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Opinion Article

The Dutch the World Tallest are Becoming Shorter. Why? Vegetables as Essential Nutrients Have Been Decreasing

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Abstract

The Dutch have been the world's tallest, with young men attaining 184cm in mean height in the late 1990s. They have shrunk by 1.0cm by the end of the 2000s. "Less varied", "more oily", diets, may have caused this change (USA Today; other mass media). According to FAO's statistics, per capita supply of vegetables in the Netherlands has been remarkably less, compared to other North European nations, and only one-fourth, compared to South Korea, where young men grew taller in height more then 10cm since the early-1960s. "A high consumption of animal protein does not result in increasing body height if overall consumption of other essential nutrients is insufficient" [1]. Vegetables/fruit are considered essential to increasing body height on top of animal products [2,3].

Introduction

The Dutch has long been told the world's tallest nation but is reported to have stopped growing taller, or to have slightly shrunk in mean height in the recent years, the 2010s [4,5] (CBS; USA Today; etc.). In Temperate Asia, Japan has long plateaued in height since the early 1990s and the young in South Korea kept growing fast to overtake Japanese peers by 3-4cm in the mid-2000s but suddenly stopped growing taller than and seem to have shrunk by 0.3-5 cm toward the end of the 2010s [6], while per capita GDP has been growing steadily. "Stature is a net measure that captures the supply of inputs to health" [7]. The author has been undertaking comparative analyses of height growth in the two countries from the perspective of inputs to health, food consumption, in the past half-century [8]. Animal protein is the key determinant of human height, only with sufficient supply of fruit/vegetables, "essential nutrients" (Blum) [1,6].

With the four professional reports of stature developments of children in the Netherlands provided [9-12], the author attempts to compare the height growth patterns of Dutch children (boys) with children in Temperate Asia in the past half-century, with probable genetic differences set aside*1.

*1 We hear often that people in the northern parts of the country are appreciably taller in height than those in the southern region within the small country of the Netherlands. According to the latest professional studies, the regional differences have nearly disappeared since 1997, due to the narrowed socio-economic differences [12].

Data

The large-scale national surveys of a statue of the population of all ages from infants to elderlies have been conducted 5 times, 1955, 1965, 1980, 1997, and 2009 in the Netherlands. In Japan, National Nutrition Surveys, which report mean height of population from infants to 24 years of age, 25-29, 30-39, 60-69 are available every year, 1946 to 2021 on the internet [13]. In South Korea, the more comprehensive Health and Nutrition Examination Surveys have been conducted, the 1st one of which took place in 1998, followed by the 2nd one in 2001, and the 3rd one in 2005 [14]. School Health Examination Surveys have been conducted in Japan from 1900 to 2020, except a few years during WWII, and the survey provides the mean height of school children from 1st grade of primary school (6 years of age) to high school seniors (17yrs), measured in the first month of the school year, April [15]. Similar surveys have been conducted in South Korea, 1960 to 2018 issues of which are available to the author [16] (Courtesy: Senshu University Ikuta Campus Library). Boys tend to grow 1-2 cm taller in mean height from 17 to 20 in age in the Netherlands [12].

Discussion

As shown in (Figure 1), the Dutch boys were 173.5cm in mean height in the mid-1950s, 10.2cm taller than Japanese peers. After a decade, the Dutch boys grew to 176.1cm, 9.7, and 12.3cm, respectively taller than Japanese and Korean peers. After another decade and a half, the Dutch grew to 182.3cm, 12.7, and 15.0cm, respectively taller than Japanese and Korean peers in 1980*2. The Dutch boys fell to 181.3cm in 1997, 10.4 and 9.4cm, respectively taller than Japanese and Korean peers and they fell to 181.0cm in 2009, 10.3 and 7.2cm, respectively taller than Japanese and Korean peers. The height differences, particularly those between the Dutch and the Korean boys appreciably narrowed. If you compare the younger boys in the three nations, the Dutch boys at 6 and 12 years of age, were 2.0 and 2.7cm, respectively shorter than Korean peers in 2009. The Dutch boys at 12 years of age were only 2-3cm taller than Japanese peers in 1997 and 2009 (Figures 2&3). Teens in Japan plateaued in height since the early 1990s, not because they began to take less animal protein but because children started to steer away from the fruit in their diet in the early 1980s [6,8] Children in Korea kept increasing vigorously in height throughout the 1970s to 1990s to overtake Japanese peers by 3-5cm in the mid-2000s but then suddenly ceased to grow any taller because they started to turn away from vegetables in their diet in the early-1990s and ate only 10% of vegetables consumed by the older generation in their 50s and 60s at the end of 2010s [6]. If children in temperate Asia had kept well-balanced diets, consuming as much fruit/vegetables as before, the differences in height between the Dutch and North-Eastern Asians should have been even narrower than we observed in the (Figures 1-3). Experts as quoted by the mass media attribute the suspension of height growth observed in the Netherlands and the United States to "less varied, oily diets" as observed in fast-food consumption [4,5]. The author does not think that "Double-Mac", Kentucky Fried chicken, and the-like are excessively "oily" but all these fast foods contain virtually no vegetables, except

for a piece of lettuce and/or onions.

*2 Mean height of Japanese and Korean boys in chosen years signifies three year-moving average, e.g., H1980=H(1979+1980+1981)/3.

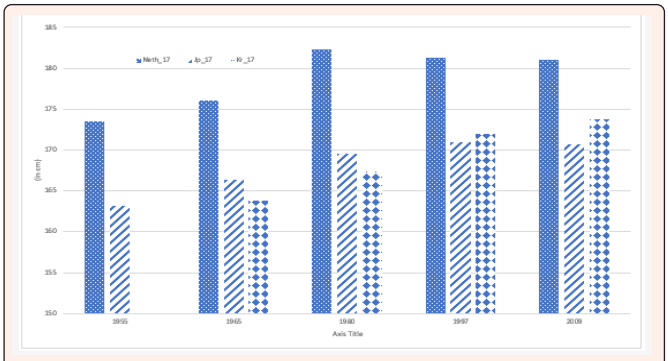

Figure 1: Changes in mean height of boys age 17, Netherlands, Japan and South Korea, 1955 to 2009.

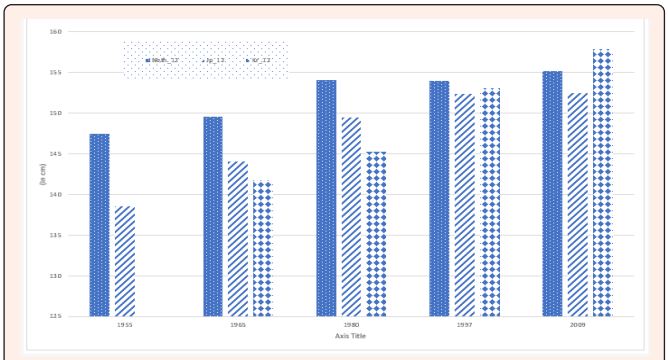

Figure 2: Changes in mean height of boys 12yrs old, Netherlands, Japan and South Korea, 1955 to 2009.

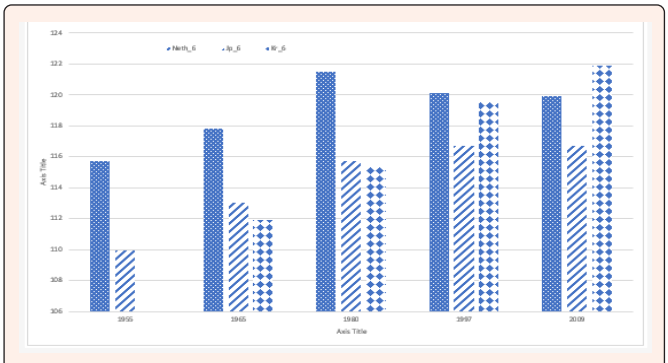

Figure 3: Changes in mean height of boys 6yrs old, Netherlands, Japan and South Korea, 1955 to 2009.

Decreased per capita supply of vegetables in the Netherlands

Mori, Cole and S. Kim [6] discovered, based on their in-depth analyses of Statistics Korea, household expenditure surveys, classified by age groups of household head, 1990 to 2019 that the young, children in growing ages, started to steer away from vegetables (Kimchi) in their at-home consumption in the early-1990s: children, under 20(0~9,10~19) are estimated to eat one-half of vegetables eaten by those in their 50s in the early-1990s, slightly less than 15% in the early-2010s, and 10% of vegetables eaten by the older generations in the end of the 2010s (Table 1).

Table 1: Changes in per capita household expenditures on vegetables by age groups, 1990 to 2019, South Korea.

Age/ Year	(% of the 50's)						
	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 Supply	(kg/year)						
	131.7	156.4	154.5	149.7	143.4	145.6	142.5

Sources: Derived from Household Income and Expenditure Surveys [16].

The equal may apply to the boys' height growth in Japan (Nutrition Surveys, 1980-2019) [13]. Due to the lack of consistent data in South Korea, we are going to compare boys' height growth from 6 years to 17 years of age in the Netherlands and the two Asian countries in the past half-century.

This is quite equivalent to "wakamono no kudamaono-banare" (steering away from fruits by the young), the Japanese government's White Paper on Agriculture, 1994 [17]. The author derived individual household consumption of fresh fruit by age groups, from Family Income and Expenditure Surveys, 1971 to 2010 [18]. The estimates are summarized in (Table 2).

Table 2: Changes in per capita at-home consumption of fresh fruit by age groups, 1971 to 2010, Japan.

Age Groups	(kg/year)						
	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	52.6	48.5	44.9	37.2	33.4	22.6
50~59	54.4	59.9	56.6	54	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 FIES [18].

Children under 20 years of age consumed at home 40kg of fruit, about the same amount as the grown-up adults in their 50s-60s in the early 1970s, they reduced fruit consumption in 1990 to the quarter level of 20 years ago, while those older cohorts increased fruit consumption about 20% over the same period. In 2010, per capita at-home consumption of fruit by the children was meager, below 5.0 kg/year, less than 10% of the volume eaten by the older cohorts in their 60s-70s. Some professionals contend that the young nowadays consume fruit in juice, which is not well-founded by the national production of bottled juice, while bottled-packed tea and "clear water" have sky-rocketed over the past decades (National Producers Association of Soft Drinks) [19]. Men stop growing in height after the age of 20. Whatever nutrients one takes after the adolescent period do not help further growth in height. When we want to discuss the association of mean height of population or cohorts with the chosen variables: environmental condition, food supply in this paper, per capita consumption by selected age groups, or birth/geographical cohorts, in place of simple per capita supply of the population should

Table 3: Changes in per capita supply of meat, milk, and vegetables, Netherlands, Sweden Denmark, and S. Korea.

(Kg/Capita)										
Year	Meat			Milk			Vegetables			
	Netherlands	Sweden	S. Korea	Netherlands	Sweden	S. Korea	Netherlands	Sweden	Denmark	S. Korea
1990	82	59	25	330	356	21	72	64	73	196
2000	90	71	46	360	354	28	98	75	91	230
2010	79	80	59	354	350	25	83	91	120	212
2014	71	76	62	265	183	8	57	89	97	210
2015	70	76	65	304	180	9	64	90	93	192
2016	69	75	67	314	179	9	66	90	97	185
2017	65	74	68	279	174	9	64	86	101	194
2018	69	73	71	276	172	11	58	83	104	201

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

be applied. In the presence of apparent age/cohort effects in food consumption [20,21], explicit efforts to identify per capita consumption by the selected cohorts in the population should be practiced, as far as feasible*3. (Table 3) provides changes in per capita supply of meat, milk, and vegetables in the Netherlands, Denmark, Sweden in Northern Europe, and South Korea in temperate Asia, 1990 to 2018. In the late-2010s, South Koreans consume nearly as much meat as the Dutch but per capita, milk consumption*4 is less than 10% of that in European countries. The majority of people in temperate Asia are featured by lack of lactase in the body. Per capita supply of vegetables in the Netherlands decreased appreciably from the decades, 1990-2010 to the mid-2010s and averaged 65% the level compared to Denmark and Sweden and only one-third the level, as compared to South Korea. The nation's per capita supply of vegetables has kept internationally quite a high level in South Korea. Nevertheless, per capita, household consumption of vegetables by growing children decreased so drastically (Table 1) that children in Korea stopped growing taller in the mid-2000s, while the economy prospered.

*3 Mori [22] and Tanaka [23] designed an econometric model, to derive individual consumption by household members by age from household consumption, classified by age groups of the household head.

*4 The author suspects that FAOSTAT, Food Balance Sheets [24] underestimate per capita supply of milk, excluding butter in the Republic of Korea. When the total supply of milk is divided by population, derived from FAOSTAT, per capita supply of milk tends to increase substantially, only with Republic of Korea. FAO has not responded to the author's inquiries.

Conclusion

When the author prepared (Table 3), changes in per capita supply of vegetables in the Netherlands, in comparison with other northern European nations and particularly South Korea in the latest decades, it proved quite natural for him to be convinced that the Dutch have been declining in height in the latest two decades. Blum states a high consumption of animal protein does not result in increasing body height if overall consumption of other essential nutrients is insufficient (2013) [1]. The author has no idea if fast food consumption has been more prevalent in the Netherlands than in other nations in Northern Europe. Judging from the statistics provided by FAOSTAT, per capita supply of vegetables has decreased appreciably in the Netherlands, whereas her neighbor countries have maintained the previous level in the past two decades. As observed in Japan, a secular decline in national per capita supply (=consumption) of fruit has been initiated by the younger generations or newer cohorts [22], who are susceptible to nutritional changes for body height development.

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