# Why Koreans Became Taller Than Japanese?

**Hiroshi Mori**

< Stature is a measure of consumption that incorporates or adjusts for individual nutritional needs; it is a net measure that captures not only the supply of inputs to health but demands on those inputs (Richard H. Steckel, 1995, p.1903).>

**Abstract:**
Children grew appreciably fast in height in Japan and South Korea after the end of WW II. Children in both countries were the same in height at the ages of maturity, both boys and girls, in the 1970s to 1980s. Japanese children ceased to grow in the early 1990s, whereas Korean children kept growing until the mid-2000s. As a consequence, Koreans are 3-4 cm taller than Japanese at present. Do these phenomena reflect ethnic differences between the two nations or differences in "inputs to health" or food consumption? Japanese children have been eating more meat and drinking substantially more milk than Korean children. On the other hand, Koreans have been eating a lot more rice with kimchi and their fruit consumption has been soaring, whereas Japanese children eat substantially less vegetables and they have reduced fruit consumption radically since the early 1980s.

**Keywords:**
height growth, food intake by age, fruit, Japan, South Korea

**Introduction**

South Koreans and Japanese were about the same in height in the 1970s and 1980s, men at 170 cm and women at 157 cm, measured at age 19-20 and 18-19, respectively(Tables 1-2). South Korea was far behind Japan in economic development until the early 2000s: per capita GNI was $640, $2,510, and $11,650 in 1975, 1985, and 1995 in Korea, as compared with $5,060, $ 11,360, and $41,270 (in current US$) over the corresponding period in Japan (World Bank National Accounts data file) and consumption of meat-eggs and milk in Korea was substantially lower, say less the one-third on per capita basis, as compared to Japan until the mid-1980s, although Koreans ate appreciably more rice and barley than Japanese(see Table 3 for details).
From the mid-1980s to the mid-1990s, Japanese grew on average a little less than 1.0 cm taller in height, both men and women, at age 19-20 and 18-19, respectively, whereas Koreans grew 3.0 cm taller, both men and women. Japanese stopped growing taller since then but Koreans grew another 1.0 cm taller until the mid-

**Table 1 Secular Changes in Male Children's Height by Age Groups in Japan and South Korea, 1965 to 2005**

(cm)

| | jp | kr | jp | kr | jp | kr | jp | kr | jp | kr |
|---|---|---|---|---|---|---|---|---|---|---|
| age (y.o.) | 1964-66 | 1965 | 1975-76 | 1975 | 1983-85 | 1984 | 1996-98 | 1997 | 2004-06 | 2005 |
| 4-5 ave | 104.6 | 98.1 | 105.5 | 101.5 | 106.3 | 105.1 | 106.1 | 106.6 | 107.0 | 107.9 |
| 9-10 ave | 130.9 | 126.0 | 133.9 | 129.6 | 134.4 | 132.9 | 135.4 | 135.4 | 135.8 | 138.7 |
| 14-15 ave | 160.1 | 152.8 | 163.8 | 155.9 | 165.1 | 161.6 | 166.1 | 165.3 | 166.4 | 168.9 |
| 19-20 ave | 165.5 | 168.8 | 168.3 | 168.4 | 170.5 | 170.1 | 171.2 | 173.3 | 171.3 | 174.4 |

Sources: *National Nutrition Surveys*, various issues for Japan; J-Y Kim et al., "Anthropometric Changes," 2008, for Korea.
Notes: jp stands for Japan and kr for S. Korea.

**Table 2 Secular Changes in Female Children's Height by Age Groups in Japan and South Korea, 1965 to 2005**

(cm)

| | jp | kr | jp | kr | jp | kr | jp | kr | jp | kr |
|---|---|---|---|---|---|---|---|---|---|---|
| age (y.o.) | 1964-66 | 1965 | 1975-76 | 1975 | 1983-85 | 1984 | 1996-98 | 1997 | 2004-06 | 2005 |
| 3-4 ave | 97.4 | 90.9 | 98.7 | 93.7 | 99.0 | 96.9 | 99.0 | 98.2 | 99.9 | 100.2 |
| 8-9 ave | 125.3 | 119.7 | 127.6 | 124.1 | 129.2 | 127.5 | 129.8 | 129.1 | 130.3 | 132.6 |
| 13-14 ave | 151.2 | 146.9 | 153.6 | 150.1 | 154.9 | 153.5 | 155.1 | 156.4 | 156.1 | 158.3 |
| 18-19 ave | 154.0 | 155.7 | 155.9 | 156.8 | 157.2 | 157.3 | 158.0 | 160.3 | 158.3 | 161.5 |

Sources: *National Nutrition Surveys*, various issues for Japan; J-Y Kim et al., "Anthropometric Changes," 2008, for Korea.
Notes: the same as Table 1.

2000s. As a consequence, Koreans are now approximately 3 cm taller than Japanese, both men and women, at age 19-20 and 18-19, respectively.

These differences can easily be attributed to ethnic traits, or genetic potentials between the two nations. According to *Human Height*, Max Roser,<ourworldindata.org/human height/>, 2017, average height of Korean and Japanese men by birth cohorts of 1900[*1] are reported to be 160 and 158 cm and those by birth cohorts of 1920 were 163 and 160.5 cm, respectively. A century ago, Koreans were 2-3 cm taller than Japanese.

According to the *National School Health Statistical Surveys* by the Japanese government Ministry of Education, conducted across the entire nation(available since 1900 on the internet), school boys at age 17 and 20 were recorded at 160.5 cm and 162.5 cm, respectively in 1920-22 averages and 161.1 cm and 162.9 cm, respectively in 1930-31 averages (refer to Appendix Table 1). Considering the large size of samples, these government survey results should not be discarded. Korean school boys and girls aged between 6 and 17 years, born and raised in Japan were recorded "very similar to Japanese children of the same sex and age" in the end of 1970s, and even taller in height and heavier in weight than their counterparts in South Korea at the same time (Y.S.Kim, 1982).

When adult male height by birth cohorts of 1856-60 compared, the Dutch, the world tallest at present, were slightly lower in height than French (Amos, 2016; Hatton, 2013, p.3). While genetics play a key role in determining human height, environmental factors, nutritional intakes at various stages of growth, in particular, need to be given due consideration as well. National surveys of heights of boys and girls in rural India over the 3 decades from the late-1970s to the early 2010s clearly demonstrate that differences of a few cm in mean height, plus and minus, have accruesd between different states in the same country (Mamidi, R.S. et al., 2016; see Appendix Table 2). The similar phenomena, "poverty and rural height penalty in inland Spain during the nutrition transition" are pointed out by Martinez-Carrion and Canabate-Cabezuelos (2016).

Many researchers in the fields of social and biological sciences have participated in determining the impacts of food intakes on children's stature development across a large number of countries and on a long-run time series basis (Steckel, 1995; Rona, 2000; Beer, Hans de, 2012; Baten and Blum, 2014; Grasgruber et al., 2014 and 2016; Hatton and Bray, 2010; Hatton, 2013; Mori, 2017; to mention only a few). In this brief study, the author attempts to add a seldom discussed spectrum of possible impacts of consumption of fruit and vegetables on children's stature growth. The insight was furnished by the epidemiological cohort studies of the residents of Mikkabi-cho, Shizuoka-ken, Japan, known for production of quality mandarins, by Japan's National Fruit Tree Science Institute in collaboration with Hamamatsu University School of Medicine. The findings strongly indicate that high intakes of fruit, particularly mandarins should be positively associated with bone mineral accrual / density in post-menopausal females (Sugiura et al, 2008; 2012; 2015; etc; Nakamura, 2016; etc.).

[*1] those born in 1900 reached 20 years of age, maturity in height, in 1920, for example.

**Secular Changes in Food Consumption in Japan and South Korea over the Past Half Century**

Japanese and Koreans share quite similar patterns in their diet: staples(shushoku), a bowl (refilled at request) of rice and pressed barley at the center and supplementary dishes (fukushoku, or okazu) at the side, composed of fish and meat, eggs and various vegetables, fresh, cooked, or marinated. All sorts of kimchi are traditionally important side dishes, salted and fermented vegetables, served at nearly each meal in Korea. Takuan, pickled cucumbers and the like may be its counterparts in Japan. As the economy grew, food consumption has increased in quantity and changed in quality and variety as well. As shown in Table 3, per capita annual net supply (=consumption hereafter) of rice and other grain products in Korea increased from 180 kg in 1965 to 232 kg in 1975 and then gradually declined to 136 kg in 2010, whereas that in Japan kept falling steadily from 151 kg in 1965 to 100 kg in 2010. It is noteworthy that Koreans ate on average almost twice as much rice as Japanese in and around 1980. Per capita consumption of meat and eggs has increased steadily in both countries over the entire period from 1965 to 2010. Korea nearly matched Japan in respect to meat consumption in the mid-2000s but Koreans' per capita meat consumption was only one third of that of Japanese in the mid-1980s and their milk consumption was less than one fourth of that of Japanese then. Per capita consumption of fish has remained nearly the same around 45 kg in Japan over the period under

**Table 3 Changes in per capita Net Supply of Major Foods in Japan and South Korea, 1965 to 2010**

(kg/year)

| | | jp | kr | | | jp | kr |
|---|---|---|---|---|---|---|---|
| rice, grains | 1965 | 150.64 | 180.22 | meat & eggs | 1965 | 24.59 | 4.96 |
| | 1970 | 134.65 | 215.36 | | 1970 | 34.09 | 5.40 |
| | 1975 | 132.55 | 232.45 | | 1975 | 39.15 | 7.11 |
| | 1980 | 118.71 | 197.59 | | 1980 | 46.73 | 13.18 |
| | 1985 | 113.89 | 181.39 | | 1985 | 50.79 | 18.40 |
| | 1990 | 109.30 | 154.59 | | 1990 | 57.29 | 25.26 |
| | 1995 | 106.58 | 151.60 | | 1995 | 63.86 | 38.39 |
| | 2000 | 102.49 | 143.87 | | 2000 | 64.79 | 47.58 |
| | 2010 | 100.19 | 135.98 | | 2010 | 66.69 | 59.13 |
| vegetables | 1965 | 119.57 | 82.25 | fish | 1965 | 42.06 | 12.53 |
| | 1970 | 126.80 | 103.98 | | 1970 | 48.82 | 12.98 |
| | 1975 | 121.26 | 147.68 | | 1975 | 55.19 | 30.05 |
| | 1980 | 122.61 | 197.88 | | 1980 | 46.73 | 28.27 |
| | 1985 | 119.49 | 181.71 | | 1985 | 50.58 | 32.78 |
| | 1990 | 116.70 | 200.60 | | 1990 | 47.53 | 28.23 |
| | 1995 | 116.61 | 222.28 | | 1995 | 44.58 | 30.98 |
| | 2000 | 112.80 | 235.69 | | 2000 | 40.78 | 33.97 |
| | 2010 | 98.88 | 196.47 | | 2010 | 33.00 | 36.62 |
| fruit | 1965 | 39.01 | 9.83 | milk | 1965 | 38.51 | 2.80 |
| | 1970 | 53.87 | 12.28 | | 1970 | 52.45 | 3.15 |
| | 1975 | 61.88 | 14.65 | | 1975 | 51.38 | 4.22 |
| | 1980 | 55.60 | 23.21 | | 1980 | 68.20 | 10.92 |
| | 1985 | 51.88 | 35.15 | | 1985 | 73.60 | 16.91 |
| | 1990 | 50.21 | 46.98 | | 1990 | 78.04 | 19.29 |
| | 1995 | 53.23 | 69.57 | | 1995 | 82.64 | 20.70 |
| | 2000 | 51.42 | 69.56 | | 2000 | 81.69 | 28.02 |
| | 2010 | 49.07 | 67.55 | | 2010 | 72.56 | 22.68 |

Sources: FAOSTAT, Food Balance Sheets, various years.
Notes: rice, grains include wheat, barleys, and other grain products.

consideration, whereas that in Korea has kept increasing from 12.6 kg in 1965 to 32.8 kg in 1985 and 36.6 kg in 2010.

Focusing on the latter half of the 1980s, for example, per capita meat and fish consumption in Japan averaged 51.6 kg per year, almost twice as much as that in Korea at 26.2 kg per year. On the other hand, Koreans ate 168 kg of rice and other grain products per year, as compared to 112 kg of rice and other grain products eaten by Japanese in the same period. Regarding intakes of animal proteins, per capita consumption of milk, excluding butter, in Korea was 16.9 kg in 1985, less than one twentieth of that in the Netherlands in the same year, overwhelmingly lower than most European countries (Appendix Table 3) but Koreans kept growing appreciably in height during the 1970s and 80s).

Per capita consumption of vegetables (potatoes not included) has remained about the same at 120 kg per year in Japan over the entire period under investigation, whereas that in Korea increased remarkably from 82.3 kg in 1965 to 197.9 kg in 1980 and 235.7 kg in 2000, twice as much as in Japan and also most European countries during the same period (see Appendix Table 3 for details). Eating a lot more rice with plentiful kimchi (Lee, Duffey, and Popkin, 2012, p.619; Kim et al., 2016; etc.) could explain, if only partially, why Koreans kept growing taller in height than Japanese during the 1980s and 1990s, when their per capita consumption of meat and milk was substantially lower than that of Japanese (Table 3). Intakes of fruit are known to be positively associated with bone mineral density or accrual for post-menopausal females and adolescents (Sugiura et al., 2008; 2015; etc.; McGartland et al., 2004; Whiting,S. et al., 2004; Vatanparast et al., 2005; Prynne, C.J., 2006; Li, J.J. et al., 2012; etc.). Per capita consumption of fruit was 39.0 kg in 1965 and increased to 61.9 kg in 1975 in Japan, equivalent to some of European countries(61 kg in 1970, in UK, for example). Fruit consumption steadily declined to 51.9 kg in 1985 and 51.4 kg in 2000 in Japan, whereas per capita fruit consumption was very low at 9.8 kg in 1965 in Korea but sharply increased to 23.2 kg in 1980, 47.0 kg in 1990, and 69.6 kg in 2000, 35% greater than in Japan in 2000.

National per capita fruit consumption is across all age groups. In Japan, young people's fruit consumption has become substantially less than older people's consumption, as will be provided in the subsequent section. If it is the case that the Korean young, particularly adolescents, have been eating nearly as much fruit as the older adults, unlike their peers in Japan, who have dramatically reduced their fruit consumption since the early 1980s (MAFF, *White Paper 1994* ; Mori and Stewart, 2011; etc.), this may have something to do with the widened disparities in height of young adults in recent years between the two nations.

**Changes in Individual Consumption of Selected Food Products by Age Groups**

*White Paper on Agriculture for 1994*, by the Japanese government Ministry of Agriculture drew public attention to the widespread tendencies of "wakamono no kudamonobanare" (leaving away from fruit by the Japanese young). Based on household data classified by age groups of household head (HH), *Family Income and Expenditure Survey* (*FIES*), households headed by the younger age groups were decreasing their purchases of fresh fruit more sharply than the older households since the early 1980s in Japan. The young's leaving off fruit was particularly distinct with mandarins, Japan's major fresh fruit in the fall-winter season (Appendix Table 4). Individual consumption by age groups was derived from dividing household consumption by a selected age group of household-head by number of persons contained in this household. Except for two-person households of head and his/her spouse, other members of families should be around 30 years apart from head, namely children and/ or parents. This approach could under or over-estimate per capita consumption by persons in a chosen HH age group, because children may eat substantially less or more than their parents. More crucially, individual consumption by children under the mid-20 years of age in present day Japan cannot be identified. To overcome these shortcomings, Mori and Inaba(1997) proposed to incorporate the family age structure by HH age groups explicitly into the model to estimate individual consumption of all family members by age. Their approach was statistically refined by Tanaka, Mori and Inaba (2004) in the

TMI model[*2], which will be employed in the subsequent analyses.

*FIES* by the Japanese government Bureau of Statistics started in 1979 to publish household purchases (=consumption) of various goods and services by the age groups of household-head, with an accidental exception in 1971. Tables 4 to 8 depict estimates of individual at-home consumption of meat (including processed meat), fish (including salted and dried fish), milk, fresh vegetables and fresh fruit by age groups of household members in 1971 and 1980-01, 1990-91, 2000-01, and 2010-11. Varying considerably depending on selected food items and periods in question, at-home consumption of foods in general may safely be assumed to account for more than half, probably 60 to 70 % of total food consumption during the 1980s through 1990s in Japan (Meat and Eggs Div., MAFF; Kobayashi, 2006; Mori et al., ERS/USDA, 2009; etc.)

After one passes the age of maturity, boys around 20, and girls around 18, increases in any kind of food products would not contribute to further increments in one's height. If the net nutritional intakes in the early

**Table 4 Changes in per capita At-home Consumption of Meat by Age Groups in Japan, 1971 to 2011**

(kg/year)

| age/year | 1971 | 1980 | 1981 | 1990 | 1991 | 2000 | 2001 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|
| 0~4 | 8.06 | 8.42 | 8.25 | 8.33 | 8.48 | 9.08 | 9.39 | 10.04 | 10.16 |
| 5~9 | 9.79 | 12.49 | 12.25 | 11.57 | 11.50 | 12.27 | 12.37 | 13.32 | 13.23 |
| 10~14 | 11.62 | 16.10 | 15.80 | 15.23 | 14.82 | 15.88 | 15.73 | 16.60 | 16.40 |
| 15~19 | 12.36 | 18.26 | 17.98 | 18.02 | 17.63 | 18.83 | 18.52 | 18.98 | 18.96 |
| 20~24 | 11.13 | 15.03 | 14.79 | 14.79 | 14.70 | 16.05 | 15.84 | 15.97 | 16.30 |
| 25~29 | 10.95 | 14.02 | 13.74 | 13.45 | 13.73 | 15.17 | 15.20 | 15.48 | 16.12 |
| 30~34 | 10.68 | 14.40 | 14.26 | 13.61 | 13.89 | 14.95 | 14.93 | 16.39 | 16.59 |
| 35~39 | 10.91 | 15.49 | 15.32 | 14.95 | 15.18 | 16.10 | 15.53 | 17.91 | 17.63 |
| 40~44 | 10.73 | 16.10 | 15.97 | 16.78 | 16.12 | 18.15 | 17.12 | 19.71 | 19.09 |
| 45~49 | 9.79 | 15.94 | 15.99 | 17.60 | 17.44 | 19.60 | 18.10 | 20.27 | 19.77 |
| 50~54 | 9.95 | 15.02 | 15.02 | 16.27 | 16.08 | 19.24 | 17.69 | 19.84 | 19.82 |
| 55~59 | 9.87 | 13.67 | 13.61 | 14.44 | 15.07 | 18.31 | 16.98 | 19.76 | 20.05 |
| 60~64 | 9.46 | 13.45 | 12.68 | 13.51 | 13.67 | 16.97 | 16.38 | 19.95 | 20.39 |
| 65~69 | 8.77 | 11.74 | 11.53 | 11.61 | 12.15 | 15.11 | 14.59 | 17.99 | 18.60 |
| 70~74 | 8.28 | 10.02 | 10.08 | 9.90 | 10.54 | 13.12 | 12.63 | 15.29 | 16.06 |
| 75~ | 7.18 | 8.30 | 8.43 | 8.19 | 8.79 | 10.99 | 10.54 | 12.56 | 13.32 |

Sources: derived from *FIES* by the author, using the TMI model.
Note: meat includes ham and other processed meats.

[*2] The basic structure of the TMI model is shown as below:

$$H_j - \sum_{i=1}^{16} C_{ij} X_i = \varepsilon_j \ (j = 1,\cdots,10 \ ; \ i = 1,\cdots 16) \qquad (1)$$

where

$C_{ij}$ = number of persons in the $i$ th age group in the $j$ th HH age group,
$X_i$ = average per capita consumption of persons in the $i$ th age group (to be estimated),
$H_j$ = average household consumption of the $j$ th HH age group
$\varepsilon_j$ = disturbance term of $N(0,\sigma^2)$.

15 assumption equations are added as constraints,

$$X_k - X_{k+1} = \varepsilon_k \quad (k = 1,\cdots 15) \qquad (2)$$

We estimated parameters, $X_i$, using the weighted least square method with constraints, i.e., to minimize,

$$\sum_{j=1}^{10} w_j (H_j - \sum_{i=1}^{16} C_{ij} X_i)^2 + \sum_{k=1}^{15} w_k (X_k - X_{k+1})^2 \qquad (3)$$

With $w_j$ and $w_k$ set at 1.0 and 0.3, respectively, to start with.

**Table 5 Changes in per capita At-home Consumption of Fish by Age Groups in Japan, 1971 to 2011**

(kg/year)

| age/year | 1971 | 1980 | 1981 | 1990 | 1991 | 2000 | 2001 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|
| 0~4 | 11.46 | 7.98 | 7.55 | 3.60 | 3.4 | 0.76 | 0.99 | 0.81 | 0.99 |
| 5~9 | 13.96 | 10.80 | 10.16 | 6.17 | 5.8 | 2.29 | 2.43 | 1.61 | 1.66 |
| 10~14 | 16.82 | 13.24 | 12.56 | 9.04 | 8.5 | 4.28 | 4.51 | 2.68 | 2.57 |
| 15~19 | 19.39 | 14.95 | 14.30 | 11.04 | 10.6 | 6.10 | 6.56 | 3.87 | 3.77 |
| 20~24 | 20.60 | 15.40 | 15.04 | 10.99 | 10.9 | 7.79 | 8.23 | 4.86 | 4.93 |
| 25~29 | 21.13 | 15.99 | 15.81 | 11.09 | 11.2 | 9.25 | 9.51 | 6.26 | 6.43 |
| 30~34 | 20.46 | 18.67 | 18.06 | 14.59 | 14.7 | 11.35 | 11.16 | 8.35 | 8.06 |
| 35~39 | 19.55 | 21.07 | 20.35 | 18.12 | 18.1 | 14.75 | 14.08 | 10.39 | 9.53 |
| 40~44 | 20.04 | 22.16 | 21.74 | 21.80 | 21.7 | 19.01 | 18.04 | 12.43 | 10.99 |
| 45~49 | 21.53 | 24.22 | 23.64 | 25.14 | 25.3 | 22.05 | 21.38 | 14.70 | 12.98 |
| 50~54 | 23.29 | 26.30 | 26.20 | 26.80 | 27.6 | 26.94 | 25.86 | 17.35 | 15.60 |
| 55~59 | 24.98 | 27.50 | 27.56 | 27.57 | 28.3 | 30.35 | 28.47 | 20.71 | 18.87 |
| 60~64 | 25.20 | 27.44 | 28.34 | 27.95 | 28.2 | 30.02 | 28.86 | 24.24 | 22.37 |
| 65~69 | 23.38 | 25.95 | 25.33 | 27.32 | 28.3 | 29.64 | 28.66 | 25.78 | 24.28 |
| 70~74 | 20.96 | 23.04 | 22.86 | 24.73 | 25.9 | 26.90 | 26.10 | 24.56 | 23.68 |
| 75~ | 18.15 | 19.96 | 19.91 | 21.56 | 22.7 | 23.58 | 22.90 | 22.34 | 21.79 |

Sources: the as Table 4.
Note: fish includes salted and deied fish.

**Table 6 Changes in per capita At-home Consumption of Milk by Age Groups in Japan, 1971 to 2011**

(lit/year)

| age/year | 1971 | 1980 | 1981 | 1985-86 | 1990 | 1991 | 1995-96 | 2000 | 2001 | 2005-06 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0~4 | 30.64 | 30.58 | 29.45 | 29.93 | 30.50 | 30.09 | 28.53 | 25.5 | 24.06 | 20.97 | 17.34 | 18.80 |
| 5~9 | 26.65 | 27.16 | 26.44 | 28.01 | 30.46 | 31.50 | 30.46 | 27.4 | 26.16 | 22.43 | 18.84 | 18.95 |
| 10~14 | 23.07 | 24.96 | 25.35 | 26.48 | 29.86 | 30.80 | 31.19 | 27.7 | 26.77 | 22.96 | 19.81 | 19.35 |
| 15~19 | 24.24 | 26.15 | 27.53 | 26.56 | 28.75 | 27.81 | 29.44 | 26.0 | 24.96 | 22.13 | 19.70 | 19.67 |
| 20~24 | 26.10 | 27.88 | 29.78 | 27.38 | 27.31 | 24.83 | 26.04 | 23.3 | 21.97 | 20.69 | 18.86 | 20.13 |
| 25~29 | 27.38 | 28.81 | 30.79 | 28.49 | 27.72 | 24.53 | 25.21 | 22.4 | 20.80 | 20.48 | 18.70 | 20.97 |
| 30~34 | 22.70 | 28.08 | 27.56 | 29.00 | 31.83 | 30.38 | 30.33 | 28.3 | 26.19 | 24.88 | 22.26 | 21.46 |
| 35~39 | 15.50 | 20.90 | 21.74 | 25.14 | 31.61 | 33.60 | 34.44 | 33.5 | 31.59 | 29.05 | 25.98 | 22.58 |
| 40~44 | 14.05 | 19.55 | 20.40 | 24.58 | 32.77 | 34.82 | 37.98 | 36.6 | 35.34 | 31.97 | 29.05 | 24.26 |
| 45~49 | 9.37 | 20.92 | 22.68 | 24.89 | 32.60 | 32.70 | 37.95 | 36.9 | 35.39 | 32.87 | 30.57 | 25.29 |
| 50~54 | 11.90 | 22.62 | 23.37 | 25.78 | 31.63 | 31.43 | 34.96 | 35.3 | 33.11 | 32.53 | 30.95 | 26.15 |
| 55~59 | 9.16 | 21.38 | 23.40 | 27.32 | 33.16 | 33.01 | 36.43 | 35.7 | 33.48 | 33.67 | 31.45 | 28.71 |
| 60~64 | 14.32 | 22.99 | 24.12 | 28.00 | 36.50 | 35.13 | 39.60 | 37.9 | 36.01 | 36.06 | 32.39 | 32.20 |
| 65~69 | 18.51 | 24.14 | 25.04 | 28.21 | 36.98 | 37.92 | 41.66 | 41.3 | 39.34 | 38.95 | 34.48 | 34.50 |
| 70-74 | 17.69 | 24.63 | 25.43 | 28.24 | 37.14 | 39.13 | 42.58 | 44.7 | 42.53 | 41.67 | 36.94 | 35.71 |
| 75~ | 15.92 | 22.53 | 23.23 | 25.68 | 33.74 | 35.89 | 38.82 | 41.8 | 39.63 | 38.78 | 34.48 | 32.84 |

Sources: the same as Table 4.

**Table 7 Changes in per capita At-home Consumption of Fresh Vegetables by Age Groups in Japan, 1971 to 2011**

(kg/year)

| age/year | 1971 | 1980 | 1981 | 1985-86 | 1990 | 1991 | 1995-96 | 2000 | 2001 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0~4 | 39.38 | 28.54 | 27.53 | 23.12 | 19.29 | 18.25 | 17.07 | 15.58 | 14.84 | 14.78 | 15.83 |
| 5~9 | 50.19 | 38.77 | 37.17 | 31.43 | 26.77 | 25.42 | 23.35 | 20.96 | 20.06 | 20.24 | 20.70 |
| 10~14 | 60.12 | 48.07 | 46.45 | 41.06 | 35.37 | 33.79 | 31.87 | 27.04 | 26.58 | 27.36 | 27.31 |
| 15~19 | 64.22 | 54.12 | 51.96 | 48.26 | 42.15 | 40.13 | 40.04 | 33.04 | 32.84 | 33.91 | 34.15 |
| 20~24 | 67.47 | 55.63 | 54.34 | 51.34 | 44.47 | 42.99 | 44.49 | 38.33 | 37.15 | 36.04 | 37.13 |
| 25~29 | 68.11 | 56.49 | 56.02 | 53.69 | 46.48 | 45.43 | 48.00 | 43.33 | 41.57 | 39.18 | 41.42 |
| 30~34 | 67.59 | 61.82 | 60.51 | 57.17 | 51.21 | 49.01 | 50.30 | 46.50 | 45.83 | 43.50 | 44.77 |
| 35~39 | 69.33 | 69.45 | 67.18 | 63.14 | 57.36 | 55.15 | 54.31 | 53.04 | 50.01 | 47.86 | 47.61 |
| 40~44 | 73.78 | 75.89 | 75.28 | 73.34 | 66.58 | 64.67 | 62.21 | 58.45 | 56.68 | 52.34 | 50.50 |
| 45~49 | 81.06 | 84.68 | 81.87 | 82.98 | 76.92 | 73.80 | 72.42 | 65.56 | 64.86 | 57.04 | 54.43 |
| 50~54 | 87.19 | 89.80 | 88.68 | 89.24 | 81.80 | 79.48 | 79.97 | 77.25 | 73.41 | 62.46 | 60.12 |
| 55~59 | 90.90 | 91.20 | 91.97 | 94.60 | 86.17 | 85.56 | 87.47 | 87.27 | 82.86 | 69.91 | 69.37 |
| 60~64 | 90.68 | 94.49 | 92.16 | 97.85 | 91.36 | 88.89 | 90.87 | 92.77 | 87.79 | 78.45 | 80.64 |
| 65~69 | 84.29 | 92.04 | 92.23 | 100.23 | 91.06 | 90.20 | 91.03 | 95.26 | 90.70 | 83.18 | 85.96 |
| 70~74 | 75.94 | 84.49 | 85.71 | 94.10 | 84.50 | 84.34 | 85.46 | 91.07 | 87.89 | 83.89 | 85.72 |
| 75~ | 66.01 | 75.51 | 76.93 | 84.70 | 75.72 | 75.85 | 77.12 | 82.78 | 80.71 | 79.06 | 80.28 |

Sources: the same as Table 4.

**Table 8 Changes in per capita At-home Consumption of Fresh Fruit by Age Groups in Japan, 1971 to 2011**

(kg/year)

| age/year | 1971 | 1980 | 1981 | 1985-86 | 1990 | 1991 | 1995-96 | 2000 | 2001 | 2005-06 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0~4 | 32.2 | 23.8 | 21.4 | 13.4 | 6.9 | 4.7 | 3.8 | 1.5 | 0.9 | 2.0 | 2.3 | 3.5 |
| 5~9 | 40.4 | 29.1 | 25.9 | 17.0 | 10.8 | 8.5 | 5.6 | 3.1 | 1.7 | 2.7 | 2.5 | 2.8 |
| 10~14 | 43.8 | 30.1 | 28.3 | 19.4 | 14.0 | 12.1 | 8.1 | 4.7 | 3.4 | 4.0 | 3.3 | 2.7 |
| 15~19 | 47.3 | 30.8 | 30.1 | 20.7 | 15.7 | 14.9 | 10.8 | 6.7 | 5.5 | 6.3 | 5.4 | 4.2 |
| 20~24 | 49.0 | 31.2 | 30.7 | 22.1 | 15.9 | 16.1 | 13.6 | 9.9 | 9.2 | 9.5 | 8.3 | 7.4 |
| 25~29 | 47.7 | 31.9 | 31.6 | 24.7 | 17.8 | 18.1 | 16.6 | 13.7 | 13.4 | 12.9 | 11.3 | 11.4 |
| 30~34 | 45.5 | 40.2 | 36.1 | 33.8 | 26.2 | 24.4 | 20.7 | 18.5 | 18.2 | 16.4 | 13.7 | 14.2 |
| 35~39 | 46.7 | 47.3 | 41.5 | 39.5 | 34.6 | 32.9 | 26.4 | 25.0 | 24.2 | 19.8 | 15.9 | 16.4 |
| 40~44 | 49.8 | 50.2 | 46.0 | 47.0 | 41.8 | 39.9 | 33.3 | 31.1 | 30.5 | 23.6 | 18.5 | 18.4 |
| 45~49 | 52.1 | 55.0 | 50.5 | 50.1 | 48.0 | 46.8 | 41.1 | 35.6 | 36.7 | 28.7 | 22.5 | 22.0 |
| 50~54 | 55.4 | 59.7 | 53.4 | 53.8 | 50.8 | 51.1 | 47.6 | 44.6 | 44.9 | 35.2 | 27.9 | 27.7 |
| 55~59 | 53.3 | 60.0 | 54.9 | 59.3 | 57.2 | 55.8 | 53.5 | 52.3 | 54.4 | 43.8 | 36.4 | 35.8 |
| 60~64 | 47.0 | 59.5 | 58.1 | 61.9 | 61.6 | 59.6 | 57.1 | 58.5 | 58.6 | 52.9 | 50.5 | 45.4 |
| 65~69 | 42.1 | 57.5 | 56.8 | 60.3 | 62.4 | 60.2 | 60.2 | 63.0 | 61.4 | 56.3 | 56.1 | 51.7 |
| 70~74 | 42.0 | 56.7 | 56.3 | 59.7 | 63.0 | 60.7 | 61.7 | 65.3 | 62.9 | 57.9 | 58.2 | 55.0 |
| 75~ | 40.4 | 51.6 | 51.2 | 59.6 | 57.6 | 55.5 | 62.5 | 66.3 | 63.7 | 58.7 | 59.4 | 56.5 |

Sources: The same as Table 4.

years of life are crucial in determining adult height (Cole, 2003; Deaton, 2007; etc.), the author suspects that quantity and quality of food consumption during adolescence should be equally decisive.

Glancing over Tables 4-8, which depict secular changes in at-home consumption of various food products by age groups from the early adolescence to the elder, the readers should notice that the Japanese population improved appreciably their food consumption, in respect to intakes of animal proteins, in particular, up to the early 1980s and the older population in their 50s up kept improving in "high-quality animal protein" intakes (Grasgruber et al., 2014, p. 99) to the early 2000s, whereas the younger population, in their adolescence, ceased to improve in their diet after the early 1980s. Consumption of meat continued to increase to the mid-1980s but fish consumption by the young was falling distinctly at the same time. Except for the older cohorts, 50 years of age and older in the mid-1980s, per capita at-home consumption of fresh vegetables has been gradually declining since the early 1970s and adolescents ate half as much vegetables as those in their 50s and 60s in the early 1990s and their vegetable consumption further fell to the one-third level of the older population in the early 2000s. As observed in the previous section, based on FAOSTAT food balance sheets, per capita fruit consumption has been declining steadily since the mid-1970s in Japan. Table 8 demonstrates that the younger cohorts, those in their teens in 1980, reduced their fruit consumption radically in the 1980s and 1990s, to nearly one-tenth level of the older cohorts in the early 2000s.

It looks apparent that Japanese children's food diets prepared at home have deteriorated somehow, if not considerably since the early or mid-1980s. It is no wonder that young adults in Japan ceased to grow in height in the early 1990s. As stated in Introduction, Korean young adults surpassed their Japanese peers, either sex, in height by 3-4 cm in the early 2000s. Have Korean children improved their food diets up to then, unlike their Japanese peers, as observed just above? School lunches were extended to all elementary schools in 1952, and to junior high schools in 1954 and 99% of elementary school students and 82% of junior high school students eat school lunches in Japan, whereas school lunches in Korea were provided to all elementary schools only in 1997, and to junior high schools in 1999 (Yutasai Huang, 2013).

*National Nutrition Survey* by the Japanese government Ministry of Health and Welfare started to publish intakes of major food and nutrition items by age groups in 1995 and *Korea National Health and Nutrition Examination Survey* (KNHNES) by the Korean government National Center for Health Statistics started to examine major nutritional intakes by broader age groups than Japan for the first time in the 1998 survey, followed by 2001 and 2005 surveys, which are not published in the annual report, as is the case with Japan. Since our major concerns are focused on the period of 1970s through 1990s, these surveys are of little relevance, if not useless.

The Korean government has been conducting national household expenditure surveys after the fashion of Japan's *Family Income and Expenditure Survey* for some time, which are not readily available in the published annual and monthly reports like in Japan. Without the open access to the original household data, we cannot construct the tables pertaining to secular changes in at-home food consumption by age groups in Korea, which should correspond to Tables 4-8, cited above. By the courtesy of Dr. Sanghyo Kim, Korea Rural Economic Institute, the author was furnished with summarized tables of household expenditures on selected major food products classified by age groups of household-head, from 1990 to 2015. Household purchases are expressed in monthly expenditures in current Korean won, neither in quantities, nor with average prices paid, as in the case of Japan's *FIES*, annual reports. The author tried his utmost to derive individual expenditures on major food items by age groups of household members for selected years, by means of the TMI model. The tentative estimates of individual household consumption of major food products by age groups over the period of 1990 to 2010 in Korea are provided in Tables 9 to 12, which may be comparable to Tables 4 to 8, presented above for Japan.

The author has twenty year experience in analyzing Japan's household consumption data classified by HH age groups (Mori and Inaba, 1997) but met with the Korean data only a few months ago. Statistics provided in Tables 9 to 12 for Korea should be viewed with caution, only to feel the general tendencies in at-home food

**Table 9 Changes in per capita household expenditures on meat by age groups in S. Korea, 1990 to 2010**

(won/month)

| age/year | 1990-91 | 1995 | age/year | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|---|
| 0~9 | 10740 | 13751 | 0~9 | 12215 | 6413 | 7456 |
| 10~14 | 11355 | 16658 | 10~14 | 17248 | 9701 | 11437 |
| 15~19 | 9861 | 15238 | 15~19 | 18599 | 11084 | 12999 |
| 20~24 | 8734 | 13338 | 20~24 | 17849 | 10555 | 11454 |
| 25~29 | 13502 | 19828 | 25~29 | 21488 | 13038 | 13439 |
| 30~34 | 16237 | 24630 | 30~34 | 25700 | 15024 | 15797 |
| 35~39 | 21001 | 31760 | 35~39 | 29981 | 17534 | 18675 |
| 40~44 | 24089 | 36744 | 40~44 | 31824 | 20002 | 21562 |
| 45~49 | 25147 | 36424 | 45~49 | 31135 | 20985 | 22997 |
| 50~54 | 25723 | 36913 | 50~54 | 32170 | 21467 | 22315 |
| 55~59 | 27175 | 37947 | 55~59 | 32398 | 22495 | 22462 |
| 60~64 | 27601 | 38717 | 60~64 | 32576 | 22933 | 21745 |
| 65~ | 23408 | 35933 | 65~69 | 30435 | 21015 | 19517 |
| | | | 70~74 | 27565 | 18885 | 17534 |
| | | | 75~ | 22971 | 15667 | 14525 |

Sources: derived from household survey by HH age by the author, using TMI model.
Notes: meat includes processed meat; expenditures in 2010 constant won..

**Table10 Changes in per capita household expenditures on fish by age groups in S. Korea, 1990 to 2010**

(won/month)

| age/year | 1990 | 1995 | age/year | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|---|
| 0~9 | 5561 | 6970 | 0~9 | 4649 | 3741 | 1024 |
| 10~14 | 6647 | 8629 | 10~14 | 5565 | 4752 | 1451 |
| 15~19 | 5937 | 8770 | 15~19 | 6046 | 5794 | 2159 |
| 20~24 | 5855 | 9185 | 20~24 | 6811 | 6928 | 3211 |
| 25~29 | 9338 | 14185 | 25~29 | 8865 | 10336 | 5020 |
| 30~34 | 12688 | 18185 | 30~34 | 11332 | 12604 | 7256 |
| 35~39 | 16712 | 23102 | 35~39 | 14138 | 14491 | 9415 |
| 40~44 | 19344 | 25727 | 40~44 | 16013 | 17004 | 11055 |
| 45~49 | 20067 | 28756 | 45~49 | 17911 | 19599 | 13491 |
| 50~54 | 22436 | 31243 | 50~54 | 20664 | 22400 | 16582 |
| 55~59 | 23522 | 32701 | 55~59 | 21850 | 25201 | 19417 |
| 60~64 | 25167 | 33934 | 60~64 | 22056 | 25063 | 20495 |
| 65~ | 22544 | 27973 | 65~69 | 21817 | 22767 | 18884 |
| | | | 70~74 | 21875 | 22463 | 18668 |
| | | | 75~ | 19930 | 20385 | 16918 |

Sources: the same as Table 9.
Notes: the same as Table 9.

**Table 11 Changes in per capita household expenditures on fresh vegetables by age groups in S. Korea, 1990 to 2010**

(won/month)

| age/year | 1990 | 1995 | age/year | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|---|
| 0~9 | 18615 | 11769 | 0~9 | 7399 | 4191 | 2350 |
| 10~14 | 18881 | 14238 | 10~14 | 9359 | 5623 | 3331 |
| 15~19 | 17630 | 12538 | 15~19 | 9642 | 6327 | 4006 |
| 20~24 | 16253 | 12634 | 20~24 | 10124 | 7316 | 4865 |
| 25~29 | 19629 | 17721 | 25~29 | 12364 | 10332 | 6203 |
| 30~34 | 22111 | 21371 | 30~34 | 14306 | 12442 | 8293 |
| 35~39 | 26633 | 26825 | 35~39 | 17402 | 14992 | 10850 |
| 40~44 | 31060 | 30515 | 40~44 | 19879 | 18030 | 13125 |
| 45~49 | 34457 | 32299 | 45~49 | 22051 | 20846 | 15806 |
| 50~54 | 34005 | 34162 | 50~54 | 23665 | 23457 | 18565 |
| 55~59 | 34862 | 38438 | 55~59 | 25405 | 25937 | 21620 |
| 60~64 | 37745 | 38313 | 60~64 | 25702 | 26677 | 23861 |
| 65~ | 33168 | 33774 | 65~69 | 24522 | 25383 | 23939 |
| | | | 70~74 | 24452 | 25237 | 23970 |
| | | | 75~ | 24505 | 25234 | 23994 |

Sources: the same as Table 9.
Notes: expenditures in 2010 constant won.

**Table 12 Changes in per capita household expenditures on fresh fruit by age groups in S. Korea, 1990 to 2010**

(won/month)

| age/year | 1990 | 1995 | age/year | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|---|
| 0~9 | 9177 | 8193 | 0~9 | 8573 | 6373 | 7003 |
| 10~14 | 9239 | 8491 | 10~14 | 9521 | 5898 | 6758 |
| 15~19 | 8534 | 8331 | 15~19 | 9249 | 5819 | 6544 |
| 20~24 | 8506 | 8706 | 20~24 | 9454 | 6202 | 6307 |
| 25~29 | 10235 | 11059 | 25~29 | 11345 | 8697 | 8272 |
| 30~34 | 10890 | 12334 | 30~34 | 12274 | 10160 | 10590 |
| 35~39 | 12976 | 14711 | 35~39 | 14251 | 10781 | 12329 |
| 40~44 | 14787 | 15961 | 40~44 | 15720 | 11584 | 13369 |
| 45~49 | 15332 | 16968 | 45~49 | 16365 | 12880 | 15045 |
| 50~54 | 16168 | 18459 | 50~54 | 17371 | 13981 | 16019 |
| 55~59 | 17910 | 18253 | 55~59 | 18086 | 14970 | 16471 |
| 60~64 | 20205 | 17544 | 60~64 | 18577 | 15203 | 15564 |
| 65~ | 18395 | 16783 | 65~69 | 17927 | 13937 | 13727 |
| | | | 70~74 | 17925 | 13728 | 13475 |
| | | | 75~ | 17957 | 13656 | 13382 |

Sources: the same as Table 9.
Notes: the same as Table 11.

consumption between the age groups in Korea, regrettably only after the year 1990. The Korean household data classified by HH age groups are likely to have some biases in under recording household expenditures by the younger households, headed by those in their twenties, in particular. Unlike the Japan's annual reports, which exclude single-person households, one person-households may be contained in the Korean data. The TMI model, which is based on the assumption that all households are composed of two persons or more, may lead to under-biases in estimating per capita consumption particularly by the young in Korea.

As is the case with household food consumption in Japan, the young in Korea consume on a per capita expenditure basis appreciably less vegetables and fruit than those in their 50s to 60s, although the differences are considerably less than in Japan. In Japan, for example, those in adolescence, from 10 to 19 years of age, consumed on average 40 kg of vegetables and 15 kg of fruit in 1990-91, as compared to some 85kg of vegetables and 55 kg of fruit, respectively, by those in their 50s to 60s. Adolescents reduced their consumption of vegetables and fruit to 30 kg and 5~6 kg, respectively in 2000-01, whereas those older cohorts kept their consumption of vegetables and fruit nearly at the previous levels over the same period. On the other hand, in Korea, the adolescents spent in terms of monthly expenditures in 2010 constant prices 18,000 and 8,900 won on vegetables and fruit, respectively, in 1990, as compared to 34,000 and 18, 000 won, respectively by those in their 50s to 60s in the same year. The Korean adolescents reduced their expenditures on vegetables to 9,500 won in 2000 but slightly increased their fruit expenditures to 9,500 won, as compared to 25,000 and 18,000 won, respectively by those in the older age groups in the same year. In a word, the Korean adolescents did not reduce fruit consumption, as their Japanese peers have done since the mid-1970s or the early 1980s.

**Another Perspective: Period versus Cohort Issue**

One year olds in 1965, for example grew to 11 year olds in 1975 and in turn 20 year olds in 1984. When we examine one's growth pattern in height by age over time, it may be more realistic to follow the same birth cohorts as they age over the years, instead of comparing different ages, say one to ten and in turn twenty year olds at a given time, say in 1985. In the preceding articles (Mori, 2016; 2017; Cole and Mori, 2017; etc.) to compare the growth patterns of children's height between the two counties, Japan and South Korea, we ignored taking this cohort view into consideration. Strictly due to the lack of data, i.e., observations of only 5 years of 1965, 1975, 1984, 1997, and 2005 being available on the Korean side, a cohort approach (Mori, Inaba, and Dyck, 2016; Mori, 2017, pp.23-4) is not feasible in practice. We have to, therefore, to give up on applying comprehensive cohort approaches to the current case of comparing growth patterns of child height between Japan and South Korea over the period of 1965 to 2005.

One year olds and 10 year olds in 1965 aged to 11 and 20 year olds, respectively in 1975, for example. Boys of the first birth cohort in Japan and South Korea grew in height from 79.5 and 74.8 cm to 141.1 and 136.0 cm by 61.6 and 61.2 cm, almost the same magnitude from 1965 to 1975, whereas boys of the second cohort grew from 133.2 and 128.3 cm to 167.3 and 168.7 cm by 34.1 and 40.4 cm, respectively over the same period, i.e., the teenage Korean boys substantially faster than their Japanese peers. Boys of one year old and 10 year old in 1975 aged to 10 and 19 year olds, respectively in 1984. Boys of the third cohort in Japan and South Korea grew from 80.3 and 75.8 cm to 136.9 and 135.2 by 56.6 and 59.4 cm, respectively and boys of the forth cohort grew from 136.5 and 131.9 cm to 170.5 and 169.9 cm by 34.0 and 38.0 cm, respectively over the same period, with the Japanese boys of either cohort surpassed appreciably by their Korean peers in growth speed (refer to Tables 5-6, Mori, 2017, pp.25).

Take another visual example. One year olds and 7 year olds in 1984 aged to 14 and 20 year olds in 1997. The boys of the fifth cohort in Japan and South Korea grew from 80.5 and 77.8 cm to 164.2 and 162.7 cm by 83.7 and 84.9 cm, respectively and boys of the sixth cohort grew from 120.8 and 120.4 cm to 170.9 and 173.4 cm by 50.1 and 53.0 cm, respectively over the same period, with the Japanese of sixth cohort surpassed by the their Korean peers by a few centimeters in growth (ibid.).

To sum up, the Korean boys grew faster than the Japanese boys in the late childhood from 10 to 20 years

of age over the period from the mid-1960s to the mid-1970s, whereas they grew much faster than the latter during the entire childhood in the next decade from the mid-1970s to the mid-1980s. From the mid-1980s to the mid-1990s, the Korean boys grew faster than their Japanese peers only during the late childhood of their teens. Further empirical investigations are needed to identify how these differences by cohort between the two nations have come about.

**Brief Concluding Remarks**

It seems not easy to summarize the differences in growth patterns of child height over the period from the mid-1960s to the mid-2000 between Japan and South Korea, the two neighboring North-East Asian countries. By quick, visual inspections, both Japanese and Koreans grew remarkably taller in height in the post-war era and they were the same in height at the ages of maturity, boys at 20 and girls at 18 in the mid-1970s through the mid-1980s but Japanese ceased to grow in height in the early 1990s, whereas Koreans kept growing and as a consequence were 2 cm taller in the mid-1990s and 3 cm taller in the mid-2000s than Japanese of either sex. When we examine the growth-patterns from infancy to the early and late adolescence in the two countries, we have noticed a couple of distinct differences: particularly in growth speed after the mid-adolescence, i.e., Koreans grew distinctly faster than Japanese during their adolescence over the period in question. The pertinent questions to be raised may include whether these differences should originate from the ethnic traits, if any, and/or the environmental circumstances, particularly nutritional intakes by the subjects under consideration.

The Korean adolescents did not eat more meat and fish than their Japanese peers and particularly their milk consumption was considerably less than in Japan in the 1980s and 1990s, as observed in the preceding sections. The Koreans, however, ate a lot more rice with kimchi and their fruit consumption soared, while the young in Japan drastically decreased their fruit consumption since the early 1980s. “The supply of inputs to health” (Steckel, 1995) should have been somehow inadequate for the growing young children in Japan, since the mid-1980s. As the author casually observes in the university students cafeterias, the young people in present day Japan do not take much vegetables and virtually no fruit, either fresh or juice. The readers may share the view with the author by glancing over *Wakamonotachi no Shokutaku* (*Dinner Table of the Young*) which portrays what the Japanese young eat by numerous snapshots of their every meals from breakfast to supper how inadequate their inputs to health look to be in present day Japan (N. Toyama, T. Hasegawa, and K.Sato, 2017).

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**Appendix Table 1 Chnages in average height of male students by age in Japan in pre-war years, 1900 to 1939**

| year \ age | 6 y.o. | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|
| 1900 | 107.0 | 110.9 | 116.1 | 120.0 | 123.9 | 127.9 | 133.9 | 140.0 |
| 1901 | 107.0 | 111.2 | 116.1 | 120.3 | 125.2 | 128.8 | 133.6 | 138.3 |
| 1902 | 107.0 | 111.5 | 116.1 | 120.6 | 124.5 | 129.1 | 133.6 | 139.1 |
| 1903 | 107.0 | 111.5 | 115.5 | 120.3 | 125.2 | 128.8 | 133.9 | 139.4 |
| 1904 | 106.7 | 110.6 | 115.2 | 119.7 | 124.5 | 127.9 | 133.3 | 139.7 |
| 1905 | 106.4 | 110.9 | 115.2 | 120.0 | 124.5 | 128.5 | 133.6 | 139.4 |
| 1906 | 106.4 | 110.9 | 115.4 | 120.0 | 124.8 | 128.8 | 133.9 | 140.0 |
| 1907 | 106.4 | 110.3 | 115.2 | 120.0 | 124.5 | 128.5 | 133.3 | 139.7 |
| 1908 | 106.7 | 111.2 | 116.1 | 120.3 | 124.2 | 128.5 | 133.6 | 139.4 |
| 1909 | 106.7 | 111.2 | 115.8 | 120.0 | 124.5 | 128.5 | 133.6 | 139.1 |
| 1910 | 107.0 | 111.2 | 115.8 | 120.3 | 124.5 | 128.5 | 133.6 | 139.1 |
| 1911 | 106.7 | 111.5 | 116.1 | 120.6 | 124.8 | 128.8 | 134.2 | 139.7 |
| 1912 | 107.0 | 111.2 | 116.4 | 120.6 | 125.2 | 129.4 | 134.2 | 140.0 |
| 1913 | 106.7 | 111.2 | 116.1 | 120.3 | 125.2 | 129.1 | 133.9 | 140.0 |
| 1914 | 106.7 | 111.2 | 115.8 | 120.6 | 125.2 | 129.1 | 134.2 | 139.7 |
| 1915 | 107.0 | 111.5 | 116.1 | 120.6 | 125.2 | 129.1 | 134.2 | 139.7 |
| 1916 | 107.0 | 111.5 | 116.1 | 120.6 | 124.8 | 129.4 | 134.5 | 140.0 |
| 1917 | 107.0 | 111.8 | 116.4 | 121.2 | 125.2 | 129.7 | 134.5 | 140.6 |
| 1918 | 107.0 | 111.5 | 116.4 | 120.9 | 125.5 | 129.7 | 134.8 | 141.2 |
| 1919 | 107.0 | 111.5 | 116.4 | 120.9 | 125.2 | 129.7 | 134.8 | 140.6 |
| 1920 | 107.0 | 112.1 | 116.4 | 120.9 | 125.5 | 129.4 | 134.8 | 140.6 |
| (1921) | 107.2 | 112.1 | 116.6 | 121.2 | 125.7 | 129.7 | 135.0 | 140.8 |
| 1922 | 107.3 | 112.1 | 116.7 | 121.5 | 125.8 | 130.0 | 135.2 | 140.9 |
| 1923 | 107.3 | 112.1 | 117.0 | 121.5 | 126.1 | 130.3 | 136.1 | 141.8 |
| 1924 | 107.3 | 112.1 | 117.0 | 121.8 | 126.1 | 130.3 | 135.5 | 142.4 |
| 1925 | 107.6 | 112.1 | 117.3 | 121.8 | 126.4 | 130.3 | 135.8 | 142.1 |
| 1926 | 107.5 | 112.3 | 117.3 | 122.1 | 126.1 | 130.7 | 136.4 | 143.0 |
| 1927 | 108.0 | 112.8 | 117.8 | 122.4 | 126.8 | 131.1 | 136.8 | 143.4 |
| 1928 | 108.1 | 113.1 | 117.8 | 122.5 | 126.8 | 131.1 | 136.7 | 143.3 |
| 1929 | 108.1 | 113.1 | 117.9 | 122.5 | 127.0 | 131.2 | 136.9 | 143.2 |
| 1930 | 108.1 | 113.2 | 118.0 | 122.6 | 127.0 | 131.4 | 137.1 | 143.3 |
| 1931 | 108.3 | 113.4 | 118.2 | 122.8 | 127.2 | 131.6 | 137.3 | 143.6 |
| 1932 | 108.5 | 113.5 | 118.3 | 123.0 | 127.4 | 131.8 | 137.5 | 143.8 |
| 1933 | 108.7 | 113.7 | 118.5 | 123.1 | 127.6 | 131.6 | 137.8 | 144.0 |
| 1934 | 108.8 | 113.9 | 118.8 | 123.3 | 127.6 | 132.2 | 138.2 | 144.7 |
| 1935 | 108.9 | 114.0 | 118.9 | 123.5 | 127.9 | 132.3 | 138.2 | 144.7 |
| 1936 | 109.0 | 114.0 | 119.0 | 123.7 | 128.2 | 132.5 | 138.2 | 144.8 |
| 1937 | 108.8 | 114.2 | 119.1 | 123.6 | 128.2 | 132.8 | 137.7 | 143.9 |
| 1938 | 108.3 | 114.2 | 119.1 | 124.1 | 128.3 | 133.0 | 137.4 | 144.7 |
| 1939 | 109.1 | 113.9 | 119.3 | 125.0 | 128.2 | 132.9 | 137.8 | 144.0 |

Sources: Ministry of Education, *School Health Examination Surveys*, 1965, Time Series Data on the internet.
Note: the data for 1921were created by averaging 1920 and 1922 by the author.

(cm)

| 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|
| 147.0 | 152.1 | 156.1 | 157.9 | 160.0 | 160.0 | 160.9 | 160.0 |
| 146.7 | 152.4 | 157.0 | 159.1 | 159.7 | 160.0 | 160.0 | 160.6 |
| 145.5 | 151.8 | 156.4 | 158.2 | 159.4 | 160.3 | 160.6 | 160.6 |
| 146.7 | 152.1 | 156.4 | 158.2 | 159.7 | 160.3 | 160.9 | 160.6 |
| 147.9 | 152.4 | 157.0 | 158.5 | 159.7 | 160.3 | 160.9 | 160.9 |
| 146.4 | 152.4 | 157.0 | 159.1 | 160.0 | 160.6 | 161.1 | 160.9 |
| 146.7 | 152.7 | 156.7 | 159.1 | 160.3 | 161.5 | 160.9 | 161.5 |
| 146.7 | 153.0 | 156.4 | 158.8 | 160.0 | 160.6 | 160.6 | 161.2 |
| 146.1 | 152.4 | 157.3 | 159.1 | 159.7 | 160.6 | 160.6 | 160.9 |
| 146.7 | 153.0 | 157.0 | 159.4 | 160.0 | 160.9 | 161.2 | 161.2 |
| 146.4 | 152.7 | 157.3 | 159.1 | 160.0 | 160.9 | 161.5 | 161.2 |
| 146.7 | 153.0 | 157.0 | 159.4 | 160.3 | 160.9 | 161.5 | 161.8 |
| 147.3 | 153.3 | 157.6 | 159.4 | 160.6 | 161.2 | 161.5 | 161.8 |
| 147.3 | 153.6 | 157.6 | 159.4 | 160.6 | 161.2 | 161.2 | 161.8 |
| 146.7 | 153.3 | 157.9 | 159.7 | 160.6 | 161.2 | 161.2 | 161.8 |
| 147.0 | 153.6 | 157.9 | 159.7 | 160.9 | 161.2 | 161.5 | 161.8 |
| 147.3 | 153.9 | 158.2 | 160.0 | 160.9 | 161.5 | 161.8 | 162.7 |
| 147.6 | 154.5 | 158.5 | 160.0 | 160.9 | 161.2 | 161.8 | 162.7 |
| 148.2 | 153.9 | 158.5 | 160.0 | 160.9 | 161.8 | 161.9 | 162.1 |
| 147.9 | 154.2 | 157.9 | 160.0 | 160.9 | 161.8 | 162.1 | 162.1 |
| 148.2 | 154.2 | 158.2 | 160.0 | 161.2 | 161.8 | 162.4 | 162.4 |
| 148.5 | 154.4 | 158.4 | 160.2 | 161.4 | 162.0 | 162.6 | 162.6 |
| 148.8 | 154.5 | 158.5 | 160.3 | 161.5 | 162.1 | 162.7 | 162.7 |
| 148.8 | 154.8 | 158.2 | 160.6 | 161.2 | 162.1 | 163.0 | 162.7 |
| 149.4 | 155.2 | 158.8 | 160.3 | 161.5 | 162.1 | 162.4 | 162.7 |
| 149.7 | 155.2 | 158.8 | 160.6 | 161.5 | 161.8 | 162.4 | 162.4 |
| 149.8 | 155.5 | 159.0 | 160.6 | 161.6 | 162.1 | 162.7 | 162.8 |
| 150.1 | 155.5 | 158.4 | 160.7 | 161.4 | 162.5 | 162.7 | 163.2 |
| 150.2 | 155.5 | 159.3 | 160.8 | 161.8 | 162.5 | 162.9 | 163.0 |
| 150.6 | 157.0 | 159.6 | 161.1 | 162.1 | 162.7 | 163.0 | 163.1 |
| 150.7 | 156.2 | 159.5 | 161.0 | 161.8 | 162.3 | 162.5 | 163.0 |
| 151.1 | 156.6 | 159.9 | 161.3 | 162.5 | 163.2 | 163.3 | 163.4 |
| 151.3 | 156.8 | 160.1 | 161.7 | 162.6 | 163.2 | 163.4 | 163.3 |
| 151.8 | 156.0 | 160.3 | 161.7 | 162.7 | 162.8 | 163.6 | 163.7 |
| 152.2 | 157.5 | 160.6 | 162.1 | 162.9 | 163.4 | 163.7 | 164.0 |
| 152.4 | 157.6 | 160.6 | 161.8 | 162.9 | 163.4 | 163.9 | 164.1 |
| 152.6 | 157.9 | 160.7 | 162.0 | 163.2 | 163.6 | 164.1 | 164.1 |
| 152.0 | 157.2 | 160.1 | 161.0 | 161.8 | 162.6 | 163.7 | 164.0 |
| 151.8 | 158.2 | 160.4 | 162.3 | 163.5 | 163.6 | 164.3 | 164.4 |
| 152.1 | 158.1 | 160.9 | 162.5 | 163.8 | 164.3 | 164.5 | 164.7 |

**Appendix Table 2 Secular Trends in Height over 3 Deacades in Rural India, Selected States**

(mean in cm)

| Period | Age | Andhra Pradesh | Gujarat | Karnataka | Kerala | Mahara-shtra | Orissa | Namil Nadu |
|---|---|---|---|---|---|---|---|---|
| 1975-79 | 15+ | 149.7 | 149.1 | 152.5 | 147.2 | 152.3 | 146.8 | 147.6 |
| | 18+ | 160.6 | 161.1 | 163.0 | 160.5 | 159.9 | 160.6 | 160.2 |
| | | | | | | | | |
| 2011-12 | 15+ | 157.3 | 157.4 | 155.0 | 163.2 | 157.3 | 147.3 | 156.8 |
| | 18+ | 164.6 | 164.9 | 165.2 | 167.9 | 165.5 | 161.3 | 167.5 |

Sources: R.S. Mamidi et al., "Secular Trends in Height in Rural India," p. 428.

**Appendix Table 3 Changes in per capita Net Supply of Selected Food Products, UK and Netherlands**

(kg/year)

| | | Netherlands | UK |
|---|---|---|---|
| meat_fish | 1970 | 83.1 | 107.3 |
| | 1990 | 102.7 | 97.9 |
| | 2000 | 130.3 | 102.5 |
| | 2010 | 113.1 | 106.5 |
| milk | 1970 | 321.5 | 231.7 |
| | 1990 | 314.8 | 232.3 |
| | 2000 | 353.2 | 220.6 |
| | 2010 | 340.5 | 240.8 |
| vegetable | 1970 | 89.4 | 75.5 |
| | 1990 | 75.1 | 88.2 |
| | 2000 | 98.0 | 87.1 |
| | 2010 | 78.4 | 92.8 |
| fruit | 1970 | 91.1 | 61.0 |
| | 1990 | 137.1 | 76.1 |
| | 2000 | 121.0 | 83.4 |
| | 2010 | 116.1 | 123.1 |

Sources:FAOSTAT, Food Balance Sheets.

**Appendix Table 4 Changes in per capita At-home Consumption of Mandarins by Age Groups in Japan, 1971 to 2011**

(kg/year)

| age (y.o.) | 1971 | 1979 | 1980 | 1981 | 1985 | 1990 | 1995 | 2000 | 2001 | 2005 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-4 | 11.43 | 10.04 | 8.46 | 6.47 | 3.78 | 0.86 | 1.67 | 0.49 | 0.78 | 0.38 | 0.12 | 0.50 |
| 5-9 | 14.41 | 11.32 | 9.37 | 7.81 | 4.44 | 1.13 | 1.86 | 0.62 | 1.00 | 0.63 | 0.18 | 0.56 |
| 10-14 | 15.88 | 11.80 | 9.07 | 8.68 | 4.70 | 1.64 | 1.77 | 0.68 | 1.17 | 0.86 | 0.39 | 0.58 |
| 15-19 | 17.31 | 12.46 | 9.31 | 9.23 | 4.82 | 2.26 | 1.79 | 0.87 | 1.34 | 0.96 | 0.74 | 0.64 |
| 20-24 | 18.06 | 12.79 | 9.54 | 9.05 | 4.85 | 2.69 | 2.02 | 1.30 | 1.55 | 1.01 | 1.16 | 0.81 |
| 25-29 | 17.57 | 12.95 | 9.60 | 9.00 | 5.09 | 3.27 | 2.25 | 1.80 | 1.81 | 1.20 | 1.53 | 1.13 |
| 30-34 | 16.65 | 14.61 | 11.68 | 10.82 | 8.82 | 6.55 | 2.83 | 2.46 | 2.42 | 2.74 | 1.79 | 1.57 |
| 35-39 | 17.10 | 19.41 | 19.66 | 14.72 | 9.74 | 10.12 | 3.18 | 4.38 | 4.55 | 3.45 | 2.16 | 2.01 |
| 40-44 | 18.45 | 21.18 | 19.39 | 16.57 | 13.96 | 11.10 | 8.13 | 6.98 | 5.86 | 4.21 | 2.68 | 2.40 |
| 45-49 | 19.25 | 22.39 | 20.37 | 17.80 | 14.52 | 12.26 | 8.36 | 7.51 | 8.19 | 4.69 | 3.37 | 2.78 |
| 50-54 | 20.75 | 23.25 | 21.24 | 18.24 | 14.59 | 12.70 | 9.12 | 8.61 | 8.92 | 7.34 | 4.18 | 3.47 |
| 55-59 | 19.87 | 23.01 | 20.52 | 17.85 | 15.57 | 14.03 | 11.72 | 9.59 | 11.95 | 8.45 | 5.23 | 4.64 |
| 60-64 | 17.17 | 22.47 | 20.51 | 18.67 | 16.51 | 14.60 | 12.11 | 11.62 | 12.52 | 9.23 | 6.86 | 6.78 |
| 65-69 | 15.22 | 22.29 | 20.54 | 17.69 | 16.26 | 13.91 | 12.63 | 12.36 | 12.61 | 9.92 | 8.93 | 8.31 |
| 70-74 | 15.19 | 22.27 | 20.59 | 17.31 | 16.13 | 13.63 | 12.86 | 12.73 | 12.65 | 10.44 | 9.70 | 8.66 |
| 75- | 14.65 | 21.27 | 19.67 | 16.43 | 15.31 | 12.90 | 12.34 | 12.26 | 12.08 | 10.16 | 9.59 | 7.99 |

Sources: derived from *FIES* data classified bt HH age by the author.
Notes: estimates for the young age groups, 0 to 9 after the mid-1990s are not statistically different from zero.