

RELATIONSHIP BETWEEN ANTHROPOMETRIC VARIABLES AND CYCLING ROAD RACE PERFORMANCE AMONG MALE ROAD CYCLIST Nandakumar M* & Rajinikumar Palaniyappan**

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Abstract:

Purpose: This study examined the association between a few chosen anthropometric characteristics and male cyclist's performance in a 50-kilometer road race.

Methodology: Thirty experienced cyclists (18-28 years old) from clubs and institutions in Tamil Nadu were chosen. Standardised instruments were used to measure height, weight, arm length, and leg length, and a 50-kilometer road race was used to evaluate performance. At a significance level of 0.05, Pearson's product moment correlation was employed.

Result: The findings indicated that performance was significantly positively correlated with height ($r = 0.689$), weight ($r = 0.742$), arm length ($r = 0.709$), and leg length ($r = 0.695$). The anthropometric variables also showed strong inter-correlations. According to these results, cyclists with ideal body proportions perform better in competition and have higher endurance efficiency.

Conclusion: According to the study's findings, anthropometric profiling is useful for identifying talent and improving road cycling training. For a more precise performance prediction, future research should incorporate physiological and skill-related characteristics.

Key Words: Cycling Performance, Anthropometry, Endurance, Cycling Road Race

1. Introduction:

Long distance cycling is considered to be a strenuous physical activity. This activity demands much preparation and training for successful participation in the event. These preparations include streamlining of eating habits, training schedules etc. The ultra endurance event of road race cycling competition can be successfully conducted only if all these components are successfully managed (Konopka, 1989).

Road cycling is one of the most widespread types of cycling, and usually leads young cyclists through the junior category towards a goal that represents a professional level of road cycling. For cycling as an endurance sport, a variety of different anthropometric characteristics, training characteristics, and physiological variables have been identified as important predictors for race performance. In cycling, it was demonstrated that individuals competing in sprint events possess a higher body mass and larger leg circumferences than distance cyclists. However, each form of cycling elicits different physical adaptations on the cyclist's body, and road cycling tends to increase aerobic capacity by increasing the lean body mass in order to produce more power (Zwaard et al., 2019).

Road cyclists are typically characterised by low body mass and body mass index (BMI), low body fat percentage, and a lowered waist to hip ratio, according to prior research on anthropometric variables (Sánchez-Muñoz et al., 2016). Road cycling is an endurance sport where performance is greatly influenced by the power to weight ratio. Height, skeletal muscle mass, body mass, and BMI are typically revealed as influencing aspects in a cyclist's role and performance (Sánchez-Muñoz et al., 2023).

The nature of the various events may have something to do with the notable variations in leg length. Experts in time trial racing use gear ratios that are far higher than those of riders competing in other sports. Thus, it is possible to propose that a longer leg length could provide a mechanical benefit, such as allowing for the employment of a longer crank arm (Foley et al., 1989). The purpose of the study is to find the relationship between the anthropometric variables (height, weight, leg length and arm length) and cycling road race performance.

2. Methodology:

2.1 Selection of Subjects:

The purpose of this study was to analyse the relationship between anthropometric variables and cycling 50-kilometer road race performance among male road race cyclists. To facilitate the study 30 male cyclists were randomly selected from various universities and clubs in Tamil Nadu in the age group from 18 to 28 years with the training experience of above 5 years.

Table 1: Demographic Data

Parameter	Mean	Range	SD
Age	21.3	18-28	2.1
Weight	70.2	58-85	7.8
Height	175.64	165-189	6.4

Training Years	6.5	4-10	2.3
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2.2 Selection of Variables:

The selected variables for this research are:

Table 2: Selection of Variables

S.No	Independent Variables	Dependent Variable
1	Height (cm)	Cycling road race performance
2	Weight (kg)	
3	Leg length (cm)	
4	Arm length (cm)	

The subjects were done with warm ups and certain drills before participating in the test. The purpose of this study is to find the relationship between selected anthropometric variables and cycling road race performance, to collect the necessary data the following variables were measured: Leg length, arm length, weight, height and 50km cycling performance.

2.3 Test Administration:

Table 3: Tools used for data collection

S.No	Variables	Tools
1	Leg Length	Steel Tape
2	Arm Length	Steel Tape
3	Height	Stadiometer
4	Weight	Weighing Scale

Steel tape was used to measure leg length and arm length, stadiometer to measure height and weighing scale to measure body weight. The distance between the radiale, which is situated on the superior border of the head of the radius at the elbow joint, and the acromial, which is the most lateral point on the acromion process of the scapula, was used to calculate arm length. Steel tape was used to take the measurement while the arm was relaxed at the side. To represent the actual length of the upper arm segments, the value was measured in cm (Eston & Reilly, 2009).

Leg length was measure using a steel tape. The subject was asked to stand upright and measurements were made from the Anterior Superior Iliac Supine to the floor. To detect variations in leg length, a difference of more than 10 millimetres was deemed significant (Eston & Reilly, 2009).

To measure height the person was instructed to stand upright with their back, heels, buttocks, and feet all touching the wall to which the stadiometer was fixed. The subject was instructed to inhale deeply, stretch upward, and hold their breath while the headboard was lowered gently to touch the vertex of the head. Height is recorded to the nearest 0.1 centimetre (Eston & Reilly, 2009).

The subject was weighed without shoes and with very little clothing on. To prevent shifting weight, the person should stand erect in the middle of a weighing scale. To the closest 0.1 kilogram, the measurement was taken. It was ensured that the measurement was not taken immediately after meals, as postprandial increases in mass may affect accuracy (Eston & Reilly, 2009).

The timing of the 50 km cycling road race was measured using a standardized procedure to ensure accuracy and reliability. The course distance was pre-measured using GPS mapping software. Each participant began from a standing start after completing a 10-minute standardized warm-up, and timing was initiated using a stopwatch. Finish times were recorded at the 50 km mark. All race times were recorded in minutes (International Cycling Union [UCI], 2021).

The data were normally distributed. The Statistical Package for Social Sciences (SPSS) version 26 was used to perform the statistical calculations. To find the correlation the Pearson's product moment correlation was used to test the significance level. The nature of data of all variables selected for this study was in ratio and the level of significance was set with 0.05 (5 Percentage).

3. Results and Discussions:

The minimum, maximum, mean and standard deviation of selected biomechanical variables of male cyclists were presented in the table 4.

Table 4: Descriptive Statistics of the selected variables

S.No	Variables	N	Min.	Max.	Mean	SD (±)
1	Cycling Road Race Performance (Minutes)	30	77.4	87	81.87	2.60
2	Leg Length (cm)		89	99	93.57	2.84
3	Arm Length (cm)		57	67	61.57	2.84
4	Height (cm)		170	185	176.57	4.16
5	Weight (kg)		61	76	67.70	4.32

Table 5: Inter-Correlation of selected Anthropometric variables and Cycling Road Race Performance

Variables	Cycling Road Race Performance	Leg Length	Arm Length	Height	Weight
Cycling Road Race Performance	1	0.695**	0.709**	0.689**	0.742**
Leg Length		1	0.996**	0.992**	0.975**
Arm Length			1	0.986**	0.972**
Height				1	0.982**

Weight					1
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Table value with df 28 at 0.05 level of significance was 0.361

*Significant at 0.05.

**Significant at 0.01

- It was evident from the table - 5 that the cycling road race performance was positively correlated with leg length ($r = 0.695$, $p < 0.05$), arm length ($r = 0.709$, $p < 0.05$), height ($r = 0.689$, $p < 0.05$) and weight ($r = 0.742$, $p < 0.05$).
- It was evident from the table - 5 that the leg length was positively correlated with arm length ($r = 0.996$, $p < 0.05$), height ($r = 0.992$, $p < 0.05$) and weight ($r = 0.975$, $p < 0.05$).
- It was evident from the table - 5 that the arm length was positively correlated with height ($r = 0.986$, $p < 0.05$) and weight ($r = 0.972$, $p < 0.05$).
- It was evident from the table - 5 that the height was positively correlated with weight ($r = 0.982$, $p < 0.05$).

4. Discussions:

The present study aimed to investigate the relationship between selected anthropometric variables (height, weight, leg length, and arm length) and 50 km cycling road race performance among male cyclists. The findings of the study demonstrated significant positive correlations between all selected anthropometric variables and road race performance. This suggests that body dimensions play an influential role in determining cycling efficiency and competitive outcomes.

The positive correlation between leg length and cycling performance ($r = 0.695$, $p < 0.05$) is in agreement with earlier findings (Foley et al., 1989), which suggested that longer legs may provide a mechanical advantage through the use of longer crank arms and improved leverage. A greater leg length allows cyclists to apply force more effectively during the pedalling cycle, thereby improving mechanical efficiency over long distances.

Arm length showed a significant positive correlation ($r = 0.709$, $p < 0.05$) with performance. Although arm length is not directly involved in power production, it contributes to handling, posture, and aerodynamics during road racing. Cyclists with proportionally longer arms may be able to maintain aerodynamic positions more comfortably, thereby reducing drag and improving overall efficiency. This finding expands on prior research that has highlighted the influence of anthropometric variables beyond lower limb dimensions (Zwaard et al., 2019).

The study also revealed a strong relationship between height and performance ($r = 0.689$, $p < 0.05$). Height is often considered a determinant of stride length and leverage in sports; in cycling, taller cyclists with proportionately long legs can generate higher power outputs. However, this advantage must be balanced with body weight to ensure an optimal power-to-weight ratio (Sánchez-Muñoz et al., 2016).

Interestingly, weight was also strongly correlated ($r = 0.742$, $p < 0.05$) with road race performance. While excess body mass may be detrimental in mountain stages due to increased energy expenditure, an optimal body weight with higher lean muscle mass can be advantageous for producing sustained power in flat or mixed-terrain events. Previous studies (Sánchez-Muñoz et al., 2023) have highlighted that lower body fat percentage, combined with sufficient skeletal muscle mass, is crucial for endurance cyclists. The present findings align with this, emphasizing that weight in the current sample may largely reflect lean mass rather than fat mass.

The strong inter-correlations among the anthropometric variables themselves (e.g., leg length and height, $r = 0.992$; arm length and height, $r = 0.986$) suggest that these variables are not independent but rather part of an integrated anthropometric profile. This interdependence describes the challenge of isolating the effect of a single variable on performance, as body proportions tend to develop proportionally.

Overall, the findings of this study emphasize that anthropometric characteristics are significant predictors of road cycling performance, particularly in endurance events such as the 50 km road race. The results support the hypothesis that body dimensions, when combined with training and physiological adaptations, contribute substantially to competitive outcomes.

5. Conclusion:

The study discovered a substantial relationship between 50 km cycling performance and height, weight, arm length, and leg length. Better endurance efficiency was demonstrated by cyclists with favourable body measurements, underscoring the significance of anthropometric profiling in performance prediction. The future study should include physiological and skill-related characteristics for more accurate prediction models, these findings can help coaches identify talent and optimise training.

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