Leg length, proportion, health and beauty: a review

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With 8 figures and 2 tables

Summary: Decomposing stature into its major components is proving to be a useful strategy to assess the antecedents of disease, morbidity and death in adulthood. Human leg length (foot + tibia + femur), sitting height (trunk length + head length) and their proportions (for example the relative leg length in proportion to stature, and the sitting height ratio [sitting height/stature × 100], among others) are used as epidemiological markers of risk for overweight (fatness), coronary heart disease, diabetes and certain cancers. There is also wide support for the use of relative leg length as an indicator of the quality of the environment for growth during infancy, childhood and the juvenile years of development. Human beings follow a cephalo-caudal gradient of growth, the pattern of growth common to all mammals. A special feature of the human pattern is that between birth and puberty the legs grow relatively faster than other post-cranial body segments. For groups of children and youth, short stature due to relatively short legs (i.e. a high sitting height ratio) is generally a marker of an adverse environment. The development of human body proportions is the product of environmental × genomic interactions, although few if any specific genes are known. The short stature homeobox-containing gene (SHOX) is the first genomic region that may be relevant to human body proportions. For example, one of the SHOX related disorders is Turner syndrome. However, in most cases research has been showing that environment is a more powerful force to shape leg length and body proportions than genes. Leg length and proportion are important in the perception of human beauty, which is often considered a sign of health and fertility. There are a variety of cosmetic, fashion, and surgical interventions to enhance perceived or actual leg length.

Key words: human stature, growth pattern, body proportions, leg length, short stature homeobox-containing gene, epidemiological markers.

Size and shape in living humans

Human beings are distinguished from the non-human primates by several anatomical features. Among these are proportions of the arms and legs relative to total body length. The human difference is illustrated in Fig. 1, and quantitative differences given in Table 1. In proportion to total body length, measured as stature, modern humans have relatively long legs and short arms. The primary reason for this is human bipedal locomotion, a behavior which evolved at least by 4.4 million years ago (MYA), as shown in the fossil hominin species Arditiphecus ramidus. Leg length must approximate 50 percent of total stature to achieve the biomechanical efficiency of the human striding bipedal gait. In modern humans this happens at the end of the...