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**Tytuł rozprawy doktorskiej:** Voice quality parameters and body build and composition of men and women

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**Dyscyplina:** biological sciences

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### **Streszczenie w języku angielskim**

The production of acoustic wave by the speech apparatus of living organisms is described by the source-filter theory. It explains that the glottis (located in the larynx) is the source of the so-called laryngeal tone, which is then filtered by the structures of the so-called vocal tract, such as the pharynx, oral and nasal cavities, so that the sound is amplified and the final product - the voice - is produced. Voice is a very important biological signal that plays a fundamental role in the social processes of living organisms, i.e. in mate selection or intra-sexual competition. It also provides a lot of important information about the biological state of an individual, such as its sex, age, biological condition (fitness), health status, as well as body size and shape. The aim of the dissertation was to evaluate the relationship of voice quality with the body build (size and shape) and body composition of adult men and women. The study attempted to determine the significance, strength and direction of the observed relationships. In addition, the question was raised as to which voice material (recordings of isolated vowels or short sentences spoken aloud) is a better determinant of body build/composition in humans. The collected material consisted of biometric features of 205 people (81 men and 124 women) aged 18-72 years whose native language was Polish. Data were collected between 2019 and 2022 at two research and teaching centers - in Wrocław and Katowice. Voice samples were collected from all subjects, consisting of two types of recordings (vowel and sentence), anthropological measurements, i.e. height and weight, head and body circumferences (neck, shoulders, chest, waist hips, arms), and body composition parameters - fat mass (FM) and fat-free mass (FFM), obtained using a professional bioimpedance analysis (BIA) analyzer. Pearson's linear correlation methods were used to evaluate the associations, and stepwise backward regression models were used to determine the strongest predictors of voice quality, which included calculated principal components for the correlated parameter groups. It was shown that there were statistically significant associations of voice quality with body build and composition in both sexes, although the

directions of these relationships were not the same in men and women. Men with greater weight and body circumferences were characterized by voices that were higher, with more feminine timbre and more unstable. Men with greater body height, on the other hand, had more stable voices. In women relationships of the opposite direction were observed - higher body weight and larger body circumferences meant higher stability and voice intensity in women. Taller women had lower voices. When the associations of voice quality with body proportions were analyzed, it was shown that men with larger waist circumferences relative to hip circumferences (H-shaped silhouettes) had greater voice instability. Men with broader shoulders (V-shaped silhouettes) were characterized by higher voices with a more feminine timbre and shorter maximum phonation times. Women with larger shoulder girths relative to hip girths (with V-shaped silhouettes) were characterized by higher voice instability, more feminine timbre and lower voice intensity. The voices of women who had relatively large waist circumferences (H-shaped silhouettes) were more intense, lower, with a more masculine timbre and greater stability. Analysis of the relationships of voice parameters with body composition showed relationships with different directions in both sexes. Men with greater body fatness had higher voices with more feminine timbre and higher instability, while those with greater muscle mass were characterized by lower voices. Women with higher body fat mass had more stable voices and spoke louder, while women with higher FFM were characterized by longer maximum phonation times. The strongest relationship with voice parameters of men and women was shown by body fat mass, body circumference and age of the subjects. Based on the results, it was not possible to determine which type of recording is more useful for studying the relationship of body build and composition in humans.

The observed results demonstrate a significant relationship between body build and composition and the quality of the voices in both sexes. Underlying these relationships are correlations arising from: (i) the positive relationship of the size of the larynx and vocal tract with body build/composition, (ii) the negative relationship of the size of the larynx and vocal tract with voice parameters, i.e. pitch or timbre. The results obtained may be useful in the future for, among others, physicians and nutritionists dealing with obese patients or doctors treating the speech apparatus of voice professionals. The results of the work may also be of interest to law enforcement personnel and forensic experts analyzing voice recordings (telephone conversations, wiretap recordings, etc.) for a broader description of the characteristics of a wanted person. The human voice, therefore, hides a lot of information that can be used for important purposes if it is known how to decode it.