

# ANALYSIS OF BODY COMPOSITION THROUGH BIOIMPEDANCE IN HIGH-PERFORMANCE SWIMMERS: PRELIMINARY STUDY

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## ABSTRACT

**Introduction:** Swimming is a complex sport that depends on several factors for good performance in the aquatic environment. Body composition analysis is essential in sports to check the health and performance of athletes. Training aims to promote adaptations and optimal performance in major competitions. Therefore, the objective of this study was to analyze the body composition of high-performance swimmers using bioimpedance. **Methodology:** Twenty-nine swimmers were selected to participate in the study. Bioimpedance was applied before training, and after the training period, we analyzed whether there were significant changes in body composition. **Partial results:** The data obtained through bioimpedance before training provide information on lean and muscle mass, weight, height, and basal metabolic rate (BMR), cellular health, fat, hydration, and intra- and extracellular water. **Final considerations:** At the moment, training is being carried out with the athletes, and it will later be verified whether it was beneficial for the swimmers.

**Keywords:** swimmers; muscle strengthening; muscle activation; bioimpedance.

## INTRODUCTION

Swimming is a complex sport, and the aquatic environment makes it unique. Swimming performance is determined by physiological, psychological, and anatomical factors, specifically depending on energy, kinematics, and kinetics (GONZÁLEZ, 2022). Body composition analysis is essential in sports to check athletes' health and performance. Training aims to promote adaptations and optimal performance in major competitions (REIS, 2020).

Bioelectrical impedance analysis has emerged as a relatively new technique for assessing hydration status in sports. Recently, attention has been given to phase angle (PhA) measurement—a simple, non-invasive, and reliable method that uses

bioelectrical impedance analysis (BIA)—which allows for whole-body body composition assessment. It is an indicator of cellular health. The use of BIVA in the sports field has grown in recent years as its reliability in monitoring fluid change during a competitive season as well as in the short term has become established. BIVA, being a practical and quick method, can be used to monitor hydration status after a swimming competition. However, to our knowledge, no study has monitored changes in BIVA patterns during a preparation cycle in swimmers (CATTEM, 2021).

This analysis can be used as a non-invasive method to estimate variable differences from electrical properties of body resistance and reactance while considering individual characteristics such as sex, age, height, and weight. In addition, phase angle has been used as a predictor of body cell mass and, for this reason, has been employed as an indicator of nutritional status. The complementary use of bioimpedance and phase angle can be useful in assessing changes in nutritional status and hydration in athletes. In addition, BIVA provides qualitative information for the classification and grading of soft tissues by comparing individual vectors and ellipses with reference populations (CARRASCO- MARGINET, 2017).

In this study, we used bioimpedance to analyze the body composition of high-performance swimmers in order to contribute to the scientific community, since there are few studies that analyze body composition and its change with training in swimming. This study aimed to monitor the body composition of swimmers for a training cycle and verify the change that training brings about, in order to improve their performance in competitions.

## **METHODOLOGY**

Our work is an experimental study in which 29 swimmers were selected from a water park in Goiás, 15 of whom were male and 14 female, aged between 10 and 30 years. The athletes' initial body composition was assessed using bioimpedance, followed by a 30-day period without training to observe how the athletes' bodies presented themselves after this period. The next stage of the study is to apply muscle and respiratory training and verify whether there is a significant change in the participants' body composition.

The TeraScience app was used to apply bioimpedance, with a total body scale, i.e., four electrodes are placed, two on one hand and two on one foot, and it assesses the body composition of the entire body. The data collected provides information on lean and skeletal muscle mass, weight, height, height, BMI, body fat, intra- and extracellular water, total cellular water, and phase angle.

## RESULTS

The data were collected in August, observing body composition after approximately 30 days without training. The variables analyzed were lean and muscle mass, weight, height, basal metabolic rate (BMR), cellular health, fat, hydration, and intra- and extracellular water. Tables 1 and 2 show the partial results for the 29 athletes.

**Table 1:** Characterization of the sample (n=29).

Variables	Gender			p
	Total (n=29)	Female (n= 14)	Male (n=15)	
	Mean±SD	Mean±SD	Mean±SD	
Age (years)	15.07±4.00	14.14±2.2	15.93±5.09	0.236
Body mass (kg)	60.20±13.36	57.72±13.32	62.52±13.43	0.344
Height (m)	1.66±0.12	1.66±0.12	1.66±0.13	0.971
BMI (kg/m <sup>2</sup> )	21.75±2.05	21.50±2.56	22.00±1.74	0.758

**Source:** Body Mass Index (BMI)

**Table 2:** Comparison of body composition between sexes (n=29).

Variables	Sex			p
	Total (n=29)	Female (n=14)	Male (n=15)	
	Mean±SD	Mean±SD	Mean±SD	
MM (kg)	47.66±13.98	50.86±12.87	44.46±14.77	0.233
MME (kg)	27.52±8.50	29.63±7.99	25.40±8.75	0.193
%GC (kg)	17.90±6.57	16.89±6.56	18.90±6.66	0.428
AEC (L)	14.96±4.28	15.98±3.87	13.94±4.57	0.214
AIC (L)	20.43±6.09	21.85±5.64	19.02±6.39	0.225
ACT (L)	35.39±10.27	37.83±9.39	32.96±10.87	0.216
AF (°)	6.43±1.44	6.61±1.44	6.25±1.47	0.518

**Source:** Muscle Mass (MM), Skeletal Muscle Mass (SMM), Body Fat Percentage (%BF), Extracellular Water (ECW), Intracellular Water (ICW), Total Body Water (TBW), Phase Angle (PA).

## **FINAL CONSIDERATIONS**

The study is based on analyzing changes in the body composition of athletes through bioimpedance after core muscle and breathing training. Currently, training is being conducted with athletes, and its benefits for swimmers will be verified at a later date.

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