2D:4D finger length ratio and skeletal biomarker of biological aging

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With 2 figures and 1 table

Abstract: The aim of this population-based study was to evaluate the association between the index to ring (2D:4D) finger length ratio and the osseographic score (OSS), the skeletal biomarker of biological aging. A sample included 802 males and 738 females who had participated in a Chuvashian skeletal aging study. Age, sex, basic demographics, anthropometric data and X-rays of both hands were collected. Each hand was visually classified on X-ray as either Type 1 – index finger was longer than ring finger; Type 2 – equal; or Type 3 – shorter than the ring finger. OSS is a skeletal biomarker that comprises osteoporotic and osteoarthritis changes observable on a hands X-ray. The mean age of males in the studies sample was 46.98 ± 17.10 and mean age females was 48.65 ± 16.62. OSS showed significant association with age (r = 0.886, p < 0.001), body mass index (BMI) (r=0.253, p < 0.001) and sex (F = 13.771, p < 0.001). Results of one-way ANCOVA for finger length ratio types of right hand showed a significant difference in OSS (d.f. = 2, F = 7.569, p = 0.001), after adjustment for age, sex, and BMI. The posthoc comparison showed that individuals with Type 3 (2D < 4D) ratio showed significantly higher OSS scores that ones with Type 1 (p = 0.012) and Type 2 (p = 0.003). In an analysis of finger length ratio types of left hand also a significant difference in OSS was found (d.f. = 2, F = 3.290, p = 0.038). The posthoc comparison showed that individuals with Type 3 (2D < 4D) ratio showed significantly higher OSS scores that ones with Type 2 (p = 0.33) ratio. Finger length ratio is associated with OSS, a skeletal biomarker of biological aging. Individuals with Type 3 finger length pattern showed significantly higher OSS that ones with Type 1 and Type 2.

Keywords: hand; osteoarthritis; 2D:4D; finger length ratio; osseographic score; Chuvashian population

Introduction

It has been suggested that the index to ring finger ratio or 2D:4D ratio is a biomarker of testosterone exposure during early intra-uterine life (Lutchmaya et al. 2004; McIntyre 2006; Putz et al. 2004). During the last two decades, the 2D:4D ratio has been examined in relation to a number of physiological processes and psychological aspects (Putz et al. 2004), sporting abilities (Manning & Taylor 2001; Paul et al. 2006), and diverse health conditions (de Kruijff et al. 2014; Hussain et al. 2014; Manning & Bundred 2000; Vehmas et al. 2006).

An osseographic score (OSS) was introduced by Kobyliansky et al. (1995) to assess the skeletal aging. It based on the radiographic features of the hand, combining both osteoporotic and osteoarthritis changes of the hand bones and joints. Foundations of OSS were originally suggested by Pavlovsky (1987) and have been used in biological age evaluations in population studies (Kobyliansky et al. 1995; Livshits et al. 1996; Pavlovsky & Kobyliansky 1997). OSS has been shown to highly correlate with the chronological age in adults of different ethnic groups (Kobyliansky et al. 1995; Karasik et al. 1999). Genetic factors may also significantly contribute to interindividual differences in biological aging (Karasik et al. 2004). In variance-component genetic analysis, performed in Karasik’s study, sex, cohort, height, body mass index, and in women, menopausal status and estrogen use, jointly explained approximately 6% of the total variance of OSS, whereas genetic factors explained an additional 57%, indicating that most of the variability of OSS was associated with internal factors, providing additional support for the use of OSS as a biomarker of biological aging.

We carried out a radiographic study on a large population sample who had participated in a Chuvashian skeletal aging study project investigating different aspects of skeletal aging.