



# Sphenoid sinuses' volume and area analysis of Brazilian individuals' CBCTs, related to sex, age, skin color, and nutritional status using DDS-Pro™ software

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## Abstract

The purpose of this study was to analyze the volume and area of sphenoid sinuses of Brazilian individuals' cone-beam computed tomography (CBCT) images using the beta version of the DDS-Pro™ 2.14.2\_2022 software (DPP Systems, Czesochowa, Poland), to assess a potential correlation to sex, age, skin color, and nutritional status, and to evaluate differences between the right and left sides. Three-dimensional volume and area measurements were made with the software using CBCT images of 113 living Brazilian individuals of both sexes (67 females and 46 males). TEM, rTEM, and *R* were used to assess the reproducibility of inter- and intra-examiner measurements. The measurement means were estimated with 95% confidence intervals according to sex and age group. There were no significant differences between the left and right sides for both volume and area and between the sexes and black and white individuals. Volume and area were significantly higher in 18 years or older ( $p < 0.05$ ) and in individuals with normal body mass index (BMI) ( $p < 0.05$ ). The obtained results do not allow indicating the use of sphenoid sinuses volume and area measurements to estimate sexual dimorphism, and the same occurred for skin color. However, such measures can help to estimate age. Further studies are suggested with a larger sample, especially for the nutritional status variable.

**Keywords** Human identification · Sphenoid sinus · Cone-beam computed tomography · Three-dimensional imaging · Forensic anthropology · Forensic dentistry

## Introduction

The percentage of people killed and missing has increased substantially due to rising crime rates worldwide and accidents from multiple causes. The most common accidents are natural disasters and car and air accidents. However, identifying individuals, regardless of the cause of death, is extremely important because it deals with humanitarian issues and has a legal function in civil and criminal proceedings [1–4].

The study of anthropometry is essential to clarify issues related to human identification due to its importance in performing linear, angular, area, and volume measurements in different body components [5, 6]. Therefore, the anthropometric analysis of the skeleton provides primary characteristics of individuals such as sex, age at death, ancestry, and stature [7]. Craniometry is essential in the forensic area, especially in forensic anthropology, as the identity of a body is often defined only with the aid of the skull through craniometric characteristics; therefore, the dentist, specialist in forensic dentistry, is the most qualified professional to carry out studies on human skulls, due to his/her knowledge in the areas of head anatomy and forensic anthropology [8].

Among the craniofacial structures, the paranasal sinuses provide valuable information to forensic sciences for identifying individuals [4, 9]. Similar to the frontal sinus (SF), the morphology of sphenoid sinuses (SS) presents high heterogeneity, and it is considered one of the most variable cavities in the human body [10], thus very useful for human identification [11].

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