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PREDICTORS OF MENTAL TOUGHNESS IN PARALYMPIC ATHLETES: THE ROLE OF AUTONOMOUS AND CONTROLLED MOTIVATION AND COMPETITIVE ORIENTATION

In contemporary contexts, Paralympic sport is regarded as a significant environment for the development of psychological resources that support athletes' effectiveness and resilience under heightened demands and multiple stressors. In this regard, mental toughness is of particular importance as an integrative characteristic reflecting the ability to maintain goal-directed activity, control, and performance under pressure. The aim of the study is to identify the contribution of autonomous and controlled motivation, as well as competitive orientation parameters, to explaining variability in mental toughness among Paralympic and Deaflympic athletes. The scientific significance of the study lies in the fact that its findings expand current understanding of the predictors of mental toughness among Paralympic and Deaflympic athletes and clarify the role of motivational and competitive factors in the mechanisms underlying its development. The study methodology included the Mental Toughness Scale (MTS), the Sport Motivation Scale (SMS), and the Sport Orientation Questionnaire (SOQ). Multiple linear regression analysis was used to statistically analyze the empirical data and determine the contribution of the examined predictors to explaining variability in the dependent variable. The findings indicate that competitiveness and autonomous motivation make the greatest contribution to explaining mental toughness. In contrast, controlled motivation and length of sporting experience did not demonstrate statistically significant effects. The findings also suggest that mental toughness is determined to a greater extent by the qualitative characteristics of motivation and achievement orientation than by the duration of sporting experience. The value of the study lies in expanding the understanding of mental toughness as an integrative psychological resource and clarifying the role of internal motivational mechanisms and competitive orientation in its development. The practical significance of the findings lies in their potential application in developing and improving psychological training programs aimed at fostering athletes' autonomous motivation and constructive competitive orientation.

Keywords: mental toughness, Paralympic sport, autonomous motivation, competitive orientation, sport motivation.

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Паралимпиадалық спортшылардың менталдық беріктігінің предикторлары: автономды және бақыланатын мотивация мен жарысқа бағдарланудың рөлі

Қазіргі жағдайда паралимпиадалық спорт жоғары талаптар мен көптеген стресстік әсерлер жағдайында спортшылар іс-әрекетінің тиімділігі мен тұрақтылығын қамтамасыз ететін психологиялық ресурстарды қалыптастырудың маңызды контексті ретінде қарастырылады. Осыған байланысты қысым жағдайында іс-әрекеттің бағыттылығын, бақылауды және өнімділікті сақтай алу қабілетін сипаттайтын интегративті қасиет ретінде менталдық беріктік ерекше мәнге ие. Зерттеудің мақсаты – паралимпиадалық және сурдлимпиадалық бағыттағы спортшылардың менталдық беріктігінің вариативтілігін түсіндірудегі автономды және бақыланатын мотивацияның, сондай-ақ жарыстық бағыттылық параметрлерінің үлесін анықтау. Зерттеудің ғылыми маңыздылығы алынған нәтижелердің паралимпиадалық және сурдлимпиадалық бағыттағы спортшылардың менталдық беріктігінің предикторлары туралы қазіргі ғылыми түсініктерді кеңейтуімен, сондай-ақ оның қалыптасу механизмдеріндегі мотивациялық және жарыстық факторлардың рөлін нақтылауға мүмкіндік беруімен анықталады. Зерттеу әдіснамасы менталдық беріктік шкаласын (MTS), спорттық мотивация шкаласын (SMS) және жарыстық бағыттылық сауалнамасын (SOQ) қолдануды қамтыды. Эмпирикалық деректерді статистикалық талдау үшін зерттелген пре-

дикторлардың тәуелді айнымалының вариативтілігін түсіндірудегі үлесін анықтауға мүмкіндік беретін көптік сызықтық регрессиялық талдау қолданылды. Зерттеу нәтижелері менталдық беріктікті түсіндіруге жарысқа бағыттылық пен автономды мотивацияның неғұрлым жоғары үлес қосатынын көрсетті. Сонымен қатар бақыланатын мотивация мен спорттық өтіл статистикалық тұрғыдан мәнді ықпал көрсеткен жоқ. Алынған деректер менталдық беріктік деңгейінің спорттық тәжірибенің ұзақтығына қарағанда мотивацияның сапалық сипаттамалары мен жетістікке бағдарланумен көбірек анықталатынын көрсетеді. Зерттеудің құндылығы менталдық беріктік туралы интегративті психологиялық ресурс ретіндегі түсініктерді кеңейтумен және оның қалыптасуындағы ішкі мотивациялық механизмдер мен жарыстық бағыттылықтың рөлін нақтылаумен байланысты. Алынған нәтижелердің практикалық маңыздылығы оларды спортшылардың автономды мотивациясы мен конструктивті жарыстық бағыттылығын дамытуға бағдарланған психологиялық даярлық бағдарламаларын әзірлеу және жетілдіру барысында пайдалану мүмкіндігімен анықталады.

Түйін сөздер: менталдық беріктік, паралимпиадалық спорт, автономды мотивация, жарысқа бағдарлану, спорттық мотивация.

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Предикторы ментальной прочности паралимпийских спортсменов: роль автономной и контролируемой мотивации и соревновательной направленности

Паралимпийский спорт в современных условиях рассматривается как значимый контекст формирования психологических ресурсов, обеспечивающих эффективность и устойчивость деятельности спортсменов в условиях повышенных требований и множественных стрессовых воздействий. В данной связи особое значение приобретает ментальная прочность как интегративная характеристика, отражающая способность сохранять направленность деятельности, контроль и продуктивность в условиях давления. Целью исследования является выявление вклада автономной и контролируемой мотивации, а также параметров соревновательной направленности в объяснение вариативности ментальной прочности у спортсменов паралимпийского и сурдлимпийского направлений. Научная значимость исследования определяется тем, что полученные результаты расширяют современные представления о предикторах ментальной прочности у спортсменов паралимпийского и сурдлимпийского направлений, а также позволяют уточнить роль мотивационных и соревновательных факторов в механизмах её формирования. Методология исследования включала применение шкалы ментальной прочности (MTS), шкалы спортивной мотивации (SMS) и опросника соревновательной направленности (SOQ). Для статистического анализа эмпирических данных был использован множественный линейный регрессионный анализ, позволивший определить вклад исследуемых предикторов в объяснение вариативности зависимой переменной. Результаты исследования свидетельствуют о том, что наибольший вклад в объяснение ментальной прочности вносят соревновательность и автономная мотивация. В то же время контролируемая мотивация и спортивный стаж не продемонстрировали статистически значимого влияния. Полученные данные также указывают на то, что уровень ментальной прочности в большей степени определяется качественными характеристиками мотивации и ориентацией на достижение, чем продолжительностью спортивного опыта. Ценность исследования заключается в расширении представлений о ментальной прочности как интегративном психологическом ресурсе и уточнении роли внутренних мотивационных механизмов и соревновательной направленности в её формировании. Практическое значение полученных результатов заключается в возможности их использования при разработке и совершенствовании программ психологической подготовки, ориентированных на развитие автономной мотивации и конструктивной соревновательной направленности спортсменов.

Ключевые слова: автономная мотивация, ментальная прочность, соревновательная направленность, паралимпийский спорт, спортивная мотивация.

Introduction

At present, Paralympic sport represents not only a domain of physical activity but also an important

means of personal development, social integration, and self-realization for individuals with disabilities. Participation in sport contributes to reducing social stigma and creates additional opportunities for ath-

letes to engage fully in society (Bond et al., 2019). In the Republic of Kazakhstan, the development of Paralympic sport has demonstrated steady positive growth, reflected in the expansion of sporting disciplines, increased participation of athletes in international competitions, and strengthened institutional support.

The increasing competitiveness and continuing professionalization of Paralympic sport have resulted in higher demands on athlete preparation. Consequently, identifying the factors that promote the sustainability and effectiveness of athletic performance, particularly psychological resources, has become an issue of growing importance.

Paralympic athletes are simultaneously exposed to multiple sources of stress, including functional impairments, intensive training demands, the risk of injury, and the need to adapt to social and organizational barriers (Fagher et al., 2016). Accordingly, psychological resources that help maintain resilience and effective performance under conditions of heightened pressure are of particular significance.

Mental toughness is regarded in contemporary sport psychology as one of the fundamental psychological resources that enables athletes to function effectively under conditions of intense stress. This multidimensional construct reflects an individual's capacity to maintain goal-directed behavior, emotional stability, and performance effectiveness when faced with demanding competitive situations (Stamatis et al., 2020). Empirical evidence indicates that higher levels of mental toughness are associated with greater resilience to competitive pressure, enhanced ability to mobilize personal resources, and sustained engagement in the training process (Mojtahedi et al., 2023; Falaahudin et al., 2021). For athletes with disabilities, this psychological resource is particularly important, as it facilitates successful adaptation both to the specific demands of competitive sport and to the broader life challenges associated with disability (Jannah et al., 2024).

Despite growing scholarly interest in mental toughness, the psychological factors underlying its development among Paralympic athletes remain insufficiently understood. Although previous studies have examined the influence of both personal and environmental factors, evidence regarding the predictors of mental toughness in athletes with disabilities remains fragmented, limiting a comprehensive understanding of the mechanisms involved in its development (Powell & Myers, 2017).

One of the most promising directions for future research involves examining the role of sport

motivation and competitive orientation. Previous studies have demonstrated positive associations between sport motivation and components of mental toughness (Zeng & Liu, 2013), while higher levels of mental toughness have been observed among athletes with a stronger achievement-oriented focus (Strümpfer, 2003).

However, the available findings remain inconclusive. Some studies have failed to identify a direct statistically significant relationship between motivation and mental toughness, suggesting that these psychological mechanisms of adaptation may operate relatively independently (Shang & Yang, 2021). Furthermore, evidence indicates that the structure of competitive orientations may play an important role: mental toughness is more consistently associated with achievement orientation, although motivational profiles may differ substantially across athletes (Cowden et al., 2021). These findings suggest that the development of mental toughness may be determined not by individual motivational characteristics alone but rather by their interaction with athletes' competitive orientation.

The review of the existing literature provides a theoretical basis for considering sport motivation and competitive orientation as potential determinants of mental toughness. Nevertheless, the limited number of studies involving Paralympic athletes, together with the inconsistency of existing empirical findings, highlights a significant gap in the literature that warrants further investigation.

Research Object-mental toughness among Paralympic athletes.

Research Subject-autonomous and controlled sport motivation, as well as competitive orientation, as predictors of mental toughness among Paralympic athletes.

Aim of the Study-the aim of this study was to examine the contribution of autonomous and controlled sport motivation, together with dimensions of competitive orientation, to explaining the variance in mental toughness among Paralympic athletes.

Research Questions

1. How are autonomous and controlled sport motivation associated with the level of mental toughness among Paralympic athletes?
2. Is competitive orientation associated with the level of mental toughness among Paralympic athletes?
3. To what extent do autonomous and controlled sport motivation, competitive orientation, and years of sports participation explain the variance in mental toughness among Paralympic athletes?

Literature review

Mental toughness (MT) is widely regarded in sport psychology as a psychological construct associated with an athlete's ability to maintain a high level of functioning under conditions of pressure, uncertainty, and stress. Across different theoretical perspectives, it has been defined either as the capacity to sustain consistent performance despite adverse circumstances (Gucciardi et al., 2015) or as a set of characteristics that facilitate control, confidence, commitment, and effective behavior in competitive settings (Jones et al., 2002; Clough et al., 2002). More recent conceptualizations describe mental toughness as an integrative psychological resource encompassing cognitive, emotional, and behavioral components that support goal-directed functioning under stressors of varying intensity (Stamatis et al., 2020).

Conceptually, mental toughness comprises characteristics such as self-confidence, perseverance, emotional regulation, optimism, and effective stress coping. At the same time, this construct demonstrates considerable conceptual overlap with resilience, hardiness, self-efficacy, and other psychological resources, suggesting that it forms part of a broader system of personal psychological characteristics (Gucciardi et al., 2017).

One of the major challenges in mental toughness research is the absence of consensus regarding its underlying structure. Within multidimensional frameworks, such as the 4C model proposed by Clough et al. (2002), MT is conceptualized as a set of interrelated components comprising control, commitment, challenge, and confidence. However, empirical evidence has demonstrated substantial intercorrelations among these dimensions and limited discriminant validity, providing support for a unidimensional conceptualization of mental toughness (Gucciardi et al., 2015). Consequently, the structural nature of MT remains an open question and continues to represent a central methodological issue within the field. The work of Gucciardi et al. (2015) provides an important theoretical and empirical foundation for subsequent studies aimed at integrating mental toughness with constructs derived from other theoretical perspectives, as well as identifying its antecedents and outcomes.

Despite conceptual differences across theoretical approaches, empirical studies have produced relatively consistent findings regarding the functions of mental toughness. Higher levels of MT have been associated with more stable athletic performance,

effective functioning under competitive pressure, greater capacity to mobilize effort, and sustained attentional focus during stressful situations (Mojtahedi et al., 2023; Pocius & Malinauskas, 2024). Furthermore, mental toughness has been linked to greater engagement in training, more adaptive coping strategies, and lower levels of emotional exhaustion.

Mental toughness is also associated with cognitive appraisal of stressful situations. Athletes with higher levels of MT are more likely to perceive challenging situations as controllable and developmentally meaningful, demonstrate greater self-control, and rely predominantly on adaptive coping strategies (Gucciardi et al., 2017).

Research on the development of mental toughness suggests that it emerges through the interaction between personal characteristics and life experiences. Important contributing factors include previous experiences of overcoming adversity, social support, and environments that simultaneously provide high expectations and appropriate support (Mahoney et al., 2014; Anthony et al., 2016).

Studies involving Paralympic athletes have shown that mental toughness is associated with perseverance, autonomy, positive self-evaluation, and pragmatic coping strategies. In this population, adaptation to chronic stressors—including functional impairments, pain, and social barriers—plays a particularly important role (Fagher et al., 2016). Moreover, mental toughness extends beyond the sporting context, contributing to resilience and independent functioning in everyday life (Powell & Myers, 2017).

Taken together, the available evidence suggests that mental toughness develops through the interaction between personal resources and environmental conditions. Consequently, examining its relationship with motivational characteristics that influence the direction and persistence of athletic behavior represents a particularly important area of investigation.

In sport psychology, motivation is considered a fundamental mechanism underlying the direction, intensity, and persistence of athletic behavior (Clancy et al., 2016). Within the framework of Self-Determination Theory (SDT), motivation is conceptualized as a continuum ranging from autonomous forms, based on intrinsic interest and personal value, to controlled forms, driven by external pressure or anticipated rewards, with amotivation representing the absence of intentional regulation of behavior (Pelletier et al., 2013). Despite their con-

ceptual distinction, motivational regulation in sport typically reflects a combination of multiple regulatory forms rather than a single motivational type. Empirical evidence consistently demonstrates that autonomous motivation is associated with adaptive outcomes, including effective coping, greater confidence, and superior athletic performance, whereas controlled motivation has been linked to athlete burnout, moral disengagement, and an increased risk of injury (Chalabaev et al., 2017). According to Achievement Goal Theory, athletes' behavior is shaped by the way they perceive and evaluate their competence, with mastery orientation being closely associated with more self-determined forms of motivation (Vansteenkiste et al., 2014), although evidence regarding the relationships between motivation and approach versus avoidance achievement goals remains inconsistent (Adie & Jowett, 2010). A person-centered approach allows motivation to be conceptualized as a set of motivational profiles, providing a more comprehensive understanding of its role in athletic performance.

Accumulating evidence indicates a close relationship between motivational characteristics and mental toughness. High intrinsic motivation has been shown to facilitate the development of mental toughness, whereas mental toughness itself is associated with effective functioning under pressure, resilience to stress, and sustained goal-directed behavior (Özsoy, 2023; Kumbar & Patil, 2024). Mental toughness is also related to a broad range of psychological variables, including self-efficacy, perseverance, coping strategies, and achievement goal orientations (Brace et al., 2020; Jones & Parker, 2019). Furthermore, it has been conceptualized as the psychological opposite of burnout, being associated with higher levels of motivation and greater persistence in goal pursuit (Strümpfer, 2003). Several studies have demonstrated positive associations between mental toughness and achievement goal orientation, particularly achievement-oriented goals. However, these relationships appear to be complex. Person-centered research suggests that high levels of mental toughness may be explained not by individual motivational variables alone but by their integration into holistic motivational profiles that incorporate different combinations of approach and avoidance achievement goals (Gucciardi et al., 2017; Cowden et al., 2021).

Overall, the existing literature indicates that mental toughness is a complex and multidimensional psychological construct that facilitates effective functioning under demanding and stressful condi-

tions. Despite a substantial body of empirical evidence, important questions remain regarding its underlying structure and developmental mechanisms.

Current research also suggests that mental toughness is closely associated with motivational characteristics and achievement goal orientations. However, these relationships are not entirely consistent across studies, indicating that they are likely to be complex and nonlinear. Specifically, mental toughness may depend not on individual motivational characteristics in isolation but on their combination within athletes' broader motivational profiles.

At the same time, research examining these relationships among Paralympic athletes remains limited, restricting the generalizability of existing theoretical models to this population. Therefore, further investigation is needed to clarify the contributions of autonomous and controlled motivation, as well as competitive orientation, to the development of mental toughness among Paralympic athletes.

Materials and methods

Data were collected through sports organizations and clubs across the Republic of Kazakhstan. The largest proportion of participants was recruited from the Mergen Sports Club (Kokshetau), along with clubs and sports centers for individuals with disabilities, Specialized Schools of Higher Sports Mastery (SHSM), regional sports training centers, and sports federations, including the Zhiger M Federation of Athletes with Disabilities, the Kazakhstan Para Ice Hockey Federation, and other relevant organizations.

Participants represented a range of cities and regions across Kazakhstan, including Kokshetau, Astana, Taraz, Kaskelen, Stepnogorsk, Shchuchinsk, Atbasar, and the Almaty Region.

The study sample consisted of Paralympic and Deaflympic athletes ($N = 70$) representing various regions of the Republic of Kazakhstan. The sample comprised 52 men and 18 women. The participants' mean age was 31.6 years, and their mean sports experience was 9.4 years.

The athletes represented a variety of sports, with arm wrestling, swimming, para powerlifting, athletics, and para ice hockey being the most common. Less frequently represented disciplines included shooting, boccia, *togyzqumalaq*, chess, wrestling, and team sports.

To assess the key psychological characteristics of the athletes, including mental toughness, moti-

vational regulation, and competitive orientation, a battery of validated psychometric instruments was employed.

Mental toughness was assessed using the Mental Toughness Scale (MTS) developed by Hamill and Gill (2013). The MTS is a brief unidimensional instrument consisting of 11 items designed to assess mental toughness as an integrative psychological resource that supports resilience to stress, confidence, and effective functioning under competitive pressure. The Russian-language adaptation developed by Bocharov, Bondarev, and Dovzhik (2023) was used in the present study.

Motivational regulation was assessed using the Sport Motivation Scale (SMS) developed by Pelletier and Vallerand (1995) within the framework of Self-Determination Theory proposed by Deci and Ryan. The questionnaire comprises 28 items measuring different forms of motivation, including intrinsic motivation (to know, toward accomplishment, and to experience stimulation), as well as extrinsic motivation represented by identified, introjected, and external regulation, in addition to amotivation. The Russian-language adaptation reported by Bocharov et al. (2012, 2023) was used.

Competitive orientation was measured using the Sport Orientation Questionnaire (SOQ) developed by Gill and Deeter (1988). The instrument consists of 25 items designed to assess individual differences in competitive orientation. It includes three subscales: competitiveness, win orientation, and goal orientation (personal mastery orientation). The questionnaire evaluates athletes' preferred approaches to achieving success in sport. The application of the Russian-language version has been described by Bocharov et al. (2023).

To ensure methodological rigor and reduce unnecessary fragmentation of predictor variables, motivation scores were aggregated into broader indices of autonomous motivation and controlled motivation in accordance with the principles of Self-Determination Theory. This approach reflects

the continuum of motivational regulation, whereby intrinsic motivation and identified regulation are conceptualized as forms of autonomous motivation, whereas introjected and external regulation are considered forms of controlled motivation. The use of aggregated motivational indices is well established in contemporary empirical and review studies, in which autonomous motivation is treated as an overarching construct consistently associated with adaptive behavioral and psychological outcomes, in contrast to controlled forms of motivation (Maninen et al., 2022; Ntoumanis, 2021). Furthermore, employing aggregated indices improves the stability of regression models in studies with relatively small sample sizes, reduces the risk of multicollinearity, and enhances the interpretability of the findings without compromising the theoretical integrity of the analysis.

Statistical analyses were performed using JASP (Version 0.95.4). Multiple linear regression analysis was conducted to examine the contribution of motivational and competitive characteristics to mental toughness. Mental toughness served as the dependent variable, whereas autonomous motivation, controlled motivation, competitiveness, and years of sports participation were entered as predictor variables. Prior to the regression analysis, the assumptions of multiple linear regression were evaluated, including assessments of multicollinearity and the independence of residuals.

Results and discussion

To test the proposed hypotheses, a multiple linear regression analysis was conducted to examine the contributions of autonomous motivation, controlled motivation, competitiveness, and years of sports participation to athletes' levels of mental toughness. The results are presented in the following tables, including the Model Summary, Analysis of Variance (ANOVA), Regression Coefficients, and Collinearity Diagnostics.

Table 1
Model Summary – Mental Toughness

Model	R	R ²	Adjusted R ²	R RMSE	R ² Change	df1	df2	p	Durbin-Watson		
									Autocorrelationn	Statistic	p
M ₀	0.000	0.000	0.000	8.489	0.000	0	68		- -0.064	2.110	.646
M ₁	0.873	0.762	0.747	4.268	0.762	4	64	< .001	- -0.047	2.083	.755

Note: M₀ represents the null (intercept-only) model; M₁ includes Years in Sport, Competitiveness, Autonomous Motivation, and Controlled Motivation as predictors of Mental Toughness.

Table 2*Analysis of Variance (ANOVA) Results for the Multiple Linear Regression Model*

Model		Sum of Squares	df	Mean Square	F	p
M ₁	Regression	3735	4	933.68	51.27	< .001
	Residual	1166	64	18.21		
	Total	4900	68			

Note: M₁ represents the multiple linear regression model predicting Mental Toughness from Years in Sport, Competitiveness, Autonomous Motivation, and Controlled Motivation. *df* = degrees of freedom; *F* = ANOVA test statistic; *p* = statistical significance level.

Table 3*Regression Coefficients of the Multiple Linear Regression Model*

Model		Unstandardized	Standard Error	Standardized	t	p
M ₀	(Intercept)	46.768	1.022		45.763	< .001
M ₁	(Intercept)	6.301	3.273		1.925	.059
	Years in Sport	-0.149	0.082	-0.113	-1.824	.073
	Competitiveness	0.533	0.077	0.633	6.894	< .001
	Autonomous Motivation	0.202	0.063	0.336	3.218	.002
	Controlled Motivation	-0.075	0.058	-0.108	-1.310	.195

Note: M₀ represents the null (intercept-only) model; M₁ represents the multiple linear regression model including Years in Sport, Competitiveness, Autonomous Motivation, and Controlled Motivation as predictors of Mental Toughness. Unstandardized coefficients are reported as *B*, and standardized coefficients as β . *SE* = standard error; *t* = Student's *t* statistic; *p* = statistical significance level.

Table 4*Collinearity Diagnostics*

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions				
				Intercept	Years in Sport	Competitiveness	Autonomous Motivation	Controlled Motivation
M ₁	1	4.619	1.000	0.001	0.011	0.001	0.001	0.002
	2	0.319	3.806	0.001	0.831	0.002	0.002	0.011
	3	0.039	10.901	0.169	0.105	0.029	0.002	0.712
	4	0.016	17.153	0.776	0.052	0.143	0.211	0.201
	5	0.008	24.365	0.053	0.001	0.826	0.785	0.074

Note: M₁ represents the multiple linear regression model including Years in Sport, Competitiveness, Autonomous Motivation, and Controlled Motivation as predictors of Mental Toughness. Eigenvalues, condition indices, and variance proportions were examined as collinearity diagnostics. Higher condition index values indicate greater potential for multicollinearity among predictors.

The multiple linear regression analysis demonstrated that the overall model was statistically significant and exhibited substantial explanatory power. As shown in Table 1, the coefficient of determination was $R^2 = .762$ (adjusted $R^2 = .747$), indicating that the predictors included in the model accounted for 76.2% of the variance in mental toughness. This finding suggests a strong fit between the proposed

model and the observed data. Furthermore, the Durbin–Watson statistic ($DW = 2.083$, $p = .755$) indicated no evidence of autocorrelation among the residuals, confirming that the assumptions underlying the regression analysis were satisfied.

The results of the analysis of variance (Table 2) further confirmed the statistical significance of the regression model, $F(4, 64) = 51.27$, $p < .001$. This

finding indicates that the combined effects of autonomous motivation, controlled motivation, competitiveness, and years of sports participation significantly explained variation in athletes' mental toughness.

The regression coefficients (Table 3) provide insight into the relative contribution of each predictor. Competitiveness emerged as the strongest predictor of mental toughness ($\beta = .633$, $B = 0.533$, $p < .001$), indicating a robust positive association whereby higher levels of competitiveness were associated with greater mental toughness. Autonomous motivation also demonstrated a significant positive effect ($\beta = .336$, $B = 0.202$, $p = .002$), suggesting that athletes with higher levels of internally regulated motivation tended to exhibit greater psychological resilience.

Years of sports participation showed a negative association with mental toughness at the level of a statistical trend ($\beta = -.113$, $B = -0.149$, $p = .073$), suggesting a possible decline in mental toughness with increasing sports experience; however, this effect did not reach conventional levels of statistical significance. Controlled motivation was not a significant predictor ($\beta = -.108$, $B = -0.075$, $p = .195$), indicating that externally regulated forms of motivation were not directly associated with mental toughness in the present sample.

Additional multicollinearity diagnostics (Table 4) indicated that the maximum condition index did not exceed the commonly accepted critical threshold (24.37), and the variance decomposition proportions revealed no evidence of substantial linear dependency among the predictors. These findings indicate the absence of problematic multicollinearity and support the appropriateness of including all predictor variables in the regression model.

Overall, the regression model suggests that mental toughness among Paralympic and Deaflympic athletes is primarily explained by psychological characteristics related to competitiveness and the quality of motivational regulation. In particular, competitiveness appears to represent a key psychological resource, reflecting a stable disposition toward striving for achievement and overcoming challenges within the competitive sport environment.

Autonomous motivation also made a substantial contribution to mental toughness, underscoring the importance of internally regulated engagement in sport based on personal values and intrinsic interest. In contrast, controlled motivation did not demonstrate a significant independent effect, suggesting that externally driven motives play a relatively

limited role in promoting psychological resilience among athletes with disabilities.

The findings further indicate that mental toughness in Paralympic and Deaflympic athletes is not simply a direct consequence of accumulated sporting experience but is more strongly associated with qualitative characteristics of athletes' motivational and personal functioning. Collectively, these results support the view that mental toughness reflects the interaction of motivational and competitive factors rather than the influence of isolated psychological characteristics.

Within the regression model, competitiveness and autonomous motivation made the largest contributions to explaining variance in mental toughness. This pattern is consistent with previous findings linking mental toughness to achievement-oriented dispositions and autonomous forms of motivation in sport (Zeng & Liu, 2013; Cowden et al., 2021). Accordingly, the ability to maintain effective functioning under competitive pressure may depend both on an athlete's willingness to actively confront challenges and on the personal significance attributed to participation in sport.

From the perspective of the stress-adaptation framework, the observed relationships suggest that competitiveness and autonomous motivation perform distinct yet complementary functions in supporting mental toughness. Whereas competitiveness reflects athletes' readiness to respond proactively to the demands of the competitive environment, autonomous motivation facilitates self-regulation and resilience in the face of external pressures (Sarkar & Fletcher, 2014). For Paralympic and Deaflympic athletes, the combination of these psychological resources may be particularly important because they regularly encounter additional stressors associated with functional impairments and the need to adapt to social and organizational barriers (Fagher et al., 2016).

The absence of a statistically significant association between controlled motivation and mental toughness suggests that externally regulated motives do not make an independent contribution to the development of this psychological resource. This interpretation is consistent with previous findings indicating that the relationship between motivational regulation and psychological resilience is complex and may depend on additional psychological mechanisms (Shang & Yang, 2021). It is therefore plausible that mental toughness is shaped not by individual motivational components in isolation but by the overall organization and interaction of motivational processes.

Likewise, the lack of a significant association between years of sports participation and mental toughness indicates that accumulated sporting experience alone is insufficient to foster this psychological resource. This finding only partially aligns with previous research reporting gradual increases in mental toughness over the course of athletic development and progression through competitive careers (Connaughton et al., 2010; Nicholls et al., 2009).

One possible explanation for this finding lies in the selective nature of athletic careers. Previous research suggests that athletes with higher levels of mental toughness are more likely to achieve elite performance and remain engaged in competitive sport over time (Gould et al., 2002). From this perspective, mental toughness should be viewed not only as an outcome of sporting experience but also as a prerequisite for successfully accumulating such experience.

It is therefore plausible that the development of mental toughness depends less on the duration of sports participation than on the quality of athletes' experiences. Experiences involving the successful management of adversity and the use of adaptive coping strategies may be particularly important in this process (Wadey et al., 2016). From the perspective of Self-Determination Theory, such developmental processes are facilitated by the satisfaction of basic psychological needs, particularly autonomy and competence, thereby creating favorable conditions for the development of enduring psychological resources (Mahoney et al., 2014).

Taken together, the observed relationships suggest that mental toughness among Paralympic and Deaflympic athletes arises from the interaction between motivational regulation and competitive orientation. Autonomous motivation and competitiveness made the greatest contributions to explaining mental toughness, whereas controlled motivation and years of sports participation did not demonstrate independent predictive value.

Overall, these findings indicate that mental toughness is shaped not by isolated psychological characteristics but by their interaction and integration. Accordingly, mental toughness may be conceptualized as an integrative psychological resource whose development depends more strongly on the quality of motivational regulation and adaptation to the demands of competitive sport than on the duration of athletic participation. These findings extend current understanding of the predictors of mental toughness in Paralympic sport and

underscore the central roles of autonomous motivation and competitive orientation in its development.

Conclusion

The present regression analysis demonstrated that competitiveness and autonomous motivation are the primary psychological predictors of mental toughness among Paralympic and Deaflympic athletes. In contrast, controlled motivation and years of sports participation did not make independent contributions to explaining the variance in mental toughness.

These findings support the conceptualization of mental toughness as an integrative psychological resource whose development is influenced more by the quality of motivational regulation and competitive orientation than by the duration of athletic participation. This underscores the central role of internal psychological mechanisms of adaptation in promoting athletes' resilience to competitive stress.

The theoretical contribution of this study lies in clarifying the role of motivational regulation and competitive orientation in the development of mental toughness among Paralympic and Deaflympic athletes, thereby extending current understanding of the psychological mechanisms underlying this construct. From a practical perspective, the findings may inform the development and refinement of psychological training programs aimed at fostering autonomous motivation and adaptive competitive orientation in athletes with disabilities.

Several limitations should be acknowledged. First, the relatively small sample size and the heterogeneity of the sample with respect to sport disciplines limit the generalizability of the findings. Future research should employ longitudinal designs to examine changes in mental toughness across different stages of athletes' careers. Further investigation is also warranted to explore the relationships between mental toughness and other psychological and social factors within the context of Paralympic sport.

Author Contributions

Krasmik Yulia: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Visualization, Writing – original draft, Writing – review & editing.

Kenzhetayeva Roza: Project administration, Validation.

Rakhmalin Bolat: Resources, Data curation, Investigation.

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