Height, body size, and longevity: is smaller better for the human body?

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Martel and Biller reported that the socially ideal height for western men is 188 cm (6 ft 2 in) and rising.[1] With advances in genetic engineering, parents will be able to control the heights of their children, and these heights are likely to increase with each new generation. Indeed, greater height and associated lean body mass are viewed positively by the medical profession and society. This bias is based on a few studies and our cultural values but ignores extensive data that indicate that shorter stature is healthier. We summarize our findings of more than 25 years of personal and literature research.

Summary points

- Advances in genetic engineering will promote a continual increase in height of successive generations
- International and national studies have shown that tallness has health and longevity risks
- Body size is controllable through dietary practices, especially during childhood and adolescence
- Many studies indicate that a near-vegetarian diet with high fiber, low salt, and few processed foods promotes health and greater longevity
- Extensive data from animal studies indicate that people with smaller bodies have delayed onset of chronic diseases and greater longevity

HEIGHT AND HEALTH

In the past 20 years, the "bigger is better" misconception has been promoted by studies that found that taller people—men over 183 cm (6 ft) and women over 165 cm (5 ft 5 in)—have lower death rates from heart disease and all causes than shorter people (men under 170 cm [5 ft 7 in] and women under 150 cm [4 ft 11 in]). In 1999, we reviewed the findings of several of these studies.[2] Virtually all of these articles have ignored abundant data showing that short height per se does not adversely affect health. For example, the first National Health and Nutrition Examination Survey (NHANES I) found no relation between height and heart disease when age and years of education were adjusted for 13,031 men and women tracked for 13 years.[3] The investigators reported that previous studies on height and health suffered from weaknesses and inconsistencies that compromised their findings. More recently, Okasha et al found no association between height and all-cause mortality in a study of 10,700 male and female students at Glasgow University, Glasgow, Scotland, observed for 40 years.[4]

The average height before the 20th century was about 10 cm (~4 in) shorter than today. Yet, coronary heart disease (CHD) before 1900 was rare.[2] Although only about 50% of the population reached 50 years of age, those surviving to 50 could expect to live another 15 to 20 years. Thus, CHD was uncommon even though there were many elderly people in the early 1900s and earlier. Since the 1960s, countries like India and Singapore have seen large increases in the incidence of CHD (including in young adults) with dietary changes and increased height.

Women average about 13 cm (~5 in) shorter than men and have considerably lower rates of CHD. Although hormones are assumed to explain this advantage, they may play only a partial role. For example, based on 1,700 deceased people in Ohio, Miller found that men and women of the same height had about the same life span.[5]

Age-standardized death rates from all causes, coronary heart disease (CHD), and stroke per 100,000 population (males) for 6 ethnic groups in California

Ethnic groups*	Height, cm (in)	Age-standardized death rates/100,000 All cause	CHD	Stroke
African American	178 (70)	1,800	316	102
White	178 (70)	1,243	302	60
Hispanic	172 (68)	856	175	49
Asian Indian†	170 (67)	668	258	33
Chinese	169 (66)	773	155	62
Japanese	169 (66)	693	146	52

*In order of decreasing height.
†Based on height data for upper socioeconomic status in India.

FINDINGS SUGGESTING THAT SHORT STATURE IS HEALTHIER

During the second half of the 20th century, the people living the longest included the Japanese, Hong Kong Chinese, and Greeks[2]—all being shorter and weighing less than northern Europeans and North Americans. In addition, data from the California Department of Health indicate that Asians and Hispanics live more than 4 years longer than taller whites.[6] Wild and associates found that East Indians, Chinese, Japanese, and Hispanics in California had lower all-cause and CHD death rates, as shown in the Table.[7] Heights obtained from other sources are shown for each ethnic group and indicate that shorter ethnic groups had lower death rates.

Compared with northern Europeans, shorter southern Europeans had substantially lower death rates from CHD and all causes.[2] Greeks and Italians in Australia live about 4 years longer than the taller host population, and shorter Turkish migrants in Germany have an age-adjusted CHD death rate half that of taller indigenous Germans. Others have pointed out that genetics is not the primary factor here because after a few generations, Mexican and Japanese migrants approach the CHD and cancer rates of the host country.[2] One of us (H E) led medical teams in studies of eight populations selected for healthy and vigorous people and found that they were also small people.[8]

A report on a 25-year study of Okinawans indicates that they have the greatest longevity in the world, including exceeding that of mainland Japanese.[9] Okinawans are vigorous and healthy into advanced ages and continue a high level of physical activity into their 90s. They have the lowest rates of cancer and heart disease in the world and also exceed most countries in centenarians at a rate of 34 per 100,000 versus 5 to 10 per 100,000 for industrialized nations. Bone fractures were found to be substantially less than in mainland Japan and the United States. The Okinawans eat a low-calorie, high-fiber diet rich in vegetables, grains, and soy. Monounsaturated and polyunsaturated fats (especially omega 3) are consumed in preference to saturated fats. Refined carbohydrates and animal products, except for fish, are consumed in small amounts. Tea and small amounts of alcohol are drunk daily. However, salt intake is 7 g, which is higher than the less than 1 g consumed by populations with lifelong low blood pressure.

The researchers, Willcox et al,[9] did not attribute this superior health to genetics because when younger Okinawans migrate to mainland Japan, Hawaii, or the United States, they soon acquire the chronic diseases of the host population. The Okinawans are shorter and weigh less than mainland Japanese, and men aged 87 to 104 years average 145.4 cm (4 ft 9 in) and 42.8 kg (94 lb).[2]

Other researchers have found many traditional societies with good health and little CHD and cancer.[10-12] For example, Walker found that rural blacks in South Africa had virtually no CHD and little diet-related cancer.[2,10] The blacks averaged about 10 cm shorter than whites. Lindeberg et al[11] reported that Melanesians living in Kitava were healthy and that heart disease and stroke were virtually absent in a population ranging in age from 20 to 86 years. The men averaged 161 cm (5 ft 3 in) and 53 kg (117 lb). A study of Solomon Island populations also found them to be free of CHD and healthy, with male heights ranging from 160 to 163 cm.[12]

Longevity studies of deceased US veterans found an inverse relation between height and longevity.[13] Evaluation of height and longevity of deceased professional baseball players and 19th century French men and women also showed an inverse relation, as shown in figures 1 and 2.[14] In a review of literature on height, body size, and longevity, we found several studies that showed a negative correlation between height and longevity.[2]

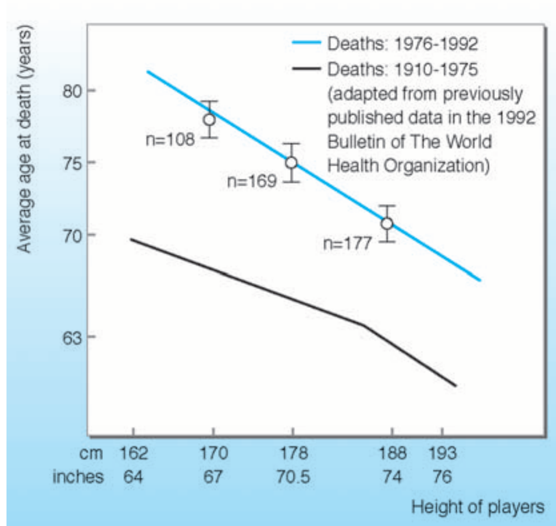

Figure 1 Reduction of baseball players' average life span with increasing height. (Reproduced with permission of Washington Academy of Sciences, Washington, DC.)

Many studies have found a positive correlation between cancer, rapid growth, and height.[2] For example, Albanes reported that rapid growth during adolescence is tied to increased cancer risk in adulthood, with a 3- to 4-mm increment in leg length above average resulting in an 80% higher risk in nonsmoking-related cancer, based on a 50-year follow-up.[15] Hebert et al also found that taller US physicians (183 cm [6 ft] or more) had a higher cancer rate than shorter ones (170 cm [5 ft 7 in] or more).[16]

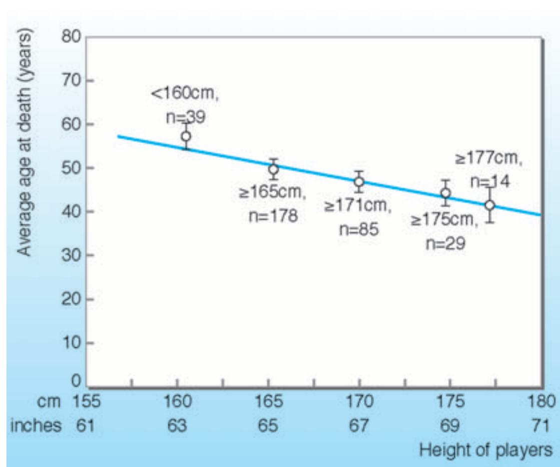

Figure 2 Average life span in years versus height for 19th century deceased French men. (Reproduced with permission of Washington Academy of Sciences, Washington, DC.)

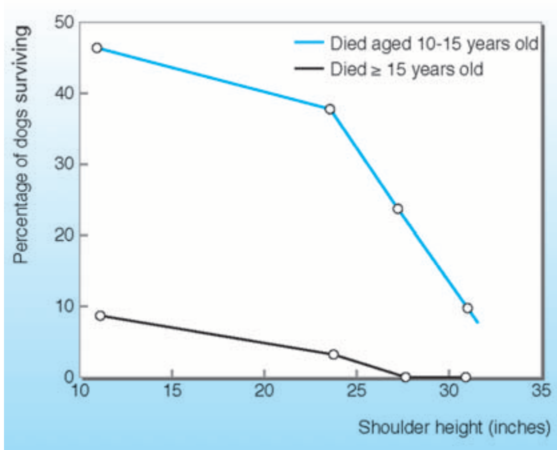

Figure 3 Longevity of dogs for 4 height groups: short, medium, tall, and very tall

DATA FROM ANIMAL STUDIES

Among different species, larger species usually grow and mature slower and live longer. However, studies of animals within the same species provide opposite results. Since the 1930s, experimental studies of genetically similar animals have found that caloric restriction with adequate nutrition produces smaller animals with extended longevity.[2] Bartke also conducted studies with genetically small mice and found that small size with ad lib nutrition resulted in extended longevity.[17] He reported that body size was a major determinant of longevity. Rollo et al found that genetically large mice had reduced longevity compared with normal-sized mice.[18] They also found that larger animals within the same species have rapid growth, higher reproductive effort, and accelerated aging.

Bartke reported that a negative correlation between body size and longevity applies to mice, dogs, and probably humans.[17] Large amounts of data are available on dogs, and researchers have found that smaller dogs live longer than larger dogs.[19] Figure 3 shows the survival of dogs based on height. Studies of monkeys have been under way for more than 10 years, and thus far the findings support those of longevity studies of smaller calorie-restricted mice and other species.[2,17] We described human examples of the benefits of caloric restriction elsewhere.[2]

BIOLOGIC CONSIDERATIONS

The biologic reasons for the lower longevity of larger bodies include more cells subject to carcinogens and the using up of cell-doubling potential (~50 doublings maximum) to achieve larger body size as an adult. This subject was discussed previously,[2] and more detail is provided in a second article.[20]

CONCLUSION

Rapid developments in genetic engineering are likely to lead to substantial increases in the height of future generations. Health and longevity are strongly affected by socioeconomic status, relative weight, regular exercise, and various health practices. However, animal and human data suggest that larger body size independently reduces longevity. Therefore, the promotion of greater height and lean body mass in our children needs to be objectively evaluated by the medical profession before it becomes the norm.

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