

Mental Toughness and 100-M Freestyle Performance Among Swimmers: A Quantitative Study of Psychological Strength and Sprint Swimming Time

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ABSTRACT: The research examines mental toughness as a psychological performance factor in 100-m freestyle swimming, with 100-m freestyle swimming as the intended target condition. The intention of the research was to learn whether swimmers with higher mental toughness race faster in a 100-m freestyle. The quantitative correlational design involved a sample of 50 swimmers, who had complete data on mental toughness and 100-m freestyle completion time. Mental toughness was assessed by the Mental Toughness Index (MTI) comprised of eight items rated on a seven-point Likert scale, and the transformed MTI score was reflected in these analyses. Time taken on 100-m freestyle completion was used as a performance-based measure of swimming in seconds. Descriptive statistics, assumption testing, Pearson product-moment correlation, and simple linear regression were used. Results indicated a statistically significant and negative inter-correlation of -0.776 between the transformed MTI score and 100-m freestyle time, $p < .001$, where more mentally resilient swimmers raced faster. Mental toughness was also found to significantly correlate with freestyle performance via regression analysis, explaining as much as 60.2% of the variance in race time ($R^2 = .602$), whereby a one-point difference in the transformed MTI score explained a 0.284-second subtraction of completion time. Mental toughness is related with sprint swimming performances and must be conceived as a natural part of sport-related training preparation. In this way, this study adds to the literature on sports psychology by providing sport-specific evidence around mental toughness in swimming and provides evidence-based recommendations for integrating psychological skills training into swimming programs.

KEYWORDS: Freestyle performance; Mental toughness; Psychological performance; Sprint swimming; Swimmers.

INTRODUCTION

It is widely accepted that swimming performance is defined as the product of combining physical, technical, tactical and psychological aspects. In sprint events such as the 100-m freestyle, performance is a product not only of physiological readiness, and that of proper stroke control as well as stroke efficiency, but also performance of ability to maintain focus, work in and under pressure in the face of competition, maintain emotional and psychological states; and of long-term effort during a short but challenging race. The 100-m freestyle is particularly sensitive to small changes in start reaction, pacing control, underwater transition, stroke rhythm, and finishing consistency. As the race is over in a brief time frame, any psychological disturbance in the process may interfere with performance time. In this regard, the notion of mental toughness has become an important construct of sport psychology as it captures the way athletes may sustain their focus, confidence, determination, and levels of emotional regulation in response to demands and performance pressure through fatigue or competition-induced stress (Driska et al., 2012; Lochbaum et al., 2022).

Academically, mental toughness as a psychological resource that underlies consistent performance among athletes has been receiving increasing interest in the past decade. Mental toughness is argued by Gucciardi (2017) as a burgeoning aspect in sport psychology that needs clearer conceptualization and stronger empirical testing. In modern sporting psychology, the phenomenon of mental toughness is seen as not a single personality trait but a multidimensional psychological capacity; it includes confidence, commitment, control, persistence, attentional regulation, and the ability to respond adaptively to adversity. This conceptual shift is important because it moves mental toughness from being reduced to a stable personal trait to a performance context because it puts mental toughness into the context of performance. The mentally tough athletes, therefore, do not look emotionally strong, they can preserve task-relevant focus, interpret pressure constructively, and maintain effective behavioral responses during training and competition (Jones et al., 2002, 2007; Liew et al., 2019; Madrigal et al., 2013). The impact of mental toughness on sports performance has been empirically confirmed in the increasing literature. Previous reviews/meta-analyses have reported that athletes with elevated mental toughness tend to demonstrate better competitive achievement and stronger performance outcomes across various sports (Cowden, 2017; Hsieh et al., 2024). Psychological mechanisms that are directly associated with sport performance, such as emotional regulation, reduced competitive anxiety, persistence under pressure, and sustained motivation can be associated

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with mental toughness. Demir et al. (2025) posited mental toughness as an important indicator of athletic performance and as a precursor to psychological stability under stress, pressure, and adversity. We conclude these results can suggest that mental toughness forms a psychological base that allows athletes to convert physical and technical training into effective competitive execution (Hufton et al., 2024).

The mental toughness component is imperative in swimming, where swimmers have to perform in an environment that asks for high levels of self-regulation. On the contrary, competitive swimming often involves the athlete in an individual performance context that limits direct in-race tactical communication, unlike many team sports. When the race starts, the swimmer would need to use internal control, pre-learned race strategy, and psychological readiness. The water also presents distinctive challenges: swimmers need to regulate breathing, rhythm, body alignment, pacing, and body movement while being the victim of tension and stress from adjacent competitors. For speed swimmers -- especially for the 100-m freestyle -- the little momentary distraction or pause in working to stay in rhythm during stroke tempo can affect total race time. Consequently, mental toughness may be seen as an important psychological resource for swimmers to maintain composure, focus, and the competitiveness aspect of the race when making swimming efforts (Beattie et al., 2019; Driska et al., 2012).

In this area, recent research involving people swimming likewise speaks to the need for mental toughness. Kesler et al. (2026), in a study of elite swimmers, demonstrated that mental toughness appears as a multidimensional construct in swimmers, which includes persistence, goal commitment, learning from mistakes, openness to coach feedback, and emotional regulation under pressure. The importance of this finding comes from its affirmation that swimming mental toughness is not simply a matter of "being strong" in general but rather a sport-specific capacity to respond effectively to the psychological and relational demands of competitive swimming. Similarly, Girginer et al. (2026) investigated imagery and breathing activities administered to adolescent swimmers with psychological intervention leading to improvements in mental toughness, although performance effects required cautious interpretation due to sample size. These recent research findings, though, suggest mental toughness is increasingly relevant within swimming research; for example, in the case of swim-specific psychological preparation and performance optimization.

Although there is increasing interest in mental toughness, empirical studies directly testing its relationship with objective swimming performance remain relatively limited. A great deal of sport psychology research has been conducted on mental toughness using mixed-sport samples, elite athlete groups, or general competitive contexts. Although these kinds of explorations provide theoretical and empirical foundations, they do not always account for the specific demands of swimming and specifically the sprint freestyle performance assessed by race time. Further, most sport psychology study relies on self-reported performance, perceived achievement, or broad competitive level, while swimming can objectively measure performance through recorded time. This presents the potential to explore mental toughness with a more precise performance indicator.

The current study closes this gap by investigating the association of mental toughness with 100-m freestyle performance by swimmers. Therefore, mental toughness is included in this study as the psychological variable, while swimming performance is measured using 100-m freestyle completion time in seconds. This method is suitable since race time is considered an objective indicator of performance: a lower time reflects better performance. It is a unique contribution that this study adds to the sport psychology literature by examining the relationship between mental toughness and 100-m

freestyle time. The first is to provide evidence on a domain-specific swimming context, rather than the common use of a mixed-sport generalization. Secondly, it also looks at mental toughness relative to an objective performance outcome and, in this way, increases the practical importance of this study results to coaches, athletes, and sport psychologists.

According to theoretical and empirical studies, swimmers with higher mental toughness will demonstrate faster 100-m freestyle performance. More mental toughness may prepare swimmers to be confident before competition, regulate pressure during the race, sustain effort despite fatigue, and remain focused until the finish. Accordingly, this study seeks to find out if mental toughness will have a positive correlation with 100-m freestyle performance among swimmers. The study also aims to ascertain the predictive impact of mental toughness on swim performance and acknowledges that it does not allow causal interpretation as the correlational design is not applicable. The results can be used to provide evidence-based research on the psychological side of performance and support the integration of mental toughness training in swimming preparation programs (Connaughton et al., 2010; Stamatis et al., 2020).

2. METHOD

2.1 Research Design

The study employed a quantitative correlational design to evaluate the relationship between mental toughness and 100-m freestyle performance among swimmers. We opted for this design as the study did not intend to manipulate variables or test an experimental intervention but sought to examine whether variation in the swimmers' mental toughness scores was statistically associated with variation in their sprint swimming performance. Mental toughness was deemed as the psychological predictor variable whilst 100-m freestyle time was used as the objective performance outcome. Since swimming performance was assessed in seconds, numbers indicating lower time values suggested better performance. Thus, the relationship needed interpretation: a negative association

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would suggest that greater mental toughness was associated with faster performance. Such a correlational design was suitable for providing empirical evidence on the psychological aspect of sprint swimming performance, but was also not able to make causal claims which would not be supported by the research design.

2.2 Participants

The participants were 50 swimmers, with complete data being available in the research dataset. All participants had a valid mental toughness score and a recorded 100-m freestyle time in seconds. The inclusion criterion was that two of the core variables, mental toughness and 100-m freestyle performance, must have complete data. Swimmers with missing or incomplete data on one of the two variables were excluded. The sample was said to have been a group appropriate for performing the Pearson product-moment correlation and simple linear regression, as the study was the association between one psychological predictor and one objective performance outcome. In the present study, although the dataset included other variables, the analysis was not conducted since the aim was specifically restricted to mental toughness and swimming performance as the only object of attention of the research project. This choice was made to preserve the conceptual rigour and focus on the extent to which psychological strength is associated with sprint freestyle performance among swimmers.

2.3 Variables and Measures

Thus, two core factors in this study were studied. Mental toughness was the predictor variable represented by the mental toughness score from the dataset. Mental toughness is the psychological capacity in which a swimmer can maintain confidence, concentration, persistence, and emotional control in sports-associated stress and performance pressure. The dependent variable was 100-m freestyle performance, represented by completion time (s). The 100-m freestyle was chosen as it offers a true-to-life measure of performance in sprint swimming. Recorded time allows performance to be evaluated objectively and homogeneously across participants, in contrast to self-reported performance measures. Since the variable that was assessed as an outcome was time, a lower score was better performance. A negative relationship with the 100-m freestyle time would consequently suggest greater mental toughness would mean swimmers were more likely to produce faster time-pieces for performance when interpreting our statistical model.

2.4 Mental Toughness Measurement

Mental Toughness was assessed on the basis of the Mental Toughness Index (MTI; Gucciardi et al., 2015). The MTI is an 8-item scale used to measure mental toughness as a unidimensional psychological construct. The participants answered each item using a seven-point Likert scale from 1 (False, 100% of the time) to 7 (True, 100% of the time). Higher scores indicate stronger mental toughness. The study used the MTI-derived mental toughness score as a continuous variable to highlight individual differences among swimmers. This enabled the analysis to estimate the magnitude and direction of the association between mental toughness and 100-m freestyle performance. Because the research was aimed to examine the role of psychological strength under objective race time, swimmers were not grouped into low, moderate, or high mental toughness categories. Instead, the MTI score (total or transformed) was used as the predictor variable. Table 1 presents the role, operational definition, measurement, and interpretation of each variable used in the study.

Table 1. Operational Definition and Measurement of Variables

Variable	Role in the Study	Operational Definition	Measurement	Interpretation
Mental Toughness	Predictor variable	The psychological capacity of swimmers to maintain confidence, focus, persistence, and emotional control in sport-related situations	Mental Toughness Index (MTI) developed by Gucciardi et al.; eight items rated on a seven-point Likert scale. The present study analyzed the MTI-derived transformed score available in the dataset	Higher transformed MTI scores indicate stronger mental toughness
100-m Freestyle Performance	Outcome variable	The swimmer's performance in completing the 100-m freestyle event	Recorded 100-m freestyle completion time in seconds	Lower time indicates better swimming performance

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In Table 1, there were two main variables in the research, mental toughness as predictor variable and 100m freestyle performance as outcome variable. This operation design made sure that the analysis was consistent to see if greater mental toughness was related to a faster sprint swimming performance.

2.5 Swimming Performance Measurement

Swimming performance, expressed by the pool swimmer's 100m freestyle completion time in seconds, was assessed in this study. We used the 100m freestyle event as performance indicator as it is a sprint swimming task that demands speed, technical effectiveness, pace control, and psychological readiness. In competitive swimming, race time is a direct and objective measure of performance and lends itself well to the examination of psychological characteristics and athletic outcomes. A brief completion time suggested faster performance. And so the interpretation of the regression and correlation results differed from variables in which higher scores were associated with better outcomes. A negative coefficient indicates better performance, which suggests higher mental toughness was related to lower and therefore quicker, 100-m freestyle time. Because it was objective, measurable and directly related to swimming performance, the use of recorded time strengthened the methodological rigor of the study.

2.6 Data Collection Procedure

The data were collected from swimmers completing a mental toughness evaluation and having their 100-m freestyle performance recorded. The mental toughness score was the psychological variable, and the 100-m freestyle time in seconds served as the performance variable. The dataset was pre-screened for completeness and accuracy before statistical analysis. The validity of both variables was checked for every case. Cases with missing values for mental toughness score or 100-m freestyle time were excluded. We also cleaned the dataset for potential input errors and extreme values that could affect the statistical results. We considered that there were variables available in the dataset, which were intentionally omitted from the present analysis as the aim of the study was to provide a focused investigation of the relationship between mental toughness and sprint swimming performance. The method ensured the consistency of the research aim, variables, and analytical approach.

2.7 Data Analysis

Descriptive and inferential statistics were obtained under analyzing data. Descriptive statistics were employed in summing up the characteristics of the two major variables, including mean, standard deviation, minimum, and maximum values. Statistical assumptions were analyzed before inferential analysis. Normality was tested to assess the appropriateness of individual items for parametric analysis, while linearity was examined to determine whether the association between mental toughness and 100m freestyle time was a fit model for correlation and regression. The correlation was computed using the Pearson product-moment correlation to test for strength and direction of the relationship between mental toughness and swimming performance. Then, simple linear regression was done to see the predicted contribution of mental toughness to 100-m freestyle time. Mental toughness was entered as the predictor variable, and 100-m freestyle time as the outcome variable. Statistical significance was evaluated at $p < .05$. Because this study uses a correlational design the results were taken as associations rather than causation. The analytical stages, statistical calculations, and purposes of each procedure are described in Table 2.

Table 2. Data Analysis Strategy

Analysis Stage	Statistical Technique	Purpose
Data screening	Missing value and data accuracy checking	To ensure that only complete and valid data were analyzed
Descriptive analysis	Mean, standard deviation, minimum, maximum	To describe mental toughness scores and 100-m freestyle times
Assumption testing	Normality and linearity tests	To determine the suitability of parametric analysis
Relationship testing	Pearson product-moment correlation	To examine the strength and direction of the association between mental toughness and 100-m freestyle time
Predictive analysis	Simple linear regression	To determine the predictive contribution of mental toughness to 100-m freestyle performance

As presented in Table 2, each analytical procedure was selected to match the correlational nature of the study. The use of Pearson correlation and simple linear regression allowed the study to examine both the degree of association and the predictive relevance of mental toughness in relation to 100-m freestyle performance. Since the design was non-experimental, the findings were interpreted as statistical associations rather than causal effects.

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2.8 Ethical Considerations

This study was designed to be done responsibly with athlete-related information. Data were analyzed for research purposes, and reported in aggregate, ensuring the anonymity of individual swimmers. No names or identifying information were included in the analysis or presentation of the results. Individual mental toughness scores and swimming times were not presented separately, although the analysis was performed in order to examine the overall statistical relationship between psychological strength and performance. Our interpretation of the findings was also cautious to avoid labelling swimmers based on their psychological scores. Mental toughness was conceptualized as a performance-related psychological construct rather than as a judgment of individual character or ability. If formal ethical approval and informed consent were obtained, the approval number, institution, and consent procedure should be inserted. The study adhered to confidentiality, responsible data handling, and respectful reporting of athlete performance data overall.

3. FINDINGS

3.1 Data Screening and Preliminary Analysis

Prior to the main statistical analysis, the dataset was pre-screened to ensure that all of the cases were appropriate for analytical work. This dataset consisted of 50 swimmers ($N = 50$) and contained full data for the following two variables, mental toughness score and 100-m freestyle time. These variables have no missing values and thus, all 50 cases were retained for analysis. In line with the objectives of the study, the study analyzed only mental toughness and 100-m freestyle performance. Other variables included in the dataset were excluded in this study to maintain the conceptual focus. Initial preprocessing in addition suggested the data were appropriately aligned with correlation and regression analysis. The time to 100-m freestyle was treated as a measure of objective performance: a smaller time indicated better performance. Prior to the primary examination, the dataset was screened to ensure completeness and applicability. The two main study variables are screened, mental toughness score and 100-m freestyle time, table below.

Table 3. Data Screening Summary

Screening Components	Result
Initial number of swimmers	50
Missing values in mental toughness score	0
Missing values in 100-m freestyle time	0
Cases excluded	0
Final cases analyzed	50

Table 3 indicates that all 50 swimmers had full data for both variables. No excluded cases, meaning the whole dataset was retained for further statistical analyses.

3.2 Descriptive Statistics

Descriptive statistics were reported to summarize the transformed MTI scores and 100-m freestyle performance times at this point. Mean transformed MTI score among the swimmers was 64.32 ($SD = 10.90$) (between 41 and 87; indicating considerable variability in mental toughness). The average time of 100-m freestyle was 69.47 s ($SD = 3.99$), with recorded times of 62.35 to 76.63 seconds. These findings showed that the swimmers really did differ widely in psychological strength and sprint swimming performance. Descriptive statistics were used to obtain descriptive information on the mental toughness scores and 100-m freestyle performance times based on their following table.

Table 4. Descriptive Statistics of Mental Toughness and 100-m Freestyle Performance

Variable	N	Mean	SD	Minimum	Maximum
Mental Toughness Score	50	64.32	10.90	41.00	87.00
100-m Freestyle Time (sec)	50	69.47	3.99	62.35	76.63

Table 4 indicates that the swimmers differed in mental toughness as well as swimming prowess. Scores mean diversity in the dataset. We can then go for investigation when the relationship is between those two variables.

3.3 Assumption Testing

Assumption testing was carried out prior to the performance of Pearson correlation and simple linear regression models. The Shapiro–Wilk test indicated the mental toughness score was normally distributed, $W = .987$, $p = .849$. It will be noted the same can

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apply to the 100-m freestyle, where it is also normally distributed, $W = .967$, $p = .172$. Also, the residuals of the regression were normally distributed, $W = .983$, $p = .666$. This scatterplot showed a clear negative linear pattern between mental toughness and 100-m freestyle time. There were no extreme standardized residuals above ± 3.00 , and the maximum absolute standardized residual was 2.31. The findings here confirmed that the data satisfied the essential assumptions of parametric correlation and regression analysis. Prior to performing Pearson correlation and simple linear regression, assumption testing was performed to evaluate the suitability of the data for parametric analysis as shown in the following table.

Table 5. Assumption Testing Results

Assumption	Test/Indicator	Result	Interpretation
Normality of mental toughness	Shapiro–Wilk	$W = .987$, $p = .849$	Normal
Normality of 100-m freestyle time	Shapiro–Wilk	$W = .967$, $p = .172$	Normal
Normality of residuals	Shapiro–Wilk	$W = .983$, $p = .666$	Normal
Extreme residuals	Standardized residuals	Max.	Z
Linearity	Scatterplot inspection	Negative linear pattern	Assumption supported

Table 5 confirms the normality and the residual assumptions. We found Pearson correlation and simple linear regression for the underlying analysis, supported in the inspection of linearity.

3.4 Correlation between Mental Toughness and 100-m Freestyle Performance

To check for the relationship between mental toughness and 100-m freestyle performance, the Pearson product-moment correlation was performed. The correlation of 100-m freestyle time and mental toughness is strongly negative ($r = -.776$, $p < .001$); hence the result. Swimmers high in mental toughness would be faster to complete a 100-m stroke—by judging that, the form of our performance measure can be put in the opposite direction of its relationship. Time taken to complete swimming is related to how you perform—lower is better performance. So, there is a negative correlation, therefore we can say there is a favorable trend in the direction of the behavioral pattern, with mental toughness corresponding to lower (and therefore faster) 100-m freestyle time. Pearson product-moment correlation was therefore performed to explore the strength and direction of this relationship on 100-m freestyle time which is presented in the table below.

Table 6. Pearson Correlation between Mental Toughness and 100-m Freestyle Time

Variables	R	p-value	Interpretation
Mental Toughness Score and 100-m Freestyle Time	-.776	< .001	Strong negative association

Table 6 suggests such a striking negative association between psychological toughness and 100-m freestyle time. Given that the shorter time the better performed, this may indicate that swimmers who have greater mental toughness had faster race time.

3.5 Regression Analysis

Simple linear regression analysis was used to examine the predictive relevance of mental toughness on 100-m freestyle performance. Result The regression analysis was significant $F(1, 48) = 72.65$, $p < .001$. Mental toughness explained 60.2% of the variability in 100-m freestyle time, $R^2 = .602$, with an adjusted R^2 of .594. The regression coefficient shows that mental toughness is also a significant predictor of 100m freestyle time; $B = -.284$, $SE = .033$; $\beta = -.776$; $t = -8.52$; $p < .001$, which means that for each unit increase in psychological toughness 100-m freestyle time would go down by 0.284 seconds, with negative coefficients. Special attention to psychological toughness was noted too, although swimmers of high mental power had faster times in sprint swims than their counterparts. The Simple Linear Regression was applied to examine whether the mental toughness was a meaningful predictor of performance at 100m freestyle as shown in the below table.

Table 7. Simple Linear Regression Predicting 100-m Freestyle Time from Mental Toughness

Predictor	B	SE	β	T	p
Constant	87.731	2.173	—	40.38	< .001

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Mental Toughness Score	-.284	.033	-.776	-8.52	< .001
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Table 7 shows that mental toughness was a significant negative predictor of 100-m freestyle time. This indicates that increases in mental toughness scores were associated with shorter completion time. Moreover, we analysed the model summary in order to find the percentage of variance of 100-m freestyle time related with mental toughness in the subsequent table.

Table 8. Model Summary

R	R ²	Adjusted R ²	F	df	P
.776	.602	.594	72.65	1, 48	< .001

Table 8 further shows that mental toughness accounted for a substantial proportion of the variance in 100-m freestyle time. The implication of this finding is that mental toughness has meaningful predictive relevance for sprint swimming performance in this study cohort. The regression equation was: 100-m Freestyle Time = 87.731 – 0.284 × Mental Toughness Score. Given this equation, we can conclude that higher mental toughness scores were associated with faster 100-m freestyle. Since the study utilized a correlational design, the inferences must be taken as statistical association rather than a causal effect.

3.6 Visual Representation of the Relationship

Visualisation and the negative relationship between mental toughness and 100-m freestyle time was noticeable from the scatterplot. The spread of points declined and mental toughness scores suggested swimmers were completing faster. As a lower time value reflects better swimming performance, it is in line with the statistical observation that greater levels of mental toughness are strongly associated with faster 100-m freestyle performance. Then in order to show correlation and regression results, a scatterplot was created for visualization of the relation between mental toughness and 100-m freestyle time.

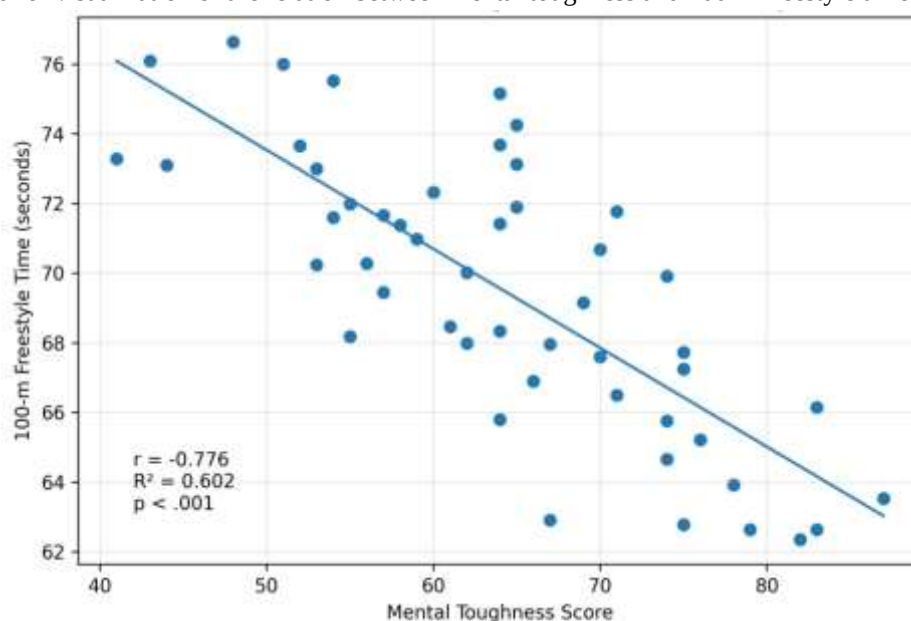


Figure 1. Scatterplot of Mental Toughness and 100-m Freestyle Time

As shown in Figure 1, the scatterplot displays a downward linear pattern between mental toughness and 100-m freestyle time. This visual pattern supports the statistical results, indicating that swimmers with higher mental toughness scores tended to record faster completion times.

4. DISCUSSION

This study investigated whether mental toughness was associated with 100-m freestyle performance in swimmers or not. The results clearly advance the key hypothesis that swimmers with higher mental toughness did perform faster 100-m freestyle runs. Rather than treating mental toughness as a peripheral psychological attribute, it appears to act as a potentially relevant performance-related resource. Given the performance in the present study was gauged by the completion time, the negative relationship between mental toughness and race time is thus a good one. In other words, swimmers reporting higher psychological capacity were more likely to take shorter times, suggesting higher performance. A preliminary important consequence of this conclusion was how psychological strength may be pivotal in a sport dominated by physiological and technical criteria. Swimming performance is defined by strength,

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endurance, stroke mechanics, start efficiency, turn execution, and pacing. These matters remain a factor. However, these results suggest that psychological readiness is associated with subsequent performance, notably in the 100-m freestyle race as it is brief, intense, and unforgiving of hesitation. The swimmer might be the fittest and most prepared person in the body, but whether the preparation takes off in a race largely depends on how we remain calm under pressure, focused, and committed.

The hypothesis was then confirmed; however, the significance of this certainty needs to be understood cautiously. There are no results showing a stronger mental state leading to faster swimming performance. The correlational nature of the design does not permit such a conclusion. What these things do tell are that mental toughness as well as performance time are closely matched in this sample. This alignment may be a valuable theoretical observation since mental toughness is widely recognised as a constellation of psychological abilities to assist athletes maintain their confidence, persistence, emotional stability and focus on task under the most stressful conditions. In a 100-m freestyle race, these capacities are not theoretical: they may be expressed in performance tasks, which may include controlling stroke rhythm, responding coolly to fatigue, sustaining effort after a turn, and finishing aggressively despite the pressure from competition.

Theoretically, the results are discussed through the perspective of mental toughness as a self-regulatory performance resource. Gucciardi (2017) emphasized that mental toughness should not be characterized as a static and stable personality characteristic; instead, it's a dynamic psychological capacity that is activated in demanding achievement contexts. This perspective is especially crucial for swimming because there is very little chance, once the competition starts, the athlete could be corrected from the outside. And following the beginning, swimmers need to depend on those internalized routines, attentional control, emotional regulation, and confidence in execution. Mental toughness may in this way help athletes regulate the psychological disruptions that commonly emerge in competition, such as excessive arousal, doubt, distraction, or discomfort (Gucciardi et al., 2015, 2017).

The 4Cs model of mental toughness, including control, commitment, challenge, and confidence, works brilliantly here as an explanatory lens as well. Control can assist swimmers in processing their own emotions prior to and during the race. There is always some kind of commitment that is working for you, and that's what can motivate you to keep going from start to finish. Challenge may be enabling some competitors to view competitive pressure more as an opportunity than a threat. Confidence could increase faith in the race strategy and technical execution. That's why sprint swimming race times are so crucial, since the rhythm of performance starts breaking down. The findings are therefore empirical and consistent with a plausible psychological mechanism by which mental toughness might enhance performance execution (Connaughton et al., 2010; Jones et al., 2007).

The findings do also support Cowden's (2017), who found that mentally tougher athletes tend to present with higher levels of achievement and performance in sport. Instead, the current investigation contributes more closely to such research through its focus on swimmers and application of an objective performance measure. The wider literature pertaining to mental toughness has usually been based on mixed-sport samples, competitive level, coach assessments, or self-reported performance. These approaches are useful but can also confound how mental toughness correlates with one performance task. In contrast, 100-m freestyle time is a direct and precise measure of performance. This lends the present study an empirical merit because it links mental toughness and an observable outcome directly rather than some general perception of success.

Results are also consistent with evidence specific to swimming. Kesler et al. (2026), focusing on elite swimmers, found that mental toughness in swimming is perceived as multidimensional, involving persistence, goal commitment, openness to feedback, learning from mistakes, and emotional regulation under pressure. The current study extends that qualitative observation to show that mental toughness is meaningful to swimmers' perceptions, as well as statistically related to objective performance time. Similarly, Girginer et al. (2026) found that imagery and breathing exercises could improve mental toughness and swimming-related outcomes among adolescent swimmers. Although their study employed an intervention design and ours a correlational design, both studies share a more general conclusion: psychological preparation is important when it comes to swimming.

Such findings, nonetheless, should not be construed as meaning, and the findings should not be interpreted as showing that mental toughness is the only or predominant driver of performance in all swimming contexts. Performance of swimming is by nature multidimensional. Technical efficiency, physiological capacity, training load, recovery status, anthropometric characteristics, and competitive experience could influence race performance. The strong association found in this work implies that mental toughness is strongly associated with performance, but also that better-performing swimmers acquire stronger psychological confidence through repeated training and competitive success. In other words, it could be a twofold effect, mental toughness may facilitate performance, and successful performance experiences may reinforce mental toughness.

This reciprocal interpretation is crucial, because it avoids a reductionist interpretation of findings. Instead of suggesting that mental toughness itself can equal greater speediness, it would be more realistic to treat mental toughness as part of a performance program. Psychological strength, in turn, interacts with physical preparation, technical mastery and competitive exposure as part of this system. Swimmers that train consistently, receive good coaching and accumulate successful race experiences may gradually develop more confidence and better emotional control. Swimmers who have a high sense of mental toughness, on the other hand, may be better able to tolerate intense training, respond constructively to errors, and keep on going even when times get tough in preparation

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periods. The current research is valuable because it shows a close relationship of this psychological dimension with the effectiveness of athletes' work and does not need to be ignored; it cannot be ignored.

The practical implications are obvious. Mental toughness should be viewed by coaches as an important aspect of swimmer growth rather than as an informal trait that swimmers are expected to possess naturally (Stamatis et al., 2020; Toth et al., 2020). Psychological preparation can be included in training by such tools as goal setting, pre-race routines, imagery, self-talk, breathing regulation, pressure simulation, and debriefing after a race. Meggs and Chen (2019) confirmed that training of psychological skills, including self-talk and goal setting, enhanced competitive performance of youth swimmers. This indication suggests that psychological abilities are trainable and may be added to physical and technical training (Reinebo et al., 2024; Simonsmeier et al., 2021; Wang et al., 2025; Wang et al., 2023). These tactics may be handy for sprint swimmers as they allow swimmers to focus on rapid execution, emotional control, and sustained intensity over a short duration (Jeong et al., 2023).

To sport psychologists, the findings indicate that mental toughness assessment may assist in the identification of athletes who need some kind of specialized psychological support. But that assessment should be approached developmentally, not judgmentally. Labelling swimmers as mentally "weak" or "strong" can be counterproductive and may oversimplify complex athlete experiences. A more constructive one may have you use mental toughness scores as one source of information for designing individualized support. For instance, swimmers who lack confidence might be supported by masterybased goal setting, yet swimmers who face challenges in focusing well under pressure might benefit from attentional control routines. In this way, the findings can inform athlete-centred coaching and evidence-based psychological support (Gucciardi et al., 2017).

Theoretically, there are two main contributions to the literature that this research makes. It does so in two main ways; first, by further enhancing the interpretation of mental toughness as a performancerelevant psychological resource in sport. Second, it extends mental toughness research into a swimming-specific context using an objective measure of sprint performance. When the variables are tested on very specific performance tasks, psychological constructs usually have significant explanatory value. In analysing that 100-m freestyle time frame, the study demonstrates how mental toughness can be meaningfully associated with a particular competitive outcome rather than general athletic success. A few limitations should be raised. The correlational design first prevents causal inference. Even with stronger mental toughness being associated with faster performance, the research can't establish whether mental toughness leads to better performance, whether the swimmers who actually become good swimmers develop stronger mental toughness, or whether both are influenced by other sources. Second, the sample size was relatively limited, which may inhibit generalization to larger swimmer populations. Third, the research was limited to 100-m freestyle, so one is concerned with swimming speed in longer distances, other strokes, relay contexts, and open-water swimming. Fourth, the study didn't account for potentially confounding variables, such as age, sex, training history, competitive level, physical fitness, and technical efficiency. Fifth, the analysis used the available mental toughness score, and a more detailed description of the instrument's dimensions and psychometric characteristics would improve methodological transparency.

In future research, this study must be extended in several directions, we further suggest. Research studies that find mental toughness to predict improved performance need longitudinal designs.

Experimental studies can examine whether or not structured mental toughness interventions improve swimmers' race performance. Additional research will also compare contrasting types of swimming events to determine if mental toughness is more important during sprint events than endurance events. It would also be interesting to see whether the relationship between mental toughness and performance is moderated by age, sex, level of competition, or training experience, in larger, more heterogeneous sample studies. Integrated models combining psychological, physiological, and technical aspects could be developed in the future to present a more complete perspective on swimming performance (Reinebo et al., 2024; Simonsmeier et al., 2021; Stamatis et al., 2020; Wang et al., 2025; Wang et al., 2023). Therefore, this study demonstrates that mental toughness is strongly associated with 100-m freestyle performance among swimmers. The results indicate that psychological strength is more than an adjunct to athletic development and may be closely connected to objective sprinting performance. Physical adaptation and skills are key in this course, however, being focused, confident, persistent, and emotionally controlled seem highly relevant in a competition as quick and pressure-sensitive as the 100m freestyle. This study supports evidence by providing swimming-specific evidence, and thus is also indicative for the integration of mental toughness development into swimmer preparation programs and further enhances the overall picture of athletic performance.

5. CONCLUSION

In this analysis, we focused on the relationship between mental toughness and 100-m freestyle performance among swimmers. In particular, it aimed at determining whether mental toughness is significantly associated with sprint swimming performance as measured objectively by race time. The results indicate that mental toughness is significantly correlated with 100-m freestyle performance. Swimmers with higher levels of mental toughness tended to finish faster, confirming the first hypothesis of the study that psychological strength is meaningfully correlated with swimmer performance. The negative orientation of the relationship is important; the result of using seconds for performance measurement is that lower time values represent better performance. The

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regression evidence also clearly demonstrates that mental toughness provided a significant predictive factor on 100-m freestyle time, indicating that the psychological strength of swimmers is strongly associated with their capacity to perform effectively in the sprint event. These findings support the conclusion that mental toughness isn't simply a psychological trait, but rather a valuable performance tool for competitive swimming. This is important for sport psychology theory as this work generalized evidence for mental toughness to a swimming-specific context including an objective performance indicator. At a more practical level, the results suggest that psychological preparation can be integrated into swimmer development programmes. Mental toughness as part of swimming professionals' workout and technical training should be added as an additional factor into physical conditioning and technical classes that coaches, sport psychologists, and swimmers can incorporate with regular meetings. Specific training strategies might be structured goal setting, pre-competition preparation, imagery, self-talk, regulation of breathing, pressure simulation, and reflective evaluation of performance. They're all strategies that swimmers can use in order to stay focused, confident, dedicated, and with some control over their emotions.

Additional research in the future could add more sample size and characteristics (swimmers from different age groups and the different races including different competitive level swimmers and swimmers from stroke & distance. Longitudinal and experimental testing was also suggested to evaluate the long run effects of mental toughness training on swimming performance. In addition, studies that are performed in the future may involve physical, technical and demographic components, to build a larger-based model based on swimming performance.

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