (48). Our results were consistent with the report, showing a rapid increase in mean BMI, especially among younger children. This increase may predict increases in body fatness in all age groups in the near future.

Conclusion

Identifying the characteristics that are related to maintaining South Korea’s relatively low fat intake would help us better understand how to promote a healthier diet. Further research on the efforts of the South Korean people and government to retain features of the traditional diet should also analyze the healthfulness of this diet. Additional research is needed to explore the full set of determinants of this dietary pattern and the subsequent health consequences, not only for obesity but for a range of diet-related noncommunicable diseases.

We thank Kyoungmi Ahn, Youn-Wook Lee, and Keum Bong Han of South Korea for their help in gathering information and Kamju Chung and Young-suk Hwangbo of the Rural Living Science Institute for sharing some of the programs offered by the institute.

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