

Dutch, The World Tallest, are Shrinking in Height: Lessons from the Cases of Japan and South Korea

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ABSTRACT

Dutch (men aged 20-21) grew in height fast and steadily from 173.5 cm in the mid-1950 to 182.3 cm in the 1980s, and 184 .0 cm in the late-1990s, “the world tallest” and levelled off, or mean height even declined by 0.3-0.5 cm, or even more in in the latest decade, despite growing social-economic environments. In North-East Asia, men in South Korea grew fast and steadily in height to overtake their Japanese peers by 3.0 cm in the mid-2000s and then stopped growing taller despite continued economic prosperity and increased per capita consumption of animal protein in their diets. The author derived per capita consumption of major food products from household expenditure surveys, classified by age groups of household head. He discovered that children in growing ages, 0~9, 10~19, started to turn away from vegetables in the early-1990s, to consume only 25% of the vegetables eaten by adults in their 50s in the mid-2000s and 10% of vegetables by the older cohorts in their 50s in the end of the 2010s. Some four decades ago, children in Japan started to turn away from fruit. They ceased to grow taller at all ages in the 1990s, despite continued higher consumption of animal protein. The Netherlands has been appreciably lower in per capita consumption of vegetables, compared to other North-European countries. Further empirical investigations along cohorts are needed, in order to determine if they have reached maximum genetic potentials.

Key Words: height; Dutch; South Korea; Japan; consumption by age; vegetables/fruit; animal protein

INTRODUCTION

Shohei Otani^{*1}, MVP 2021 in US Baseball-League, is 193 cm in height, very tall, approximately 20 cm taller than average Japanese young men. His father, Toru, is 182 cm in height, 16 cm taller than his contemporaries. His mother, Kayoko, is 170 cm in height, 15 cm taller than her contemporaries. Genetics! Shohei's elder brother, Ryuta, is 183 cm in height and his elder sister, Yukari, is 168cm, 10 cm taller than her contemporaries, but 2 cm shorter than her mother. (*1 Japanese, born and raised in Japan)

“Genetics” cannot explain everything. Richard Steckel (1995) states: Stature is a net measure that captures the supply of inputs to health [1] (p.1903). Shohei and his brother and sister grew up in the same living condition, under the same parents and social-economic circumstances. Shohei should have utilized the supply of inputs to health to the fullest extent.

According to the large-scale nationwide growth studies, young boys in the Netherlands (children from immigrants excluded) grew steadily in height after WW II to the end of the 20th century to be the “world tallest” and ceased to grow thereafter. The socio-economic conditions

have been improving in the Netherlands, as measured in per capita GDP [2] (Schonbeck et al., p.373). It is most likely that the Dutch may have reached a sort of genetic potential as a group but why they have stopped growing in height or reported to be shrinking slightly^{*2}, by 0.3~0.5 cm, possibly within statistical error, in recent years? [3;4] (*2 Stephen and Wit, Report, *Voeding Magazine*, 2019; christophercloutier, September 17, 2021).

DATA

The government of the Netherlands conducted large scale children's growth studies, five times after the end of WWII, 1952-56, 1964-66, 1978-1980, 1996-97, and 2009[5;6;7;8]. The surveys cover the age range from zero to 21 years old. On the Asian side, the age range is limited to 1st grade in primary school (6 years old) to senior grade in high school (17 years old), based on *National School Health Statistics Surveys* [9;10], conducted every year on larger scale than *National Nutrition Surveys* [11;12], both in Japan and South Korea. Boys tend to grow approximately 2.0 cm taller beyond 17 years of age in the Netherlands, whereas boys in Japan seem not to grow that much^{*3}. (*3 When boys are measured by one year bracket beyond 17 years of age, we often come across questionable figures such that 18 years old are slightly shorter than 17 years old in the same year, due to the smaller size of the observations, the case of *National Nutrition Surveys*.)

Table 1 enumerate changes in mean height of boys by age from 6 to 17 years old in the Netherlands, Japan, and South Korea, 1955, 1965, 1980, 1997 and 2009, where specific year denotes 3 year moving average^{*4} in Japan and South Korea (*4: such that 1980 denotes moving average of 1979 to 1981).

Those born in 1980, for example, grew to 1 year old on birthday in 1981, 6 years old in 1986, 12 years old in 1992 and 17 years old in 1997. To identify one's biological growth patterns in height, for example, it is desirable to trace birth cohorts rather than to compare rising ages in the same year. With the limited number of years of observation as shown in Table 1, we cannot compare changes/ differences in the growth velocity of children's height in the past half century between the Netherlands and the two Asian nations. Nevertheless, one has some idea on how fast or slow the Dutch children have grown in height in the past half century in comparison with children in the North-East Asia.

We first compare the three countries in terms of increments in boys' height from 6 y to 17 y, over the intervals, 1955-1965, 1965-1980, 1980-1997, and 1997-2009 (Table 2). Over the entire period from 1955 to 2009, the Dutch boys grew consistently faster, more than 5 cm, than Asian boys. However, when we cut growth ages into 6-12, and 12-17, we come across different pictures. Dutch boys grew slightly faster than Asian boys, from 6 to 12 during the first period from 1955 to 1980, but the situation reversed in the latter half of the period. From 1980 onwards, Korean boys grew appreciably faster than the Dutch boys, as much as 3-5 cm faster. The Dutch boys, however, grew distinctly faster, more than 5 cm, when measured from 12 y to 17 y than Asian boys. Korean teens grew steadily to overtake their Japanese peers in height by 3 cm in the mid-2000s. The Korean boys increased in height by 20.7 cm from 12 y (1st grade in junior high school) to 17 y (senior in high school), the difference being: 27.0-20.7=6.3 cm less, or slower, when compared to the Dutch boys. Caucasians tend to grow appreciably faster in

their adolescence than Asians. More data from other European countries might confirm this statement.

KOREAN CHILDREN STOPPED GROWING IN HEIGHT IN THE MID-2000S

After WW II, Japan's economy recovered to the pre-war level in 1955 and kept fast and steady progress to the early-1990s, when the "bubble burst", followed by a decade-long recession. South Korea, a former colony of Japan, was devastated by the Korean-War (1950-53), started to make steady progress beginning in the mid-1960s, two decades behind Japan. In terms of relative per capita GDP, South Korea was one-fourth in the early-1990 and one half the level of Japan in the mid-2000s [12].

As shown in Table 3, Japanese boys were a few cm taller than Korean peers at all ages in the 1960s-70s. The younger segments of Korean school boys reached the same levels in height as their Japanese peers in the 1980s and gradually overtook them by 3-4 cm in the following decades. The Korean teens grew as tall as their Japanese peers in the 1990s and overtook them by 3.0 cm in the mid-2000s and then abruptly ceased to grow taller. The Korean economy experienced very high prosperity in the 2000s-2010s and per capita consumption of animal products, particularly animal meats increased equivalent to that of the Netherlands, as we will see in the subsequent section. And yet, children in South Korea plateaued in height, regardless of age in the 2010s. The author suspects that this Korean experience might apply to the Dutch case of height stagnation in the past decade or so.

WHAT THE DUTCH COULD LEARN FROM THE KOREAN CASES?

Let the author put forth his conjecture, first. Children in South Korea started to turn away from Kimchi, basically vegetables fermented, in their diets. By courtesy of Dr. S. Kim, Korea Rural Economic Institute, the author obtained annual reports of *Household Income and Expenditure Surveys* [13] classified by age groups of household head, 1990 to 2019 only a year ago. The annual report provides household age compositions by HH age groups, such that household headed by those in their early 40s, 40~44, has 0.522 persons in age, 0~9, 0.725 persons in age, 10~14, and so on in the year, 2000. With these precious data, it was easy for the author to estimate expenditures by individual family members by age on specific commodity group, say meat, vegetables, and so forth, by means of the TMI model (2004) [14]. Table 4 enumerates individual expenditures on vegetables by household members, classified by age groups of household members, 0~9, 10~14, 15~19, 20~24, ---, for the period from 1990 to 2019 in South Korea.

Koreans are known to consume a lot of vegetables (Lee, HS, Duffey, and Popkin, 2012) [15]. However, children in growing ages from 0~9, 10~14, and 15~19, in particular started to reduce their vegetable consumption in their household diets in the early 1990s, or shortly before 1990. According to *Food Balance Sheets*[16], prepared by KREI, per capita supply(= consumption) of vegetables in South Korea was 131 kg in 1990-91, increased to 150 kg in 2005-6 and slightly decreased to 143 kg in 2017-18. Children in age, 0~19, consumed 50% of vegetables eaten by those in their 50s in the early 1990s, dropped to some 20% in the mid-2000s and 10% in the end of the 2010s. Children in Korea drastically "steered away" from vegetables over the past three decades, comparable to Japan's wakamono no kudamonobanare (steering away from fruit by the young), stated in the Japanese government's *White Paper on Agriculture*, 1994 [17].

In regards to fruit consumption, the author has been contending for the past few years that consumption of animal protein does not result in increasing body height, if consumption of other essential nutrients is insufficient, as Blum stated years ago [18]. In the case of the plateau in of height increases of Japanese children observed in the late-1980s, fruit and vegetables proved “essential nutrients”, insufficient in supply (Tables 4-5, Mori, 2018; 2020) [19;20].

In reviewing references on the plateauing of the Dutch in height during the past decade or two, we often come across “plant-based protein” [21], implying the obsession with “high-quality” protein (Grasgruber, 2014; 2020; etc.) [22;23]. The Netherlands has been on the top list of animal protein supply, milk, in particular, in Europe (Table 6). According to *Food Balance Sheets*, FAOSTAT, renewed in methodologies, it became apparent that per capita supply of vegetables in the Netherlands has been appreciably lower than in the rest of the Northern European countries and has declined steadily in the past decade [24;25]. Based on decades long cohort analyses of food consumption (Mori, *Structural Changes*, LAMBERT, 2020)[26], the author surmises that a secular decline in national per capita supply($\approx$ consumption) should imply sizable decreases in per capita consumption of the newer/ younger cohorts in the population, i.e., per capita consumption of vegetables by the children in growing ages in the Netherlands may have been declining more than simple national per capita supply indicates.

If fast food diets are more prevalent in the Netherlands lately than other nations in the North Europe [27;28], children in the Netherlands should have reduced vegetables, “essential nutrients” in consumption. “Big-Macs” or Kentucky-Fried Chicken” provide very little vegetables. In discussing the secular trends in height, per capita consumption of “essential nutrients” by children in growing ages, in place of nation’s simple per capita consumption needs to be identified.

CONCLUSIONS

In the mid-20th century, the young men in the Netherland were 173 cm in mean height. They steadily grew to 184 cm, the world tallest in the mid-1990s, and levelled off afterwards, or even started to decline by 0.3-0.5 cm. Most likely, they may have reached genetic potentials in the mass population. If children in growing ages eat more meat and drink more milk, plausible results would be increases in BMI^{*5}. Based on the biological observations on secular trends in children’s height and food consumption of various food groups by children in growing ages, in place of nation’s simple per capita consumption in Japan and South Korea, increases in animal protein do not result in increasing body height, if consumption of other essential nutrients, vegetables and fruit, is insufficient. (*5 Korean school boys, 17 years of age, increased from 21.8 to 23.4 in BMI from 2000 to 2017, while they increased in height only 0.7 cm from 173.0 to 173.7 cm over the same period (Mori, 2021) [29].

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TABLES

Table 1 Secular changes in mean height of boys by selected age, Netherlands, Japan and South Korea, 1955,1965,1980,1997 and 2009

(cm)

	1955			1965			1980			1997			2009		
age	Nethl Jp			Nethl Jp Kr			Nethl Jp Kr			Nethl Jp Kr			Nethl Jp Kr		
6 y	115.7	109.9		117.8	113.0	111.9	121.5	115.7	115.4	120.1	116.7	119.5	119.9	11.6	12.9
12 y	147.5	138.5		149.6	144.1	141.8	154.1	149.5	145.2	154.0	152.4	153.1	155.2	15.7	15.9
17 y	173.5	163.2		176.1	166.4	163.8	182.3	169.6	167.3	181.3	170.9	171.9	181.0	17.7	17.3

Sources: Refer to the text.

Table 2 Height growth from 6 y to 12 y and 12 y to 17 y over the period from 1955 to 1965,---,1997 to 2009, boys in Netherlands, Japan and South Korea

(cm/10 years)

	Country	1955 ⇒ 65	1965 ⇒ 80	1980 ⇒ 97	1997 ⇒ 09
6 ⇒ 17	Nethl	60.4	64.5	59.8	60.9
	Jp	66.2	56.6	55.2	54.0
	Kr		55.4	56.5	54.3
		1955 ⇒ 65	1965 ⇒ 80	1980 ⇒ 97	1997 ⇒ 09
6 ⇒ 12	Nethl	33.9	36.3	32.5	35.1
	Jp	28.6	32.7	27.2	27.0
	Kr		33.3	37.7	38.4
		1955 ⇒ 65	1965 ⇒ 80	1980 ⇒ 97	1997 ⇒ 09
12 ⇒ 17	Nethl	28.6	32.7	27.2	27.0
	Jp	27.9	25.5	21.4	18.3
	Kr		25.5	26.7	20.7

Sources: Table 1,

Notes: growth from 6 y to 12 y and 12 to 17, over the approximately 10 year period: Not in the same year.

Table 3 Changes in mean height of school boys by age, Japan and South Korea, 1965 to 2015												
Japan											(cm)	
Age	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2017
6 y	113.4	114.5	115.2	115.7	116.4	116.8	116.8	116.7	116.7	116.7	116.5	116.5
7 y	118.8	120.0	120.8	121.3	122.1	122.5	122.6	122.4	122.5	122.6	122.5	122.5
11 y	138.6	140.4	141.9	142.8	143.3	144.4	144.9	145.3	145.1	145.0	145.2	145.1
12 y	144.7	147.0	148.6	149.5	150.1	151.5	152.0	152.8	152.6	152.4	152.6	152.7
16 y	165.7	166.9	167.9	168.8	169.3	169.6	170.1	170.1	170.0	169.9	169.8	169.9
17 y	166.7	167.9	168.8	169.6	170.2	170.5	170.9	170.9	170.8	170.7	170.7	170.6
Sources: School Health Examination Surveys, Ministry of Education, various issues.												
S. Korea												
Age	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2017
6 y	111.9	112.9	112.9	115.4	116.2	117.7	119.0	120.2	121.0	121.8	120.5	120.6
7 y	115.2	117.6	118.5	120.5	121.9	123.0	124.7	125.9	126.8	127.7	125.8	125.7
11 y	131.4	134.5	136.1	139.6	141.6	143.7	145.7	147.9	149.4	150.4	149.0	149.4
12 y	141.8	143.7	143.2	145.2	147.6	149.7	152.0	154.8	156.9	158.0	156.7	157.2
16 y	161.9	163.9	164.3	165.9	167.3	168.3	170.3	172.1	172.8	173.1	172.7	172.9
17 y	163.8	166.1	166.1	167.3	168.9	169.7	171.0	172.9	173.7	173.7	173.4	173.5
Sources: School Health Examination Surveys, Department of Education, various issues.												

Table 4 Changes in per capita household expenditures on vegetables by age groups,							
1990 to 2019, South Korea					(% of the 50's)		
age/year	1990-91	1995-96	2000-01	2005-06	2010-11	2014-15	2017-19
0-9	49.8	31.4	30.5	19.4	12.6	13.6	8.5
10~14	51.8	34.5	34.1	22.5	15.3	15.1	10.1
15~19	51.6	35.1	36.5	25.9	18.9	16.8	12.9
20~29	55.2	42.1	43.8	34.5	27.7	25.5	22.4
30~39	73.3	64.7	62.3	54	48.2	50.2	45.6
40~49	96	87.8	85.5	78	72.6	73.3	68.1
50~59	100	100	100	100	100	100	100
60~	95.1	98.3	104	107	116.2	121.1	130.5
per capita							(kg/year)
supply	131.7	156.4	154.5	149.7	143.4	145.6	142.5
Sources: derived from <i>Household Income and Expenditure Surveys</i> [13].							

**Table 5 Changes in per capita at-home consumption of fresh fruit
by age groups, 1971 to 2010, Japan**

	(kg/year)						
age groups	1971	1980	1985-86	1990	1995-96	2000	2008-10
0~9	36.3	26.5	15.2	8.9	4.7	2.3	3.0
10~19	45.6	30.5	20.1	14.9	9.4	5.7	4.7
20~29	48.3	31.5	23.4	16.8	15.1	11.8	10.5
30~39	46.1	43.8	36.6	30.4	23.6	21.8	16.4
40~49	51.0	52.6	48.5	44.9	37.2	33.4	22.6
50~59	54.4	59.9	56.6	54.0	50.5	48.5	36.4
60~	42.9	56.4	60.4	61.2	60.4	63.3	57.1
Grnd-ave.	45.6	41.6	36.4	33.8	31.5	31.1	28.9

Sources: derived by the author from Family Income and Expenditures Surveys, Jp. Government.

Table 6 Changes in per capita supply of meat and vegetables, Netherlands, Sweden,

	Denmark, and S. Korea			(kg/capita)			
	meat			vegetables			
	Netherld	Sweden	S. Korea	Netherld	Sweden	Denmark	S. Korea
1990	82	59	25	72	64	73	196
2000	90	71	46	98	75	91	230
2010	79	80	59	83	91	120	212
	meat			vegetables			
2014	71	76	62	57	89	98	210
2015	70	76	65	64	90	93	192
2016	70	75	67	66	90	97	185
2017	65	74	69	64	86	101	194
2018	69	73	71	58	83	104	201

Sources: FAOSTAT, Food Balance Sheets, old methodologies for 1990-2010
and new methodologies for 2014-18.