ARE SWIMMERS AND CYCLISTS DIFFERING EACH OTHER ON THE BASIS OF SELECTED PHYSIOLOGICAL VARIABLES? – A JUXTAPOSITION ANALYSIS

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ABSTRACT

The goal of the study being presented is to determine the physiological differences between cyclists and swimmers. Thirty swimmers and thirty cyclists, all national athletes from various Indian states, were included in the research investigation. They are between the ages of 18 and 28yrs.The data were evaluated using an oximeter for oxygen saturation analysis, vital capacity by dry spirometer, and fat % and BMI by Omron body composition monitor. These data were collected from the Indian national swimming and cycling competitions in Bangalore in 2021 and Senior National in Mumbai 2021 India, respectively.The mean and standard deviation among swimmers and cyclists were determined by performing descriptive statistics and for further analysis an independent T-test employed on the obtained data. The degree of significance was fixed at 0.05 to test the hypothesis. IBM SPSS 20 Version statistical programs for social science were used to perform the statistical analysis. As per the research findings, t-statistics are significant for oxygen saturation, with the exception of BMI, fat percentage, and vital capacity, where the P value is more than 0.05. According to this research study, outcome states that there is a considerable difference in oxygen saturation between swimmers and cyclists, although there is insignificant difference in BMI, fat percentage, and vital capacity between the both sports, it concludes that the swimmers are having a significant difference than cyclist for oxygen saturation except in BMI, vital capacity & fat percentage. Therefore, the null hypothesis is failed to reject in BMI, vital capacity and fat % whereas in regard of oxygen saturation the null hypotheses is failed to accept.

Keywords: swimmers, cyclist, oxygen saturation (SpO2, BMI, fat percentage (fat%), Vital Capacity (V.C.)

INTRODUCTION

Swimming is a racing sport that can be done individually or in a team. While going in the water, one must use their full body. The sport is played in open water, such as a lake or sea, or in pools. With a different kind of distance events in butterfly, backstroke, breaststroke, freestyle, and individual medley, competitive swimming is a very well knowing Olympic sports **(https://en.wikipedia.org/wiki/Swimming_(sport)).** And the most popular type of cycling is road cycling, in which riders travel on paved roads. It covers cycling for fun, competition, commuting, and usefulness. Road bicycles are specifically designed according to the road cycling and possess unique qualities. Road bicycles allow riders to use aerodynamic posture while riding at higher pace because to its lighter frames, thinner tires, and drop handlebars. An intermediate rider can reach up to approximately 29 to 32 km/h on a normal road, and a elite cyclist can reach or ride approximately upto 40 km/h. Since air resistance is having an important role at greater speeds, road bikes with aerodynamic designs have been developed time by time to maximize the rider's energy expenditure in moving the bike forward (**https://en.wikipedia.org/wiki/Road_cycling**). In swimming, pacing in 1500-meter freestyle swimming events is typically represented by a parabolic or U-shaped curve, which shows that swimmers keep a consistent pace during the mid-distance of the race, with the maximum swimming velocity occurring at the start and last laps. Nevertheless, there is insufficient data to ascertain whether the 1500 m race winners choose a different pace from other, less successful swimmers competing in this event only. In way of to ascertain the best pace for winning or earning a medal, a research set out to characterize the pacing tactics used by 1500 m freestyle competitive swimmers in World Championships (long course) from 2003 to 2019 by **(Lara B, Del Coso J., 2021)**. For sports like cycling, a high ventilatory capacity is necessary. It is roughly linearly correlated with minute ventilation (VE) and high maximal aerobic capacity (VO2). Most elite cyclists achieve the respiratory rate (RR) of about 55 breaths/ min. when the cyclists are at their maximal exertion.

Lots of researches have focused that the population involved in high-level sports shall not be suitable for spirometric theoretical values. No benchmarks are there for elite professional cyclists. **(Dauty M et.al, 2021)** authors goal was to use reference equations to establish forecast spirometric values. During the medical evaluation at the starting of the sport season, 135 French Caucasian high-level professional cyclists, ages 18 to 38, had basic anthropometric assessment and spirometry. Theoretical and measured values were contrasted. Anthropometric parameters were used to create predictive equations that explain spirometric parameter fluctuations. High-level cyclists, with the exception of forced vital capacity (FVC), forced expiratory volume (FEV) in 1 sec. (FEV1), and forced expiratory flow (FEF) at 25% of FVC, exhibited spirometric values that were indeed higher than the theoretical values established from a general population. Body height was only a reliable predictor of FVC and FEV1. Body weight and height account for 43.5% of the variation in FVC. The body height alone accounts for 25.8% of the variation in FEV1. Depending on body height and sport specificity, high-level cycling is linked to significant respiratory adaptations, such as prolonged and intense endurance training. These outcomes have prospective use in individual clinical settings for the diagnosis of obstructive illness and the assessment of bronchodilator medication reversibility.

Whereas, Skilled swimmers typically have lung capacities that are above average. Caused by the growth of a big chest and lengthy trunk, the total capacity of lung and vital capacity increases during training in adolescence and, which aids swimmers in maintaining their buoyancy. The runners and swimmer's pulmonary function tests, where two distinct sports groups, were examined and contrasted in the many studies. The author **(Sable M et. al., 2012)** took thirty swimmers who routinely swam two to three kilometers a day were compared to thirty middle distance runners in terms of age, sex, weight and height. The swimmers and runners chosen for the research had been training for the previous three years. Vital Capacity (forced) and Tidal Volume (TV). Swimmers had higher maximum voluntary ventilation (MVV) and expiratory volume (forced) in 1 sec. (FEV1) than runners. Exercise that involves swimming has an effect on lung volume measurements because swimmers' diaphragm and other respiratory muscles must expand to a greater pressure during the respiratory cycle. This can improve the function of these muscles and change the elasticity of the lung, chest wall, or ventilatory muscles. Compared to runners, swimmers have better vital capacity (forced) and other lung functions.

Another author the using a sample of 280 competitive female swimmers, the correlation between body composition and swim performance was assessed. The study come to the result that there is a significant correlation among body height, body mass, residual lung volume (RV), and lean body mass (LBM), but it is an inverse correlation to the time recorded for the 100-yard swim. Significant increases in lean body mass (BLM) and it is observed a decreases/ decline in fat mass during the competitive swim season, particularly while the session of hard training. Enhancing muscle size and contractile quality, along with fat mass decline during maintaining an ideal balance, might be a favourable impact on swimming performance and are probably crucial for optimizing competitive swimming performance. Additionally, seasonal variations in muscle mass tend to mirror variations in swim performance, suggesting that maintaining consistent body composition control throughout the season can enhance both training and performance. Author concludes that SmO2 (oxygen saturation) measures could be used in adjoining with other physiological variables to approximate VO2 and energy expenditure values. Additionally, SmO2 measurements could be utilize as a supplemental criterion to distinguish between anaerobic and aerobic workload in athletes. **(Dopsaj M. et.al., 2020)**.

This research is aimed at defining the juxtaposition analysis between swimmers and cyclist based on some specific physiological parameters that how some physiological variables differ the swimmers and cyclists.

PROCEDURE AND METHODOLOGY

Thirty swimmers and thirty cyclists, all national players from various Indian states, were included in the study. They are between the ages of 18 and 28. Every participant was informed of the goal of the study. Prior to taking part in the testing procedures, each individual gave their consent. The physiological parameter which are selected for analysis in this research were BMI, fat percentage, vital capacity, and oxygen saturation. The variables were selected on the basis of their alignment with the expertise and understanding of the researchers, in addition with the feasibility criteria. The data were evaluated using an oximeter for oxygen saturation analysis, vital capacity by dry spirometer, and fat % and BMI by Omron body composition monitor. These data were collected from the Indian national swimming and cycling competitions in Bangalore in 2021 and Senior National in Mumbai 2021 India, respectively. The mean and standard deviation among swimmers and cyclists were determined by performing descriptive statistics and for further analysis an independent T-test employed on the obtained data. The degree of significance was fixed at 0.05 to test the hypothesis. IBM SPSS 20 Version statistical programs for social science were used to perform the statistical analysis. As per the research findings, t-statistics are significant for oxygen saturation, with the exception of BMI, fat percentage, and vital capacity, where the P value is more than 0.05. The standard deviation and mean value are graphically shown in Figures 1 and 2, and the results are shown in Tables 1 and 2.

RESULT AND INTERPRETATION

Table 1- Descriptive Statistics of physiological variables of swimmers and cyclist

Variables	Group	N	Mean	Std. Deviation
BMI	Swimmers	30	20.63	2.61
	Cyclist	30	20.93	1.55
Fat Percentage	Swimmers	30	18.73	4.18
	Cyclist	30	17.60	3.37
Vital Capacity	Swimmers	30	4120.00	749.43
	Cyclist	30	3726.66	834.15
Oxygen Saturation	Swimmers	30	98.70	0.46
	Cyclist	30	98.03	0.71

Table 1 displays the physiological variable mean and standard deviation values for cyclists and swimmers. The mean BMI for swimmers is 20.63±2.61, for cyclists it is 20.93±1.55, and for fat percentage, swimmers' mean score is 18.73±4.18 and cyclists' mean score is 17.60±3.37. Additionally, swimmers' mean vital capacity is 4120±749.43 and cyclists' mean score is 3726.66±834.15, and the mean oxygen saturation for swimmers is 98.70±0.46 and cyclists' mean score is 98.03±0.71, respectively.

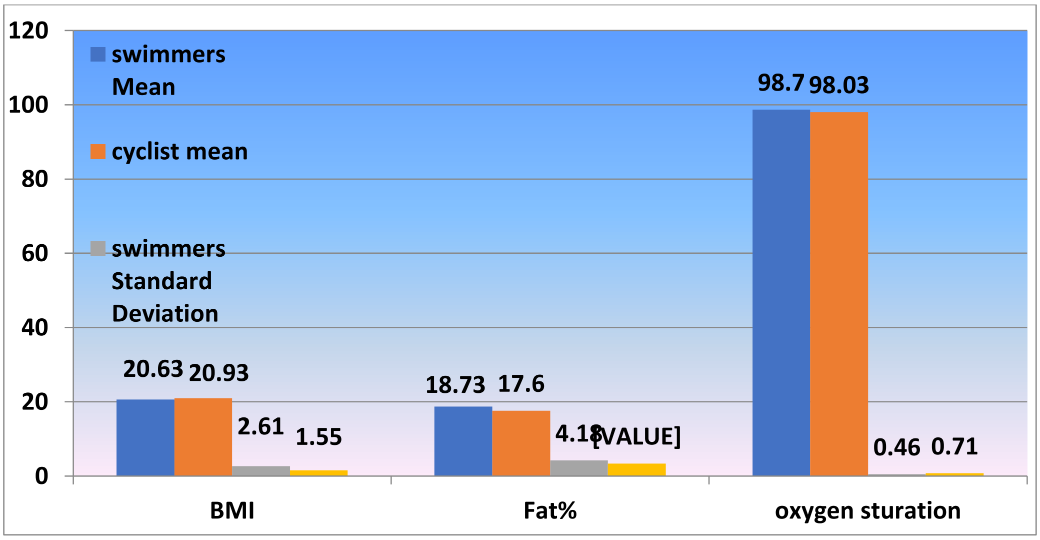

Figure 1- Graphical Representation of Mean and Std. Deviation score for BMI, fat %age and vital capacity of swimmers and cyclist

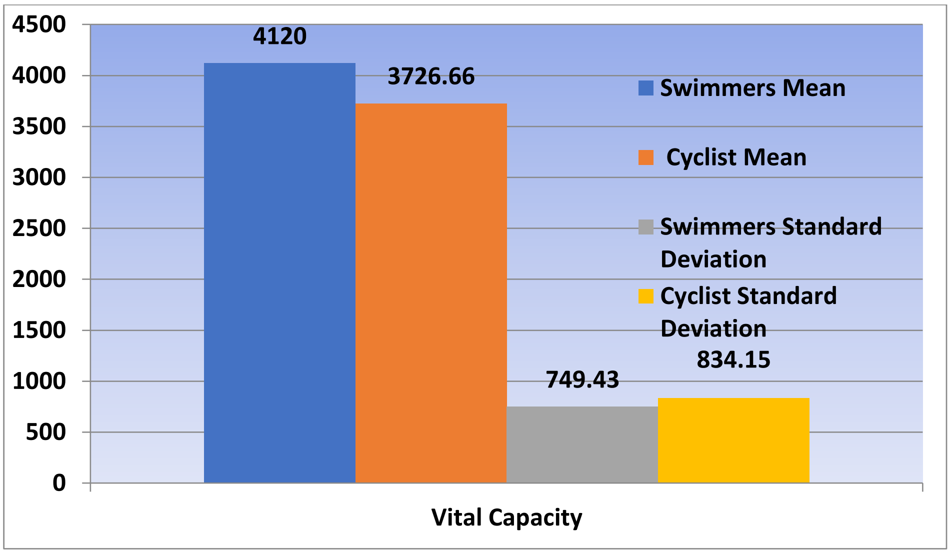

Figure 2- Graphical Representation of vital capacity's Mean score and Std. Deviation of swimmers and cyclist

Table 2- 'T' Test on the data of Swimmers and cyclists

S. No.	Variables	't' Value	Df	Sig.
1.	BMI	-.540	58	.591
2.	Fat Percentage	1.154	58	.253
3.	Vital Capacity	1.921	58	.060
4.	Oxygen Saturation	4.264	58	**.000***

*Significant level at 0.05

Table 2 displays the results of the independent t-test comparing cyclists and swimmers. In the t-statistics the value oxygen saturation is significant except in BMI, vital capacity and fat percentage due to greater value of P which is more than 0.05. Therefore, for BMI, fat percentage, and vital capacity, the null hypothesis of equality of variance may be accepted and This research study recommend that while the variances in BMI, fat percentage, and vital capacity between swimmers and cyclists are identical, there is a significant difference in oxygen saturation (0.000<0.05) among the both groups, indicating that the null hypothesis of equality of variance cannot be accepted.

DISSCUSION AND CONCLUSION

According to this research study, outcome states that there is a considerable difference in oxygen saturation between swimmers and cyclists, although there is insignificant difference in BMI, fat percentage, and vital capacity between the both sports, it concludes that the swimmers are having a significant difference than cyclist for oxygen saturation except in BMI, vital capacity & fat percentage. (**Sable M. et. al., 2012**) the author claims in their research work that swimmers had higher maximum voluntary ventilation (MVV) and expiratory volume (forced) in 1 sec. (FEV1) than runners. Exercise that involves swimming has an impact on volume of lung measurements because swimmers' diaphragm and other respiratory muscles must expand to a greater pressure during the respiratory cycle. This can improve the function of these muscles and change the elasticity of the lung, chest wall, or ventilatory muscles. Compared to runners, swimmers have better vital capacity (forced) with related other lung functions. Same in the current research swimmers shown the higher vital capacity than cyclist. Another author **(Armour J, et. al., 1993)** suggest in their findings that swimmers might have grown physically wider chests with more alveoli rather than larger alveoli, which might have permit them to achieve greater volume of lungs than either runners or the control group. This could have happened regardless of differences in fat-free mass, height, alveolar distensibility, age at training commencement, sternal length, or chest depth. In regard of oxygen saturation **(Wood RJ et.al. 1997)** author came to the conclusion that individual pulse oximeters required to be validated and that the effect of dyshaemoglobins must also be considered after noting the reliability of two pulse oximeters while maximal cycling exertion. Another author **(Vasquez Bonilla AA. et. al., 2022)** conclude that SmO2 readings can be an additional metric to distinguish between an athlete's aerobic effort and anaerobic workload, and that VO2 and energy expenditure values could be measured using SmO2 in combination with additional physiological markers. **(Dauty M et.al., 2021)** claim that High-level cyclists, with the exception of vital capacity (forced) (FVC) and expiratory volume (forced) in a single second (FEV1), and forced expiratory flow (FEF) at 25% of FVC, exhibited spirometric levels that were noticeably greater than the theoretical values established from a general population. Body height was only a reliable predictor of FVC and FEV1. Body weight and height account for 43.5% of the variation in FVC. The body height alone accounts for 25.8% of the variation in FEV1. Depending on body height and sport specificity, high-level cycling is linked to significant respiratory adaptations, such as prolonged and intense endurance training. A study by **(B Roels et.al., 2005)** demonstrates that swimmers have extremely particular training adaptations, especially when differentiate to triathletes, and that the exercise testing modality impacts the VO2MAX result. This could be because of acute physiological reactions influencing maximal cardiac output or oxygen extraction, in addition the specialized training status of the various athletes. Conversely, the VT did not change across the two testing modes in either group, suggesting that the various training regimens had no effect on this measure.

Therefore, we come to the conclusion that the oxygen saturation has a significant variation among swimmers and cyclist where swimmers show higher mean score than cyclist which interpret that swimmer having high oxygen saturation. whereas the BMI, fat % and vital capacity between both sports does not state any notable variation or having least significant difference among each other, Therefore the null hypothesis is failed to reject in BMI, vital capacity and fat % whereas in regard of oxygen saturation the null hypotheses is failed to accept.

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