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Meta-analytic structural equation modeling (MASEM) analysis of athlete well-being in South Korea

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ABSTRACT

Athlete well-being has emerged as a critical concern in South Korea, where early specialization, authoritarian coaching practices, and academic exclusion remain deeply embedded in elite sport systems. This study employed meta-analytic structural equation modeling (MASEM) to synthesize findings from 51 empirical studies and examine how psychological, physical, and social variables interact to shape athlete well-being. Utilizing a two-stage MASEM framework alongside confirmatory factor analysis (CFA), the results revealed that psychological and subjective well-being function as key levers for enhancing athlete outcomes, with physical well-being acting as a central mediating factor. Social support consistently showed significant positive associations across all domains of well-being. Conversely, performance pressure, constrained autonomy, and limited educational access were linked to distress, burnout, and maladjustment following retirement. The final model demonstrated excellent fit and theoretical coherence, integrating core tenets from Self-Determination Theory and ecological systems frameworks. These findings underscore the necessity of embedding well-being into the structural fabric of sport—through reforms in coaching education, investment in mental health infrastructure, and athlete-centered development policies. Future research should adopt longitudinal designs and broaden subgroup representation to inform more inclusive and context-sensitive care models for athletic populations.

1. Introduction

South Korean elite athletes are developed within an extraordinarily demanding performance-based environment where early specialization and institutional rigidity often eclipse the importance of holistic growth. From adolescence, many student-athletes are inducted into elite training tracks that privilege intensive athletic performance over psychosocial development and formal education (Im & Hong, 2021). These early trajectories, reinforced by school-affiliated athletic programs and hierarchical team structures, commonly result in the systematic exclusion of academic pursuits and interpersonal growth. This imbalance, shaped by structural norms rather than individual choice, fosters high rates of physical overuse, psychological distress, and social alienation that persist well beyond the athletic career (Kim & Kim, 2023).

A central mechanism reinforcing this imbalance is the performance-dependent structure of institutional evaluation. Coaches' job security and schools' reputations often hinge upon athletes' competitive outcomes, prompting intensified training loads and authoritarian coaching styles that prioritize winning over athlete welfare (Lee et al., 2009). As a

result, training regimens are frequently optimized for short-term performance, with little regard for long-term athlete sustainability, injury prevention, or life-course adaptability (Lee et al., 2009).

One particularly concerning consequence is the systemic denial of educational access. Over 80 % of Korean student-athletes reportedly do not receive sufficient academic instruction throughout their competitive years (So, 2022). Schools often condone or even facilitate academic neglect by manipulating attendance records or waiving curricular obligations, thereby enabling athletes to focus solely on sport. While this may benefit athletic performance in the short term, it leaves athletes ill-equipped for post-sport transitions, resulting in heightened economic precarity and limited occupational mobility (Asia Economy, 2024).

These structural issues are not abstract. A vivid and deeply unsettling illustration is the case of national triathlete Choi Suk-hyeon, whose suicide in 2020 brought international attention to the abusive conditions many Korean athletes endure. Beginning her athletic career in early adolescence, Choi was subjected to repeated physical beatings, forced fasting, verbal abuse, and psychological manipulation by her coaches and team staff. The abuse was sustained and documented—Choi

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submitted multiple formal complaints to national sports institutions, including audio recordings of the violence—but her claims were dismissed or left unaddressed. Institutional inaction contributed directly to her isolation and despair. Before her death, Choi kept a detailed diary chronicling the daily psychological trauma she experienced, which later became critical evidence in the public inquiry following her death.

Public reaction was swift and emotional. Media coverage of her case prompted mass protests, emergency legislative hearings, and widespread condemnation of the Korea Triathlon Federation and the Korean Sport & Olympic Committee. Yet despite the public outcry, the case was far from anomalous. Rather, it was a flashpoint that exposed the normalized authoritarianism, lack of accountability, and institutionalized indifference within Korea's elite sports system. Coaches often hold unchecked power over athletes' physical, emotional, and even financial lives—creating a context where coercion is both tolerated and concealed under the rhetoric of discipline and performance.

Despite heightened public awareness and policy discussions following Choi's death, academic research has been slow to keep pace with the structural complexity of the issue. Much of the existing literature continues to focus on isolated psychological outcomes such as stress, burnout, or coaching style preferences, often analyzed through bivariate correlations. These methods, while informative, fail to illuminate the interdependent, systemic factors—cultural, institutional, and interpersonal—that collectively shape athlete well-being in high-performance environments.

To address this gap, the present study employs Meta-Analytic Structural Equation Modeling (MASEM), a methodology that integrates traditional meta-analytic effect sizes with the causal modeling capacities of structural equation modeling. MASEM is particularly well-suited for unpacking multilevel phenomena, allowing the estimation of direct, indirect, and mediated relationships across a large and heterogeneous evidence base. This study synthesizes findings from 51 empirical investigations conducted over the past two decades in South Korea, encompassing variables related to physical condition, psychological resilience, and social support structures.

The rationale for using MASEM in this context is threefold. First, it enables a comprehensive synthesis of a fragmented literature base, offering a unified structural model of athlete well-being. Second, it allows for the identification of latent constructs and mediated pathways that traditional analyses may overlook. Third, MASEM offers a platform for context-sensitive modeling, capturing the unique features of Korea's elite-first, high-pressure, and human-rights-challenged sports environment. As such, this methodology offers both analytical rigor and practical relevance, aligning well with the need for evidence-based reforms in athlete development systems.

1.1. Theoretical background

Athlete well-being is widely recognized as a multidimensional construct encompassing physical, psychological, and social dimensions (Lundqvist, 2011; Ryff, 1989). This framework has been predominantly developed in Western contexts, where supportive infrastructures—such as athlete-centered coaching, educational integration, and safeguarding policies—are relatively established. In contrast, its applicability to structurally coercive and hierarchically organized sport systems, such as those found in South Korea, remains underexplored.

To address this gap, the present study draws on Self-Determination Theory (SDT; Ryan & Deci, 2017), which posits that autonomy, competence, and relatedness are essential psychological needs for optimal motivation and well-being. In environments where these needs are chronically frustrated—through authoritarian coaching, restricted personal agency, or educational neglect—SDT predicts declines in intrinsic motivation, emotional regulation, and resilience (Hong et al., 2022). In the Korean elite sport system, such patterns are often institutionalized rather than incidental. Consequently, this study conceptualizes psychological resilience and perceived social support as potential

mediators that may buffer the negative effects of structural need frustration.

Complementing SDT, Burnout Theory (Smith, 1986) conceptualizes athlete burnout as a multidimensional syndrome—comprising emotional and physical exhaustion, reduced sense of accomplishment, and sport devaluation—that emerges from prolonged exposure to performance pressure, limited autonomy, and role conflict. In this study, Burnout Theory is used not as a guiding framework but as a conceptual anchor for the primary outcome variable: athlete exhaustion. The integration of SDT and Burnout Theory enables a dynamic analysis of both motivational antecedents and psychological consequences within high-pressure sport environments.

To contextualize these individual-level dynamics within broader sociocultural structures, the study incorporates Ecological Systems Theory (Bronfenbrenner, 1979). This theory situates athlete development within nested systems—ranging from interpersonal relationships to institutional policies and societal norms—that interact to shape experience. In the Korean context, school-based athletic teams, rigid performance hierarchies, and culturally sanctioned discipline practices converge to create a tightly interwoven ecology (Kim, 2021; So, 2022). This ecological lens allows for a more holistic understanding of how environmental forces may support or undermine athlete well-being.

Although a growing body of Korean research has examined coaching style, burnout, and psychological stress, much of the literature relies on univariate or bivariate analyses, limiting insight into the structural interdependencies among key variables. To address this methodological gap, the present study employs Meta-Analytic Structural Equation Modeling (MASEM)—a technique that synthesizes effect sizes across studies and enables the estimation of direct, indirect, and mediated pathways between constructs (Cheung, 2015). While MASEM has been widely applied in global research to examine complex relationships in fields such as education, health psychology, and organizational behavior, it has yet to be utilized to investigate athlete well-being in the South Korean context.

This study addresses that gap by adopting an exploratory, model-building approach to examine how physical conditioning, psychological resilience, and social support interact within Korea's high-pressure sport ecology. In doing so, it develops a context-sensitive theoretical model that reflects the lived experiences of athletes operating under systemic constraints.

2. Method

This study employs Meta-Analytic Structural Equation Modeling (MASEM) to systematically examine the structural dynamics of athlete well-being in the South Korean context and to develop empirically grounded intervention strategies. MASEM integrates traditional meta-analysis with Structural Equation Modeling (SEM), allowing the synthesis of both effect sizes and inter-variable pathways across multiple studies. This approach enhances both the statistical precision and theoretical depth of analysis by uncovering latent mechanisms that link physical, psychological, and social dimensions of athlete experience (Cheung, 2015; Jak, 2015).

Whereas conventional meta-analyses primarily summarize correlations between pairs of variables, MASEM enables the modeling of directional relationships and mediation pathways among constructs. This is particularly relevant in the South Korean sports system, which is shaped by intersecting factors such as authoritarian coaching styles, educational marginalization, and rigid hierarchical norms. These structural characteristics require an analytical framework capable of disentangling complex, multilevel interactions—making MASEM a robust and context-appropriate tool for this study.

1) Rationale and Research Design

Elite athletes in South Korea face a distinct sociocultural

environment characterized by early specialization, intensive training regimens, hierarchical coach-athlete relationships, and pressure to perform from a young age. Prior research has often examined isolated dimensions of athlete experience—such as injury, motivation, or burnout—through bivariate correlations or univariate regression models. While useful, these designs do not capture the reciprocal and interactive nature of physical, psychological, and social determinants operating within a system marked by structural constraints (Kim et al., 2023; Im et al., 2021).

This study addresses that gap by employing MASEM to model directional relationships and latent structures across aggregated datasets. Specifically, the analysis explores not only how physical status, social support, and psychological resilience independently relate to well-being but also how they interact as mediators and moderators. For instance, psychological resilience may serve as a mediating mechanism through which physical fitness contributes to mental well-being, while social support could moderate the negative effects of coercive coaching. This systems-level modeling approach reflects the reality of athlete experience more accurately than traditional variable-by-variable techniques and supports the development of integrated intervention strategies.

2) Data Collection and Selection Criteria

Data for the meta-analysis were collected through a systematic review conducted in accordance with PRISMA guidelines (Moher et al., 2009). The process included the following steps (Fig. 1).

● Database Search

- Conducted in three major South Korean academic databases: RISS, DBpia, and KISS.
- Search terms included combinations of: “athletes,” “well-being,” “sports psychology,” “athlete welfare”, combined using logical connectors to capture relevant records.

- The review covered publications between 2003 and 2023, encompassing 20 years of literature.

● Deduplication

- Reference management software (EndNote and Mendeley) was used to remove 307 duplicate records.

● Screening

- Titles and abstracts were screened for relevance.
- Exclusion criteria:
 - Qualitative-only studies
 - Studies unrelated to South Korean athletes
 - Absence of empirical data

● Eligibility Criteria

Studies were included if they met all of the following.

- The study population consisted of South Korean athletes
- Reported quantitative data with either correlation coefficients or convertible effect sizes
- Defined well-being as either a dependent or mediating variable
- Published as peer-reviewed articles or graduate theses/dissertations
- Final Inclusion
 - A total of 51 studies met all inclusion criteria.
 - Final selection was based on independent evaluation by two trained reviewers. Disagreements were resolved through structured discussion.

3) Quality Assessment and Publication Bias

To improve interpretive robustness, methodological quality was independently assessed using a modified Downs and Black checklist, which included criteria for statistical reporting clarity, sampling procedures, and operationalization of constructs. Studies scoring below 60 % were excluded to ensure analytic reliability. The quality assessment was conducted by two trained reviewers, and inter-rater reliability was high (Cohen’s kappa = .87).

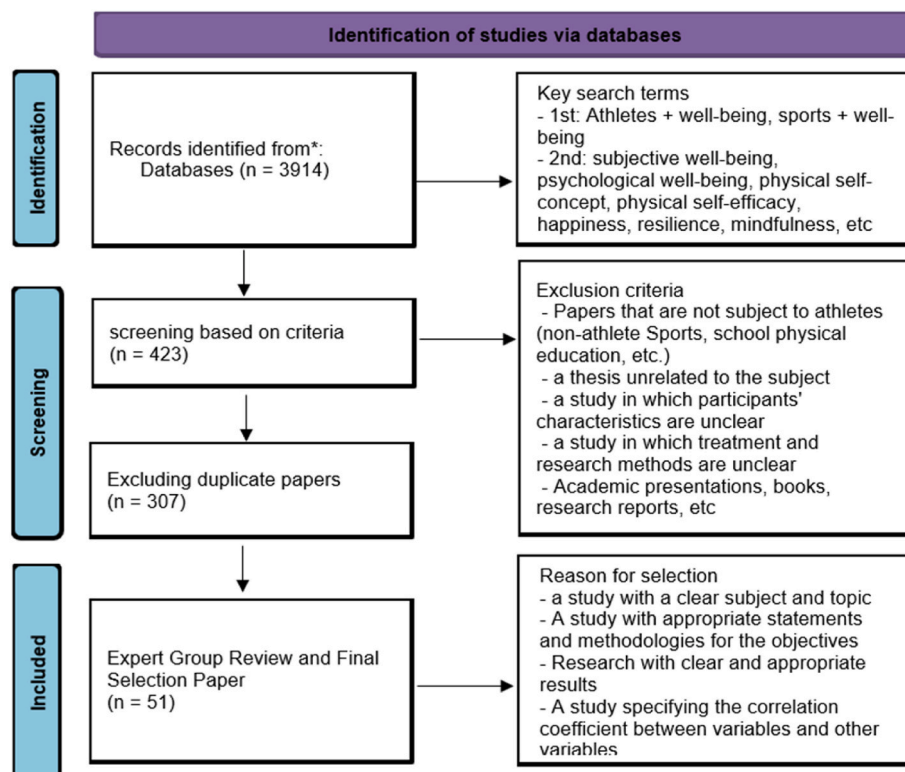


Fig. 1. PRISMA guidelines (Moher et al., 2009).

Alternative tools considered included the Newcastle–Ottawa Scale (NOS), which offers rapid assessment for non-randomized designs, but was deemed insufficient for the cross-sectional nature of many included studies. AMSTAR 2 and ROBIS assess systematic reviews themselves rather than individual primary studies, and the GRADE approach is more appropriate for grading interventions than structural modeling. Therefore, Downs & Black was selected for its comprehensive applicability and prior domain validation in sports science meta-analyses.

To address publication bias, Funnel Plot asymmetry was visually inspected and corrected using the Trim-and-Fill method (Borenstein et al., 2009). Results were further verified via Egger's regression test (Fig. 2).

4) Effect Size Calculation and Interpretation

Pearson's r was used as the effect size metric. Where studies reported beta coefficients or other statistics, standardized formulas were applied to convert data. Interpretation followed Cohen's (1988) benchmarks.

- Small effect: $r = 0.10$
- Medium effect: $r = 0.30$
- Large effect: $r = 0.50$

A 95 % confidence interval (CI) was calculated for each pooled estimate to evaluate precision and generalizability.

5) MASEM Procedure

MASEM was conducted in two sequential stages using the R software environment (metaSEM package), which allows for the advanced synthesis of meta-analytic correlation matrices and structural equation modeling. This approach enables both statistical integration and theory-driven testing of complex, latent relationships.

2.1. Stage 1: correlation pooling and homogeneity testing

In the first stage, correlation matrices were extracted from each eligible study and synthesized using a random-effects model, which accounts for both within- and between-study variance. The pooled correlation estimates served as the foundation for subsequent structural modeling.

To evaluate the consistency of findings across studies, homogeneity testing was performed using the following indices.

- Q-statistics were used to test whether the variability in effect sizes across studies exceeded what would be expected due to sampling

error alone. A statistically significant Q value ($p < .05$) suggests the presence of heterogeneity.

- I^2 statistics quantified the percentage of total variation across studies that was due to real heterogeneity rather than chance. I^2 values of approximately 25 %, 50 %, and 75 % are interpreted as low, moderate, and high heterogeneity, respectively (Higgins et al., 2003).
- Confidence Intervals (CIs) around the pooled correlations were calculated to assess the precision and reliability of the aggregated estimates. Narrower intervals indicate higher precision.

The results of this stage guided the decision to retain the random-effects model and informed the structural model's parameter assumptions in Stage 2.

2.2. Stage 2: structural model specification and estimation

In the second stage, the pooled correlation matrix was used to estimate the hypothesized structural relationships among latent constructs representing physical status, psychological resilience, social support, and athlete well-being.

2.2.1. Key modeling features included

- Mediation effects, such as the role of psychological resilience in explaining the indirect influence of physical condition on well-being
- Moderation effects, such as the buffering role of perceived social support on the negative impact of coercive coaching
- Estimation of path coefficients using maximum likelihood estimation, based on the pooled matrix
- Model fit was evaluated using widely accepted indices:
 - o CFI (Comparative Fit Index) and TLI (Tucker–Lewis Index), where values $\geq .90$ indicate acceptable fit
 - o RMSEA (Root Mean Square Error of Approximation), where $\leq .08$ suggests reasonable error
 - o SRMR (Standardized Root Mean Square Residual), where $\leq .08$ indicates acceptable residuals

This two-stage procedure combines the breadth of empirical evidence with the depth of theory-driven modeling, offering a robust framework for understanding the multilevel determinants of athlete well-being. It also reflects the systemic nature of stress, support, and resilience in South Korea's performance-oriented and hierarchically structured sport environments.

2.3. Research findings

This section presents the synthesized results of the meta-analysis and

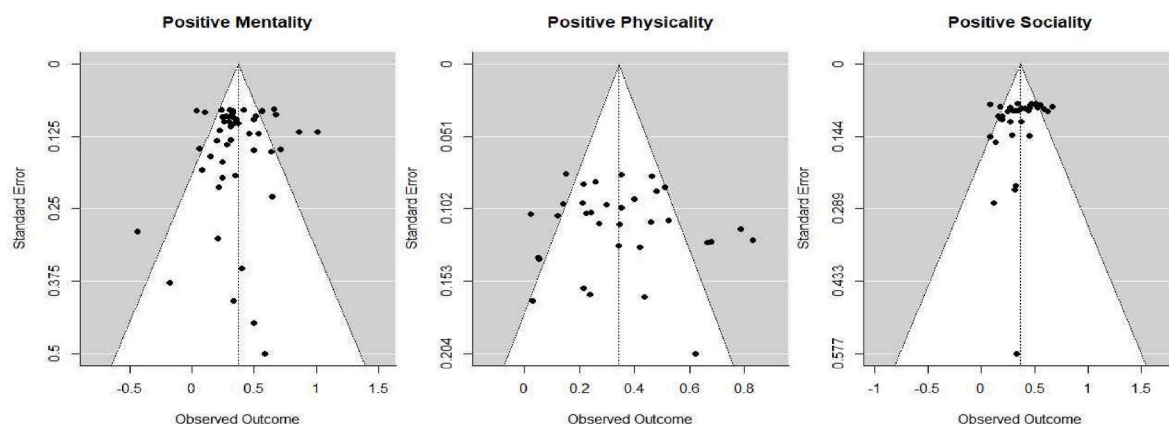


Fig. 2. Positive factor meta-analysis results Funnel Plot.

structural modeling. The findings are organized into three parts: (1) Descriptive characteristics of the included studies, (2) pooled effect sizes of key factors associated with well-being, and (3) structural pathways identified through Meta-Analytic Structural Equation Modeling (MASEM).

3. Characteristics of the analyzed studies

A total of 51 studies were included in the final analysis. In terms of publication type, 31 (60.8 %) were peer-reviewed journal articles, 15 (29.4 %) were master’s theses, and 5 (9.8 %) were doctoral dissertations. The inclusion of graduate-level theses alongside journal publications reflects the growing academic engagement with athlete well-being across scholarly levels in South Korea (Table 1).

3.1. Study distribution by publication year

Analysis by year of publication revealed a sharp upward trend in output: only 11.5 % of studies were published prior to 2010, while 88.3 % appeared thereafter—indicating rising academic interest, particularly following increased national dialogue on athlete rights and mental health from 2015 onward (Table 2).

3.2. Sample size distribution

Regarding sample size, 16 studies (31.4 %) involved more than 300 participants, 21 (41.2 %) ranged from 200 to 300, and 14 (27.4 %) had fewer than 200 participants. The predominance of mid-to-large sample sizes enhances the generalizability and statistical power of the meta-analytic findings (Table 3).

4. Analysis of key variables influencing athlete well-being

4.1. Relationship between physical factors and well-being

Physical factors—including injury experience, overall health, and fitness levels—exhibited a significant positive correlation with well-being ($r = .33, p < .001$). Athletes with better physical health demonstrated greater psychological stability and self-confidence in their performance. However, excessive injury risks were identified as a major deterrent to well-being, leading to increased stress, performance decline, and negative post-retirement quality of life. Furthermore, congested competition schedules and inadequate recovery time were found to exacerbate physical fatigue and deteriorate well-being (Table 4).

4.2. Relationship between psychological factors and well-being

Psychological well-being—comprising self-efficacy, emotional stability, and burnout prevention—was one of the most influential factors affecting overall well-being ($r = .36, p < .001$). Athletes with higher self-efficacy managed stress more effectively and were less susceptible to negative emotions, thus sustaining longer careers. Conversely, those with lower psychological well-being suffered from performance anxiety and, in severe cases, experienced depression or suicidal tendencies. The role of coaching was significant, as positive reinforcement improved motivation, while authoritarian coaching increased stress levels (Table 5).

Table 1
Classification of papers to be analyzed by publication type.

Type of publication		N(%)
Academic journal		31(60.8 %)
Thesis	Master	15(29.4 %)
	Doctor	5(9.8 %)

Table 2
Classification of papers subject to analysis by publication year.

Year of publication	N(%)
2016–2023	29(56.9 %)
2011–2015	16(31.4 %)
2006–2010	5(9.8 %)
2000–2005	1(1.7 %)

Table 3
Classification of papers subject to analysis by Sample size.

Sample size	N(%)
Over 300	16(31.4 %)
200~300	21(41.2 %)
100~200	12(23.5 %)
Fewer than 100	2(3.9 %)

Table 4
Relationship between physical factors and well-being.

Factor	k	Effect size r	CI	I2(%)	Q	p
Physical	33	.3303	0.2672, 0.3906	71.13	103.81	<.0001

Table 5
Relationship between psychological factors and well-being.

Factor	k	Effect size r	CI	I2(%)	Q	p
Psychological	50	.3567	0.3018, 0.4092	71.09	164.74	<.0001

4.3. Relationship between social support and well-being

Social support—including relationships with coaches, teammates, and family—was another critical determinant of well-being ($r = .35, p < .001$). Athletes with strong support networks exhibited greater emotional stability and engagement in training and competition. In contrast, authoritarian coaching styles and excessive pressure contributed to heightened stress. The presence of supportive family and friends played a crucial role in fostering psychological resilience and life satisfaction. Higher team cohesion also correlated with increased well-being, emphasizing the importance of fostering positive social interactions (Table 6).

These findings highlight that a combination of positive mental state, physical condition, and social support is essential for athlete well-being. Enhancing well-being requires targeted interventions in psychological care, physical conditioning, and social environment improvements.

5. Structural relationships identified through MASEM

MASEM analysis revealed the interconnections between physical, psychological, and social factors in shaping athlete well-being. Key results include (Tables 7-9).

1. Positive Mentality → Psychological Well-being ($\beta = .34, p < .001$)

Table 6
Relationship between social factors and well-being.

Factor	k	Effect size r	CI	I2(%)	Q	p
Social	38	.3512	0.3049, 0.3960	61.17	93.80	<.0001

Table 7

Path factor related to Psychological Well-being.

Path	Estimate	Z	β	SE	CI	X	p
b21	.3518		.3380	.0732	0.2083, 0.4953	4.8047	<.001
b31	.2350		.2310	.1190	0.0017, 0.4683	1.9740	.0484
b32	.2202		.2165	.0764	0.0070, 0.3701	2.8810	.0040

Table 8

Path factor related to Subjective Well-being.

Path	Estimate	Z	β	SE	CI	X	p
b21	.3767		.3598	.0524	0.2740, 0.4794	7.1899	<.001
b31	.4019		.3816	.0735	0.2578, 0.5460	5.4658	<.001
b32	.2252		.2245	.0545	0.1185, 0.3320	4.1358	<.001

Table 9

Path factor related to Physical Well-being.

Path	Estimate	Z	β	SE	CI	X	p
b21	.3222		.3155	.0425	0.2388, 0.4056	7.5726	<.001
b31	.1814		.1794	.0427	0.0976, 0.2651	4.2466	<.001
b32	.2751		.2684	.0465	0.1839, 0.3662	5.9154	<.001

- o A stronger positive mentality has a statistically significant and practically meaningful association with psychological well-being. The standardized coefficient indicates a moderate effect.
- 2. Positive Physicality → Psychological Well-being ($\beta = .23$, $p < .05$)
 - o Higher levels of physical conditioning are positively associated with psychological well-being. Although the effect size is relatively smaller than other predictors, it remains statistically significant, indicating a meaningful relationship.
- 3. Positive Sociality → Psychological Well-being ($\beta = .22$, $p < .01$)
 - o Social support also contributes meaningfully to psychological well-being with a significant positive effect.
- 4. Positive Mentality → Subjective Well-being ($\beta = .36$, $p < .001$)
 - o A positive mentality shows a statistically significant and moderately association with subjective well-being. This indicates that individuals with greater emotional stability and coping ability tend to experience higher levels of subjective life satisfaction.
- 5. Positive Physicality → Subjective Well-being ($\beta = .38$, $p < .001$)
 - o Physical conditioning is strongly and significantly related to subjective well-being. This suggests that better physical health and endurance contribute substantially to an individual's overall sense of well-being.
- 6. Positive Sociality → Subjective Well-being ($\beta = .22$, $p < .001$)
 - o Social support is positively associated with subjective well-being. The relationship remains statistically significant, emphasizing the meaningful role of social connectedness.
- 7. Positive Mentality → Physical Well-being ($\beta = .31$, $p < .001$)
 - o A positive mentality was moderately and significantly associated with physical well-being, suggesting that mental strength contributes to better physical health.
- 8. Positive Physicality → Physical Well-being ($\beta = .18$, $p < .001$)

- o Physical conditioning has showed a smaller yet significant effect, indicating that fitness enhances physical functioning to a modest degree.

9. Positive Sociality → Physical Well-being ($\beta = .27$, $p < .001$)

- o Social support also had a meaningful impact, highlighting the role of interpersonal support in sustaining physical health.

6. Structural validation of the athlete well-being model

To further evaluate the structural validity of the athlete well-being model, a confirmatory factor analysis (CFA) was conducted using the Lavaan package in R. As shown in Table 10, the model demonstrated excellent fit ($\chi^2 = 2.839$, $p = .242$; CFI = .994; TLI = .981; RMSEA = .034 [90 % CI: 0.000–.115]; SRMR = .023). All standardized loadings were statistically significant, with subjective well-being (.76) emerging as the most influential latent indicator.

7. Factors that diminish athlete well-being

In addition to identifying positive contributors, this study also systematically examined structural and contextual stressors that deteriorate athlete well-being. Drawing from reported negative effect sizes (r -values) and thematic groupings within the literature, four primary domains emerged.

7.1. Excessive competition and performance pressure

Intense emphasis on winning, overtraining, and team cohesion at the cost of individual well-being were significantly associated with psychological distress (e.g., $r = -0.544$ for task cohesion; $r = -0.525$ for cognitive anxiety). These findings underscore the psychological costs of performance-first cultures that characterize elite sport systems in South Korea and elsewhere.

7.2. Authoritarian coaching climates

Coaching environments characterized by rigid expectations, limited athlete autonomy, and excessive emphasis on obedience were consistently linked to diminished psychological well-being. Negative associations were found with obsessive passion ($r = -0.411$) and negative self-esteem ($r = -0.383$), indicating that overly directive coaching can undermine intrinsic motivation and emotional stability. These findings are consistent with Self-Determination Theory (SDT), which posits that the frustration of basic psychological needs—autonomy, competence, and relatedness—leads to negative affect and disengagement. The distinction between controlling and autonomy-supportive coaching should therefore be central in designing effective coach education and athlete support programs.

Table 10

Model fit and factor loadings for the athlete well-being CFA model.

Category	Value	
Weighted Average Sample Size	N = 362.33	
Fit Indices	$\chi^2 (2) = 2.839$, $\hat{f} = 0.242$	
	CFI = 0.994	
	TLI = 0.981	
	RMSEA = 0.034, 90 % CI [0.000, 0.115]	
	SRMR = 0.023	
	Unstandardized Loadings	Standardized Loadings
Estimated Parameters	PW1 = 1.000 (Fixed)	PW1 = 0.52***
	SW1 = 1.454***	SW1 = 0.76***
	PHW1 = 0.773***	PHW1 = 0.41***
	PHW2 = 0.690***	PHW2 = 0.36***

7.3. Educational deprivation and career uncertainty

Athletes who lacked access to adequate educational resources during their training years reported lower post-career adjustment and greater psychological vulnerability (e.g., $r = -0.59$ for depression; $r = -0.39$ for avoidance behavior). These effects highlight the need for integrated dual-career support and long-term planning within athlete development systems.

7.4. Injuries and accumulated fatigue

Repetitive physical strain and inadequate recovery infrastructure were linked to reduced confidence, chronic stress, and shortened careers (e.g., $r = -0.230$ for physical anxiety; $r = -0.41$ for performance-related decline). These findings emphasize the role of preventive care, load management, and holistic rehabilitation strategies.

Overall, these deterioration factors reflect structural vulnerabilities embedded in the current sports development model. They reinforce reviewer concerns regarding the psychological and systemic stressors disproportionately affecting elite athletes in high-pressure, high-performance settings. Addressing these issues requires not only individual-level interventions but also organizational and cultural reforms that prioritize athlete well-being over short-term competitive success.

8. Discussion

This study was designed to fill a critical gap in South Korean sport psychology by offering a context-sensitive, integrative model of athlete well-being. Prior research has tended to examine single outcomes in isolation—such as perceived stress (Kim, 2021), burnout (Kim et al., 2023), or coach-athlete relationship quality (Lee et al., 2009)—without considering how physical, psychological, and social factors intersect to shape the athlete experience holistically. Moreover, rigid training regimens, limited academic access, and authoritarian coaching styles—well-documented in the Korean athletic system—have been shown to systematically undermine long-term development and psychological stability (Kim & Kim, 2023). However, few studies have attempted to model these complex interdependencies using a multivariate, structural approach. This study addresses that gap using Meta-Analytic Structural Equation Modeling (MASEM) and confirmatory factor analysis (CFA) to derive an empirically grounded, multidimensional model of athlete well-being.

The synthesis of 51 empirical studies through MASEM enabled both statistical precision and theoretical depth. By estimating direct, indirect, and mediated pathways, this study captured how physical conditioning, psychological resilience, and social support interact within high-performance sport environments. The analysis confirmed positive mentality as strong predictors of both subjective and psychological well-being, with physical health emerging as a key mediating variable. These findings provide compelling evidence for a systems-level approach to athlete support, especially in socio-culturally constrained settings like Korea.

These results align with and extend Self-Determination Theory (SDT; Ryan & Deci, 2017). While SDT traditionally focuses on the satisfaction of autonomy, competence, and relatedness as core psychological needs, this study demonstrates how those needs are often chronically frustrated in the Korean sport context—requiring athletes to rely on internal psychological patience as a compensatory buffer. Furthermore, this model supports Bronfenbrenner's Ecological Systems Theory (1979) by showing that macro-level structures (e.g., academic neglect, rigid coaching hierarchies) and micro-level factors (e.g., peer support, coping style) interact to shape developmental outcomes. The integration of SDT and ecological theory within the MASEM framework adds explanatory nuance, illustrating how athletes' psychological outcomes are co-constructed through systemic pressures and individual resources.

Importantly, this study also extends prior applications of MASEM in

the sport sciences. While international studies have used MASEM to model constructs such as resilience (Lin, Zhu, et al., 2024), motivation (Iasiello, van Agteren, & Muir-Cochrane, 2023), or injury recovery, they rarely account for culturally specific variables such as authoritarian coaching, early specialization, or academic exclusion—hallmarks of the Korean sport system. This study is the first to apply MASEM in a Korean context while adapting latent variables and pathways to reflect these cultural contingencies. For example, physical well-being was modeled not merely as an endpoint, but also as a mediating mechanism linking psychological and social domains—an approach uncommon in prior international literature.

The CFA further validated the structure and coherence of the latent constructs used. High model fit indices (CFI $>.95$, RMSEA $<.06$) indicated strong internal consistency and construct validity, enhancing confidence in the derived model. Still, several limitations must be acknowledged. The dataset was skewed toward team sports, which may limit generalizability to individual sports with different performance cultures. In addition, many studies lacked gender-disaggregated data, precluding subgroup analysis. These constraints reflect broader limitations in the Korean research corpus rather than flaws in this synthesis per se. However, they point to the need for future studies to address diversity and representation more directly.

Another limitation relates to the methodological nature of the source data. The majority of included studies employed cross-sectional, survey-based designs, which restrict causal inference and may be subject to common method bias. While MASEM provides a robust framework for examining inter-variable relationships, longitudinal and experimental studies are needed to validate these findings over time. Future research should also incorporate qualitative methods to better understand how athletes interpret and navigate their environments—especially in light of the psychological distress and institutional betrayal reported in high-profile cases like that of Choi Suk-hyeon.

In conclusion, this study presents a rigorously validated, culturally attuned model of athlete well-being that highlights the importance of integrated psychological, physical, and social supports. The findings offer both theoretical advancement and practical implications for sport psychologists, coaches, and policymakers in Korea and beyond. Rather than treating well-being as a byproduct of performance, the model emphasizes its central role in sustainable athlete development. Future research should build on this foundation by incorporating diverse samples, longitudinal methods, and cross-cultural comparisons to generate globally relevant, equity-focused sport systems.

8.1. Limitations and future directions

While this study presents a robust meta-analytic structural model of athlete well-being, several limitations should be noted. First, the included studies were predominantly focused on team sports (e.g., soccer, volleyball), with a limited number of investigations into individual sports. As a result, the generalizability of the findings may be constrained, especially in contexts such as gymnastics or track and field, which involve different coaching styles and athlete development trajectories.

Second, gender-disaggregated data were inconsistently reported across the included studies. This prevented the analysis of gender-specific patterns in athlete well-being, a critical area that warrants further exploration. Future research should intentionally design studies that capture the diverse experiences of male, female, and non-binary athletes in elite settings.

Third, the dataset consisted mainly of cross-sectional studies, limiting the ability to infer causality. Although MASEM enables the exploration of structural relationships, it does not replace the need for longitudinal or experimental designs. Future studies should employ time-series or prospective approaches to test the temporal dynamics of psychological, physical, and social predictors of well-being.

Fourth, the reliance on survey-based data, though common in sport

psychology research, restricts insight into contextual or narrative experiences. Integrating qualitative methods (e.g., interviews, ethnography) can enhance understanding of systemic pressures and lived realities.

Lastly, while this study addressed structural dimensions of well-being, policy implications remain context-bound to South Korea. Comparative cross-national research could reveal how differing cultural, educational, and governance systems influence athlete well-being, thereby informing more globally relevant frameworks.

9. Conclusion

This study offers an integrative, evidence-based framework for understanding athlete well-being in South Korea by modeling the interrelationships among psychological, physical, and social factors. Moving beyond the limitations of bivariate analyses prevalent in prior literature, our use of Meta-Analytic Structural Equation Modeling (MASEM) and Confirmatory Factor Analysis (CFA) reveals a complex, yet coherent structure of influence across these domains. Importantly, the findings do not simply affirm known associations but demonstrate how well-being outcomes emerge from the interplay of inner psychological resources and external support systems.

Rather than reiterating which variables exert the strongest statistical effects, this study underscores their interdependent functionality: psychological capacities such as resilience gain impact when embedded in supportive environments; physical conditioning enhances mental health when integrated with emotional care; and social connections not only buffer stress but amplify adaptive coping processes. These insights advocate for a reconceptualization of athlete well-being as a systems-level phenomenon, shaped by layered contexts rather than isolated traits.

As such, institutional stakeholders—ranging from sport federations to educational bodies and coaching organizations—must implement coordinated, multi-level interventions. These interventions should be theoretically informed, empirically validated, and sensitive to the developmental realities of athletes. Psychological training programs, equitable education access, athlete-centered coaching practices, and injury prevention protocols should no longer operate in silos. Instead, they should be aligned within a unified policy framework aimed at long-term well-being, not short-term performance gains.

Future research should prioritize longitudinal, mixed-method designs, with special attention to underrepresented athlete subgroups and sociocultural variables. Cross-national comparative studies could also deepen theoretical generalizability and inform global best practices. In doing so, the field of sport psychology can evolve from fragmented insight to holistic care—offering not only performance enhancement but sustainable human development.

CRedit authorship contribution statement

Seongwoo Daniel Seo: Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Junghoon Huh:** Writing – review & editing, Supervision, Project administration.

Declaration of the use of AI

During the preparation of this work, the authors used ChatGPT for language editing. The authors reviewed and edited the content as needed and take full responsibility for the final version of the manuscript.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author.

Ethical statement

Ethical approval is not applicable to this manuscript.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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