

# Image Perception of Female Breast Beauty and Its Relation to 3D Anthropometric Measurements

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## Abstract

This study aimed to explore the relationship between breast shape measurements and breast beauty assessment. Breast Beauty Subjective Assessment System (BBSAS) was developed to evaluate the beauty of breasts. 75 female subjects aged 20-39 years were selected for assessment from the anthropometric database of BIFT-Aimer Human Engineering Research Centre. 43 females working in intimate apparel design were chosen as judges to answer a five-scale questionnaire using the BBSAS. 66 detailed measurements especially related to the breast region were also taken for investigation. Data analysis results indicated that the breast beauty score was highly correlated with breast side view profile and breast erectness. Beautiful breasts selected by judges had the following common characteristics: the ratio of bust height to whole body height was 0.71; a triangle was constructed by front neck point, right bust point and left bust point was an isosceles triangle with the top angle less than  $60^\circ$ . The regression equation to predict the breast beauty scale was obtained based on key breast measurements. This study provides a new knowledge on relationship between the breast shape and breast beauty, as well as some useful guidelines for bra design.

*Keywords:* Breast Beauty; Beauty Subjective Assessment; 3D Anthropometric Measurements; Regression Analysis

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## 1 Introduction

Female breast shape is a key constituent of their gender features, and vital for the beauty of female appearance. Fully understanding female breast structure is of great significance for the structure design of lingerie products and breast shaping for the mannequin development. Since breast shape, position, contour and volume can all directly influence the clothing design, parameterization study of breast shape beauty has become a key research direction in this field.

Since 1960s, Japanese Wacoal Corp. has carried out systematic studies to analyze the features of Japanese female body shapes, and published related research achievements on criteria of female body shape beauty in the past 30 years [1]. Gold Proportion, proposed in 1965, was formed on

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the basis of anthropometric measurements and questionnaire survey on the ideal body shapes. The results indicated that if the body height was 100, the gold proportion of the breast, waist and hip girth should be 53:37:55. Beautiful Proportion, proposed in 1979 by Wacoal, introduced the age factor into the Gold Proportion, and established proportion formulas on measurements of such items as breast girth, waist girth, hip girth and leg length in proportion to the body height. Gold Canon, proposed in 1994 by Wacoal, summarized common characteristics of beautiful body shapes based on anthropometric measurements and subjective assessment, and proposed a new beauty index “Beauty Balance”, including the girth balance of bust, waist & hip, the torso proportion balance, three-dimensional balance of the breast, three-dimensional balance of the hip, the balance of height and weight, balance of height and proportion, etc.

Liang et al. categorized breast shapes into 9 basic types depending on 254 subjects and 10 3D measurement and took the intermediate type as the standard type [2]. It was concluded that the proportion of breast height to body height for young Chinese females was about 0.71, and the ratio of distance between two bust points to the chest width was around 0.5. The distance between two bust points and height of the bust point were regarded as major factors influencing the female breast shape beauty. In addition, the relevant measurements of the breast cross section, such as ratio of chest width to distance between two bust points, ratio of bust girth to underbust girth and ratio of breast girth to distance between two bust points, were also used to describe the girth characteristics of the breast, and were taken as the basis to categorize breast types, together with the girth measurements [3].

Liu et al. defined the bust girth more than 54% of the body height as the beautiful breast [4]. Zhang summarized several characteristics necessary for the beautiful breast: distance between two bust points should not be more than 20 cm, width of the breast base should be around 10-12 cm, the height from the breast base to the bust point be around 5-6 cm, etc. [5]. Fang and Jiang discussed the aesthetic significance of the breast from the perspective of the physiological structure and shape categories of the breast, and confirmed the measurements related to the ideal breast judgment, including distance between two bust points, height of the breast, diameter of the areola, etc. [6]. Hou introduced a set of multiple regression equations to predict responses about bust height, breast position and shape using several predictors like weight, whole body height and hip girth [7].

Based on the breast shape and its position, Chen et al. carried out manual measurements for 100 female college students and obtained the breast-related data, and proposed a method to determine the position of the bust point through the measurements such as bust girth, distance between two bust points, the vertical distance from the centre of the nipple to the horizontal level of the central point of the upper arm on the same side. It was proposed that the perfect breast shape should meet the following requirements: the triangle constructed by front neck point, right bust point and left bust point should be an equilateral triangle. The ratio of the distance between the bust point and the outer-most point of the breast to the distance between the bust point and the inner-most point of the breast should be close to the gold proportion of 0.618 [8].

The physiological structure of the breast is also critical for the breast shape. Westreich et al. proposed that only the breast that is not drooping can be regarded as the perfect breast. They defined the landmarks for breast measuring according to bone points, and tried to avoid using soft tissues. Taking those points as references, they measured 50 white females who possessed perfect breasts. Based on data analysis results, they introduced the multiple regression equation to calculate the “standard” breast volume: first to multiply logarithm of the distance from the