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Effects of mental training interventions on self-confidence and psychological performance in table tennis athletes: a systematic literature review

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ABSTRACT

Self-confidence and related psychological competencies are widely regarded as decisive determinants of success in table tennis, a fast and tactically dense racket sport in which cognitive-affective control frequently separates players of comparable technical ability. Despite growing empirical interest, evidence on how deliberate mental training shapes confidence and psychological performance in this population has not been consolidated. This systematic literature review synthesises peer-reviewed evidence on the types of mental training applied to table tennis athletes and their effects on self-confidence and psychological performance. The review followed the PRISMA 2020 framework, searching the Scopus database and identifying 1,703 records published between 2021 and 2025. After duplicate removal and sequential title–abstract and full-text screening against predefined eligibility criteria, eighteen studies were retained for qualitative synthesis. Thematic analysis showed that structured mental-skills programmes, particularly visuo-motor behaviour rehearsal and mindfulness, consistently reduced competitive anxiety and enhanced mental toughness, whereas confidence, self-efficacy, motivation, and resilience emerged as robust correlates of technical accuracy and competitive performance. The findings advance a cognitive-affective account of table tennis expertise and offer actionable guidance for coaches, while underscoring the need for larger randomised trials and standardised confidence measures.

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Introduction

Table tennis is among the most widely practised racket sports in the world, valued for its accessibility, low injury risk, and its capacity to promote physical, cognitive, and psychosocial development across the lifespan (Aparicio-Chueca & Muñoz-Vila, 2025; Liu, 2025). Beyond its recreational appeal, the sport constitutes a demanding performance domain in which milliseconds and fine perceptual-motor judgements decide outcomes, and in which the psychological make-up of the player is increasingly recognised as a competitive resource rather than a peripheral concern (Marchese et al., 2022). This dual identity, as both a health-promoting activity and an elite performance discipline, has made table tennis a productive context for examining how mental processes translate into observable sporting behaviour.

The extreme speed of rallies imposes exceptional demands on attention, anticipation, and emotional regulation, so that technical proficiency alone rarely guarantees success (Akbari et al., 2023; Guarnieri et al.,

2025; Taghi et al., 2025). Players must sustain confidence and composure while executing high-risk strokes under time pressure, and the accuracy of decisive shots has been linked directly to self-belief and rapid cognitive processing (Haryanto et al., 2024b; Zhu et al., 2022). These observations align with a broader movement in sport science that treats confidence, motivation, and anxiety not as by-products of skill but as modifiable determinants of performance that can be trained deliberately.

A substantial body of research has documented the cognitive and neurophysiological superiority of experienced table tennis players, including enhanced perceptual processing, cognitive inhibition, visuospatial cognition, and neural efficiency relative to novices (Chen et al., 2024; Huang et al., 2024; Peng et al., 2022, 2024; Shi et al., 2024; Visser et al., 2022). Complementary work has probed unconscious information processing and priming effects that distinguish expert performers, and has shown that this expert cognition is state-dependent, with dual-task demands and sleep loss measurably degrading anticipation and control (Dai et al., 2023; Meng et al., 2025; Schaefer & Amico, 2022). This literature convincingly establishes that expertise in table tennis is cognitively grounded, yet it has concentrated on perception and cognition while devoting comparatively little attention to the affective and self-regulatory constructs, above all self-confidence, that athletes and coaches consistently identify as pivotal.

More recently, interest has shifted toward interventions designed to strengthen the psychological resources of players. Structured mental-skills programmes such as visuo-motor behaviour rehearsal and mindfulness for performance have been trialled with table tennis athletes, alongside motivationally grounded pedagogies and technology-assisted psychological training systems (Luo & Li, 2024; Peng & Kim, 2023; Sharma & Prasad, 2023; Sharma et al., 2024; Tebourski et al., 2022). In parallel, digital and multimedia tools have been introduced to enrich skill acquisition and engagement (Ma et al., 2024; Xie et al., 2025). Together these developments signal an emerging, if still fragmented, evidence base on the intentional cultivation of mental performance in the sport.

Two limitations constrain the field. First, the constructs of interest are heterogeneous and inconsistently operationalised: confidence, self-efficacy, mental energy, resilience, and motivation are measured with disparate instruments and are frequently examined in isolation rather than as an integrated system (Chuang et al., 2022; Haryanto et al., 2024b; Wang, 2023). This fragmentation obscures whether, and how strongly, mental training influences confidence specifically. Second, much of the psychologically oriented work in table tennis addresses states that impair performance, such as mental fatigue, rather than interventions that build enabling resources, leaving the applied question of what to train comparatively underexamined (Habay et al., 2021).

Methodological constraints compound these gaps. Existing syntheses in racket sports have targeted adjacent topics, notably mental fatigue and attentional focus, rather than confidence or mental training as such, and primary intervention studies are often limited by modest samples, short follow-up, and a scarcity of randomised designs (Ding et al., 2024; Starzak et al., 2024). No prior systematic review has consolidated the evidence on mental training and confidence in table tennis specifically, despite the accelerating output of relevant primary studies over the last five years. A dedicated synthesis is therefore both timely and necessary to map what has been done, to appraise its quality, and to distil defensible conclusions for practice.

Accordingly, this review systematically consolidates recent peer-reviewed evidence on mental training and confidence in table tennis athletes, clarifying the interventions that have been applied and the psychological outcomes they influence. By integrating findings across intervention and correlational designs, the review offers a coherent account of the cognitive-affective foundations of table tennis performance and identifies priorities for a more rigorous evidence base. The review is guided by two research questions:

RQ1: What types of mental training interventions have been applied to table tennis athletes?

RQ2: How do mental training interventions affect self-confidence and psychological performance in table tennis athletes?

Method

Research Design and Framework

A systematic literature review was adopted because it provides a transparent, replicable, and rigorous method for locating, appraising, and synthesising the available evidence on a defined question, thereby reducing the selection and interpretation bias inherent in narrative reviews (Liberati et al., 2009; Tranfield et al., 2003). The review was designed and reported in accordance with the Preferred Reporting Items for Systematic

Reviews and Meta-Analyses (PRISMA) 2020 statement, which specifies the identification, screening, eligibility, and inclusion stages that structure the study-selection process and its documentation (Page et al., 2021). The PRISMA framework was selected for its wide acceptance in sport and health science and for the auditability it confers on each decision in the selection pathway.

Search Strategy

Prior to constructing the search string, the review question was decomposed using the PICOS framework (Population, Intervention/Interest, Comparison, Outcome, Study design) to ensure the systematic identification of core search concepts. The Population comprised table tennis athletes across junior, senior, elite, and recreational levels. The Intervention/Interest encompassed mental training and psychological skills, including imagery, self-talk, goal setting, mindfulness, and mental practice. The Comparison was conventional training, no intervention, or alternative psychological interventions, where applicable. The Outcomes of interest were self-confidence, sport confidence, self-efficacy, and psychological performance. Eligible Study designs included experimental, quasi-experimental, observational, and mixed-method studies. Each PICOS element was translated into a cluster of synonyms and then combined with Boolean operators into a single search string executed in the title, abstract, and keyword fields. The exact Boolean search string applied in Scopus was:

> TITLE-ABS-KEY(("table tennis" OR "ping-pong") AND (psycholog* OR "mental training" OR cognitive OR confidence OR "self-confidence" OR motivation OR anxiety OR focus OR concentration OR imagery OR mindfulness))

Truncation was applied to capture morphological variants, so that psycholog* retrieved psychology, psychological, and psychologically. The field code TITLE-ABS-KEY restricted retrieval to the title, abstract, and author-keyword fields, focusing the search on records in which the target concepts were substantively addressed rather than mentioned in passing. Limiters were then applied for publication period, document type, language, source type, publication stage, and open-access availability, each justified in the eligibility criteria below. The string was piloted and refined iteratively; an initial narrower formulation returned too few psychologically relevant records, prompting the inclusion of adjacent cognitive-affective terms to improve sensitivity without unduly compromising precision. The PICOS framework here served solely to structure the search and is distinct from the design-specific appraisal procedure described below.

Databases and Information Sources

Scopus served as the primary and authoritative bibliographic source, chosen for its broad multidisciplinary coverage of peer-reviewed sport science, psychology, and health journals and for the structured metadata it provides for reproducible screening. The search was executed and the metadata exported in a single session to ensure a stable record set, and the export served as the evidence base for all selection counts and descriptive characteristics reported in this review.

Eligibility Criteria

Table 1. Inclusion and exclusion criteria.

Criterion	Inclusion	Exclusion
Publication period	2021–2025	Published before 2021
Document type	Journal article	Review, conference paper, book chapter, editorial, note
Language	English	Non-English
Source type	Journal	Book series, conference proceedings, trade publications
Publication stage	Final	In press / articles not in final form
Accessibility	Open access, full text available	Abstract only or full text not retrievable
Population	Table tennis athletes / players (any competitive level)	Non–table tennis populations or purely clinical cohorts not engaged as players
Focus / outcome	Directly addresses mental training and/or self-confidence and psychological performance	Purely biomechanical, physiological, technical, nutritional, or engineering focus with no psychological outcome

Study Selection Process

Study selection proceeded through three sequential stages. Screening was conducted independently by two reviewers at both the title-and-abstract and full-text stages. Inter-rater agreement was $\kappa = 0.81$ for title-and-abstract screening and $\kappa = 0.84$ for full-text assessment, indicating strong concordance; disagreements were resolved by discussion with reference to the eligibility criteria in Table 1, and borderline records were retained for full-text review rather than excluded at the abstract stage. First, duplicate records were identified and

removed. Second, the titles and abstracts of the remaining records were screened against the eligibility criteria to exclude records that were clearly irrelevant, for example those addressing table tennis solely from a biomechanical, physiological, or engineering perspective, or those addressing psychological constructs in populations other than table tennis players. Third, the full texts of the records that passed the title–abstract stage were assessed in detail for eligibility, and the final set of studies was retained for synthesis. Records were excluded at the full-text stage when their outcomes were unrelated to psychological or confidence constructs, when a psychological or cognitive focus was present but lacked a mental-training intervention or a confidence-related outcome, when the population were not table tennis athletes, or when the report was a review or otherwise non-empirical. Screening decisions were documented at each stage, and disagreements over borderline records were resolved through discussion until consensus was reached.

Quality Assessment

Methodological quality was appraised independently of the search strategy, using design-specific critical appraisal tools so that each study was evaluated with the instrument most appropriate to its design rather than with a single tool applied uniformly. The appraisal followed four steps: classification of each study by design; selection of the corresponding appraisal instrument; assessment of the study against every criterion in that instrument using the tool's own response categories; and integration of methodological strengths and limitations into the synthesis. Randomised controlled trials were appraised with the Cochrane Risk of Bias 2 tool; non-randomised and quasi-experimental studies with the Joanna Briggs Institute (JBI) quasi-experimental checklist; cohort and longitudinal studies with the JBI cohort checklist; and analytical cross-sectional and correlational studies with the JBI analytical cross-sectional checklist. Where mixed methods were present, the Mixed Methods Appraisal Tool was used (Hong et al., 2018). Consistent with the developers' guidance, aggregate numerical scores were not used as exclusion thresholds; instead, studies with greater methodological concerns were retained but interpreted with additional caution. Appraisal was conducted by two reviewers, with disagreements resolved by discussion and, where necessary, a third reviewer, and Inter-rater agreement was quantified using Cohen's kappa (Cohen, 1960), yielding $\kappa = 0.81$ for title-and-abstract screening and $\kappa = 0.84$ for full-text eligibility assessment, both indicating strong reliability by the benchmarks of Landis and Koch (1977). For quality appraisal specifically, the two reviewers achieved $\kappa = 0.79$, interpreted as substantial agreement; residual disagreements on individual checklist items were resolved through discussion, and where a third reviewer was needed, their judgement was final. The appraisal outcomes are summarised in Table 2.

Table 2. Summary of methodological quality appraisal of included studies.

Author(s), Year	Study design	Appraisal tool	Criterion results	Overall interpretation
Zhang et al., 2024	Cross-sectional (correlational)	JBI cross-sectional	Y, Y, Y, Y, U, Y, Y, Y	High
Tsou et al., 2024	Quasi-experimental	JBI quasi-experimental	Y, Y, Y, N, Y, Y, U, Y, Y	Moderate–High
Peng & Kim, 2023	Quasi-experimental (methodological)	JBI quasi-experimental	Y, U, Y, N, Y, Y, U, Y, Y	Moderate
Xu et al., 2025	Experimental (within-subject)	JBI quasi-experimental	Y, Y, Y, Y, Y, U, Y, Y, Y	High
To-aj et al., 2025	Randomised controlled trial	Cochrane RoB 2	Low–Some concerns across domains	Moderate–High
Wang et al., 2025	Randomised controlled trial	Cochrane RoB 2	Low–Some concerns across domains	High
Aparicio-Chueca & Muñoz-Vila, 2025	Cross-sectional survey	JBI cross-sectional	Y, Y, Y, Y, Y, U, Y, Y	High
Wang, 2023	Cross-sectional (correlational)	JBI cross-sectional	Y, Y, Y, Y, U, Y, Y, Y	Moderate–High
Liu, 2025	Longitudinal / cohort	JBI cohort	Y, Y, Y, Y, U, Y, Y, Y, U, Y, Y	High
Haryanto et al., 2024b	Cross-sectional (correlational)	JBI cross-sectional	Y, Y, Y, Y, U, Y, Y, Y	High
Akbari et al., 2023	Cross-sectional (correlational)	JBI cross-sectional	Y, Y, U, Y, U, Y, Y, Y	Moderate
Sharma & Prasad, 2023	Randomised controlled trial	Cochrane RoB 2	Some concerns (allocation, blinding)	Moderate
Sharma et al., 2024	Randomised controlled trial	Cochrane RoB 2	Some concerns (allocation, blinding)	Moderate

Author(s), Year	Study design	Appraisal tool	Criterion results	Overall interpretation
Luo & Li, 2024	Quasi-experimental	JBI quasi-experimental	Y, Y, Y, N, Y, Y, U, Y, Y	Moderate–High
Haryanto et al., 2024a	Cross-sectional (correlational)	JBI cross-sectional	Y, Y, Y, Y, U, Y, Y, Y	High
Tebourski et al., 2022	Quasi-experimental (controlled)	JBI quasi-experimental	Y, Y, Y, U, Y, Y, Y, Y, Y	High
Marchese et al., 2022	Cross-sectional survey	JBI cross-sectional	Y, Y, Y, Y, Y, Y, Y, Y	High
Chuang et al., 2022	Cross-sectional (correlational)	JBI cross-sectional	Y, Y, U, Y, U, Y, Y, Y	Moderate

Note. Y = Yes; N = No; U = Unclear. For randomised trials, domain-level RoB 2 judgements are summarised narratively rather than as item-level codes.

Data Extraction Procedure

A standardised extraction form was used to record, for each included study, the authors and year, country of data collection, study design, sample characteristics, the mental training intervention or psychological construct examined, the outcome measures, and the principal findings. Extraction was performed by one reviewer and verified by a second to minimise transcription error, and the extracted fields provided the basis for the descriptive tables and the thematic synthesis that follow.

Bibliometric and Thematic Mapping

To characterise the corpus, descriptive bibliometric mapping was undertaken across publication year, country of data collection, and the psychological constructs addressed. Author keywords and construct labels were grouped to identify recurring thematic clusters, which informed the organisation of the synthesis. This mapping was descriptive in purpose and was used to visualise the distribution and emphasis of the evidence rather than to generate formal network statistics.

Data Analysis and Synthesis

Given the heterogeneity of designs, populations, and outcome measures, a quantitative meta-analysis was not appropriate; instead, evidence was combined using thematic synthesis (Thomas & Harden, 2008). Findings from each study were coded inductively, related codes were grouped into descriptive themes, and these were developed into analytical themes aligned with the two research questions. The synthesis deliberately moved beyond enumeration of individual studies to examine convergence, divergence, and nuance across the corpus, and the credibility of each theme was weighed against the methodological quality of its contributing studies.

Reporting and Documentation

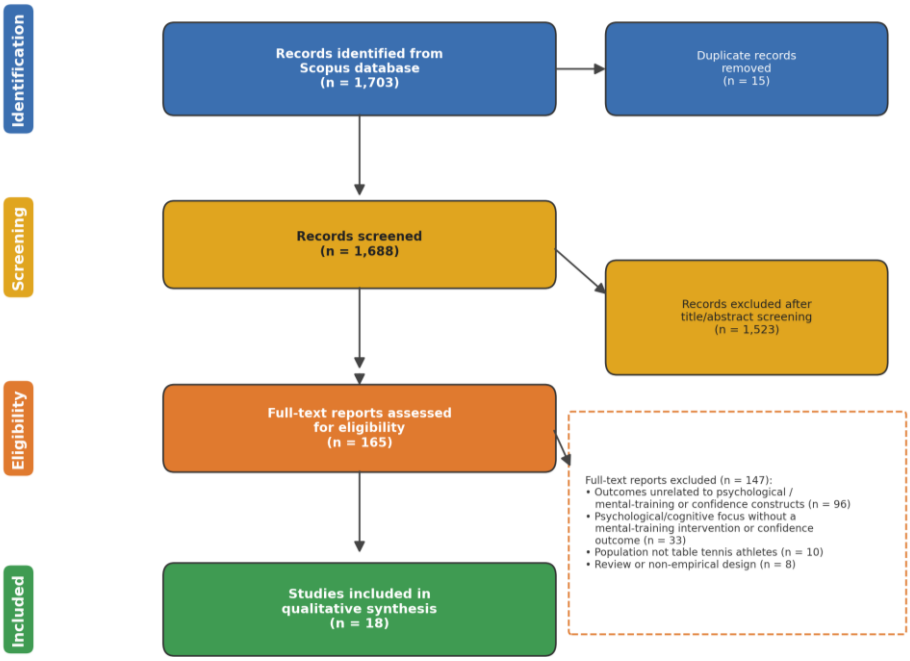

Figure 1. PRISMA 2020 flow diagram of the study-selection process.

The review complied with the PRISMA 2020 checklist for the reporting of systematic reviews, and the flow of records through identification, screening, eligibility, and inclusion is documented in the PRISMA flow diagram. (Page et al., 2021).

Results and Discussions

Study Selection Results

The search of Scopus identified 1,703 records. After the removal of 15 duplicate records, 1,688 records remained and were screened at the title and abstract level, at which stage 1,523 records were excluded as clearly irrelevant to mental training or confidence in table tennis. The full texts of the remaining 165 records were assessed for eligibility, and 147 were excluded with reasons: 96 reported outcomes unrelated to psychological, mental-training, or confidence constructs; 33 addressed psychological or cognitive topics without a mental-training intervention or a confidence-related outcome; 10 involved populations that were not table tennis athletes; and 8 were reviews or otherwise non-empirical. Eighteen studies satisfied all criteria and were retained for qualitative synthesis. This flow is depicted in Figure 1 and is numerically consistent across the abstract, methods, and results.

Descriptive Characteristics of Included Studies

The eighteen included studies were published between 2022 and 2025, with a marked concentration in 2024 and 2025, indicating rapidly intensifying interest in the psychological dimensions of table tennis (Figure 2). Geographically, the evidence base was dominated by studies conducted in China, followed by Indonesia and India, with additional contributions from Taiwan, Italy, Spain, Thailand, and Tunisia, reflecting the sport's strongest competitive and research cultures (Figure 3). The corpus combined intervention designs, including randomised and quasi-experimental trials, with a substantial body of correlational and cross-sectional work, and it spanned populations from children and older adults to elite and para-athletes. The characteristics of each study are summarised in Table 3, and their classification by theme and method is presented in Table 4.

Table 3. Summary of included studies.

Author(s), Year	Title	Country	Design	Key findings
Zhang et al., 2024	The Divergent Effects of Resilience Qualities and Resilience Support in Predicting Pre-Competition Anxiety and Championship Performance	China	Cross-sectional (two samples)	Resilience qualities, rather than resilience support, predicted lower pre-competition cognitive anxiety and superior championship performance, with anxiety mediating the relationship.
Tsou et al., 2024	Para table tennis improves psychological/mental and cardiovascular health in individuals with spinal cord injury	Taiwan	Quasi-experimental	A four-week para table tennis programme reduced physical stress and improved self-efficacy and autonomic (vagal) regulation in adults with spinal cord injury.
Peng & Kim, 2023	Psychological Training Method for Table Tennis Players Using Deep Learning	China	Quasi-experimental (methodological)	A deep-learning, heart-rate–based system improved the accuracy of monitoring players' physiological states to inform and adjust psychological training.
Xu et al., 2025	Enhanced proactive control under stress: divergent neural dynamics of social vs. monetary rewards in table tennis athletes	China	Experimental (within-subject)	Social (intrinsic) rewards restored proactive cognitive control under acute stress more effectively than monetary rewards, evidenced behaviourally and neurally.
To-aj et al., 2025	Comparing Competitive and Recreational Table Tennis Training: Impacts on Quality of Life in Older Adults — A Randomized Controlled Trial	Thailand	Randomised controlled trial	Structured competitive training yielded greater gains in psychological and physical quality-of-life domains than recreational play among older adults.
Wang et al., 2025	The impact of table tennis intervention on short video addiction among college students in China: the chained mediation effect of	China	Randomised controlled trial	A sixteen-week table tennis intervention reduced short-video addiction through a chain mediation of reduced cognitive bias and improved self-control.

Author(s), Year	Title	Country	Design	Key findings
	cognitive bias and self-control			
Aparicio-Chueca & Muñoz-Vila, 2025	Table Tennis for Health: A Multidimensional Perspective on Its Physical, Emotional, and Social Advantages	Spain	Cross-sectional survey	Regular practice was perceived to deliver substantial emotional and social benefits alongside physical–cognitive gains, supporting the sport's multidimensional psychological value.
Wang, 2023	How self-reflection and resilience can affect pre-competition anxiety? Evidence from national competitive table tennis in adolescent players	China	Cross-sectional (correlational)	Self-insight and resilience significantly predicted lower cognitive and somatic pre-competition anxiety in adolescent players.
Liu, 2025	Multidisciplinary correlates of table tennis participation in children: a concept mapping study	China	Longitudinal (12 months)	Sustained participation was associated with improved self-efficacy and psychological resilience and with reduced perceived stress in children.
Haryanto et al., 2024b	Self-Confidence and Cognitive Speed: Key Predictors of Topspin Accuracy in Competitive Table Tennis	Indonesia	Cross-sectional (correlational)	Self-confidence and cognitive processing speed were significant positive predictors of topspin stroke accuracy in competitive players.
Akbari et al., 2023	Impact of reaction speed, eye-hand coordination, and achievement motivation on backhand drive skills of table tennis players	Indonesia	Cross-sectional (correlational)	Achievement motivation, together with reaction speed and eye-hand coordination, contributed significantly to backhand drive performance.
Sharma & Prasad, 2023	Effect of VMBR Training on Psychological Dimensions of Anxiety and Mental Toughness of Table Tennis Players	India	Randomised controlled trial	Six weeks of visuo-motor behaviour rehearsal significantly reduced sport anxiety and enhanced mental toughness relative to a control group.
Sharma et al., 2024	Analyzing the Impact of VMBR Training on Table Tennis Players' Competence in Performing Alternate Counter and Forehand Drive Shots With Precision	India	Randomised controlled trial	A twelve-week visuo-motor behaviour rehearsal programme significantly improved counter and forehand-drive precision, indicating transfer from mental rehearsal to technical execution.
Luo & Li, 2024	Application of psychological model — ARCS motivational strategies in teaching table tennis curriculum in elementary schools	China	Quasi-experimental	ARCS-model teaching significantly increased learning motivation and course interest and improved skill attainment compared with traditional instruction.
Haryanto et al., 2024a	Exploring cognitive processing speed, emotional intelligence, and topspin shot accuracy in table tennis	Indonesia	Cross-sectional (correlational)	Emotional intelligence and cognitive processing speed were positively associated with topspin accuracy, highlighting affective-cognitive contributions to performance.
Tebourski et al., 2022	Effects of Mindfulness for Performance Programme on Actual Performance in Ecological Sport Context: Two Studies in Basketball and Table Tennis	Tunisia	Quasi-experimental (controlled)	The Mindfulness For Performance programme increased mindfulness skills and improved actual performance in young table tennis players relative to control.
Marchese et al., 2022	Personality Traits and Motives in Table Tennis Players	Italy	Cross-sectional survey	Players scored highest on conscientiousness and were driven predominantly by intrinsic, self-determined motives, irrespective of competitive level.

Author(s), Year	Title	Country	Design	Key findings
Chuang et al., 2022	Pre-competition mental energy and performance relationships among physically disabled table tennis players	Taiwan	Cross-sectional (two studies)	Higher pre-competition mental energy was positively associated with subjective performance among elite and national para-athletes.

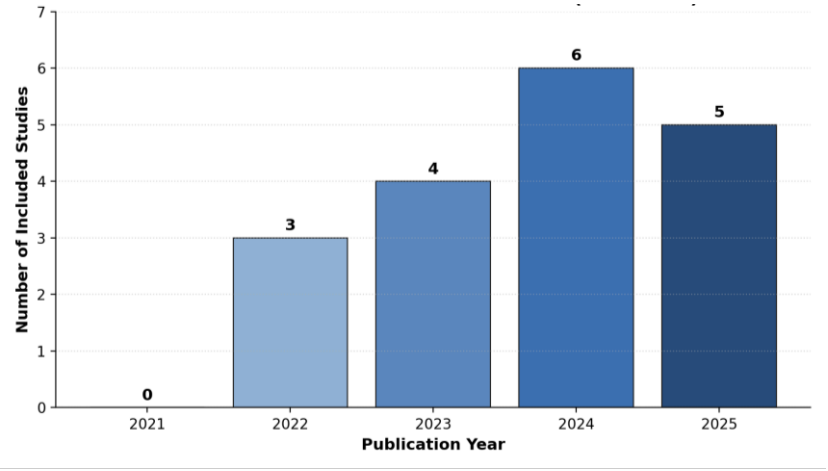

Figure 2. Annual distribution of the included studies (2021–2025).

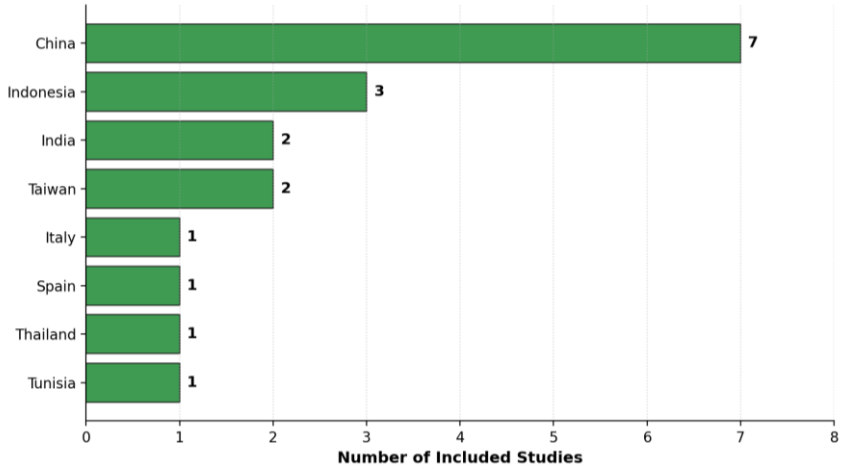

Figure 3. Geographic distribution of the included studies by country of data collection.

Table 4. Classification of included studies by theme and method.

Author(s), Year	Country	Research design	Theme / focus	Intervention / correlate	Outcome
Sharma & Prasad, 2023	India	RCT	Structured mental-skills training	Visuo-motor behaviour rehearsal	Reduced anxiety; increased mental toughness
Sharma et al., 2024	India	RCT	Structured mental-skills training	Visuo-motor behaviour rehearsal	Improved stroke precision
Tebourski et al., 2022	Tunisia	Quasi-experimental	Structured mental-skills training	Mindfulness for performance	Increased mindfulness; improved performance
Peng & Kim, 2023	China	Quasi-experimental	Structured mental-skills training	Deep-learning psychological monitoring	More accurate training regulation
Luo & Li, 2024	China	Quasi-experimental	Motivation & motivational strategies	ARCS motivational model	Higher motivation; better skill attainment

Author(s), Year	Country	Research design	Theme / focus	Intervention / correlate	Outcome
Akbari et al., 2023	Indonesia	Correlational	Motivation & motivational strategies	Achievement motivation	Better backhand drive skill
Marchese et al., 2022	Italy	Cross-sectional	Motivation & motivational strategies	Personality & intrinsic motives	Conscientiousness; self-determined motivation
Haryanto et al., 2024b	Indonesia	Correlational	Self-confidence & self-efficacy	Self-confidence; cognitive speed	Higher topspin accuracy
Tsou et al., 2024	Taiwan	Quasi-experimental	Self-confidence & self-efficacy	Para table tennis programme	Increased self-efficacy; better health
Liu, 2025	China	Longitudinal	Self-confidence & self-efficacy	Sustained participation	Improved self-efficacy; resilience
Zhang et al., 2024	China	Cross-sectional	Anxiety, resilience & emotional regulation	Resilience qualities	Lower anxiety; better performance
Wang, 2023	China	Correlational	Anxiety, resilience & emotional regulation	Self-reflection; resilience	Lower pre-competition anxiety
Chuang et al., 2022	Taiwan	Correlational	Anxiety, resilience & emotional regulation	Pre-competition mental energy	Higher subjective performance
Xu et al., 2025	China	Experimental	Anxiety, resilience & emotional regulation	Reward under acute stress	Restored proactive control
To-aj et al., 2025	Thailand	RCT	Well-being, QoL & psychosocial benefits	Competitive vs recreational training	Greater psychological QoL
Wang et al., 2025	China	RCT	Well-being, QoL & psychosocial benefits	Table tennis intervention	Improved self-control; reduced addiction
Aparicio-Chueca & Muñoz-Vila, 2025	Spain	Cross-sectional	Well-being, QoL & psychosocial benefits	Regular practice	Emotional & social benefits
Haryanto et al., 2024a	Indonesia	Correlational	Emotional intelligence & cognitive-affective correlates	Emotional intelligence; cognitive speed	Higher topspin accuracy

Thematic Synthesis

Two analytical themes were developed to address the research questions. The first concerns the range of mental training approaches applied to table tennis athletes, and the second concerns their effects on confidence and psychological performance. Within these, six descriptive clusters emerged, as visualised in Figure 4.

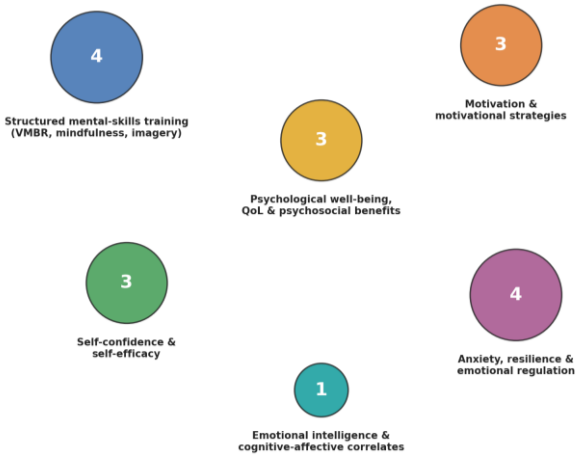

Figure 4. Thematic clusters derived from the included studies; bubble size is proportional to the number of contributing studies.

Findings for RQ1: Types of mental training applied to table tennis athletes
The corpus reveals a modest but diversifying repertoire of mental training approaches. The most clearly delineated interventions were structured mental-skills programmes. Visuo-motor behaviour rehearsal featured prominently, delivered over six to twelve weeks in randomised designs that combined relaxation with imagery-based rehearsal of match situations (Sharma & Prasad, 2023; Sharma et al., 2024). Mindfulness-based training was also applied through a purpose-built Mindfulness For Performance programme that progressed from psychoeducation and attentional identification to acceptance training and integration into competition (Tebourski et al., 2022). A more technologically oriented form of psychological training was represented by a deep-learning system that monitored players' physiological states to inform the calibration of mental preparation, illustrating the entry of data-driven methods into this space (Peng & Kim, 2023).

A second, motivationally grounded category was evident in pedagogic and dispositional work. The ARCS motivational model was implemented as a teaching strategy to sustain attention, relevance, confidence, and satisfaction during instruction, producing gains in learning motivation and skill (Luo & Li, 2024). Complementing these applied strategies, correlational and survey studies characterised the motivational and personality profiles that underpin engagement, reporting that players are distinguished by conscientiousness and by predominantly intrinsic, self-determined motives, and that achievement motivation is bound up with technical skill acquisition (Akbari et al., 2023; Marchese et al., 2022). Taken together, the evidence indicates that mental training in table tennis currently spans deliberate skills-based interventions, motivational pedagogies, and technology-assisted monitoring, although structured, replicable protocols remain concentrated in a small number of research groups.

Findings for RQ2: Effects on self-confidence and psychological performance
Across designs, the evidence converges on the conclusion that mental resources shape performance, and that confidence and its cognate constructs are central to this relationship. Self-confidence was identified as a direct and significant predictor of the accuracy of decisive strokes, with confident players executing topspin shots more reliably than less confident peers, and emotional intelligence and cognitive processing speed acting alongside confidence in the same predictive space (Haryanto et al., 2024a, 2024b). Self-efficacy showed similar behaviour: participation-based interventions raised self-efficacy in both clinical-athletic and developmental populations, coupling psychological gains with improvements in health and resilience (Liu, 2025; Tsou et al., 2024). These findings position confidence not as an epiphenomenon of skill but as a modifiable contributor to it.

The intervention studies extend this correlational picture toward causal inference. Visuo-motor behaviour rehearsal reduced somatic and cognitive anxiety and enhanced mental toughness, and a comparable programme improved the precision of counter and forehand-drive strokes, demonstrating transfer from covert rehearsal to overt performance (Sharma & Prasad, 2023; Sharma et al., 2024). Mindfulness training likewise improved actual competitive performance in young players by strengthening attentional stability under pressure (Tebourski et al., 2022). Anxiety and its regulation recurred as a pivotal mechanism: resilience qualities and self-reflection predicted lower pre-competition anxiety and, in turn, superior championship performance, while pre-competition mental energy tracked subjective performance in para-athletes, and intrinsic rewards restored proactive cognitive control under acute stress (Chuang et al., 2022; Wang, 2023; Xu et al., 2025; Zhang et al., 2024). Finally, broader psychosocial gains, encompassing quality of life, self-control, and emotional and social well-being, accompanied structured engagement with the sport, underscoring that mental training benefits extend beyond the scoreboard (Aparicio-Chueca & Muñoz-Vila, 2025; To-aj et al., 2025; Wang et al., 2025).

Comparative and Critical Analysis
Methodologically, the corpus is bifurcated. A minority of studies employed randomised or controlled intervention designs capable of supporting causal claims, and these clustered around visuo-motor behaviour rehearsal and participation-based programmes (Sharma & Prasad, 2023; Sharma et al., 2024; To-aj et al., 2025; Wang et al., 2025). The majority relied on cross-sectional and correlational designs that, although informative about association, cannot establish direction of effect (Akbari et al., 2023; Chuang et al., 2022; Haryanto et al., 2024a, 2024b; Marchese et al., 2022). Sample sizes ranged from small experimental groups to survey cohorts of several hundred, and outcome measurement was notably heterogeneous, with confidence, self-efficacy, mental energy, and resilience each assessed by different instruments. This methodological unevenness means that the strongest applied claims, those concerning structured mental-skills training, rest on relatively few trials, whereas the constructs of greatest theoretical interest, confidence and self-efficacy, are most often examined in designs that cannot isolate their causal contribution. Over the

review period, a discernible shift toward interventionist and technology-assisted approaches is nonetheless evident, suggesting a field in methodological transition. Adjacent experimental work on attentional-focus instructions, although centred on motor accuracy rather than confidence, reinforces the trainability of cognitive strategies in the sport and points to methods that future confidence-focused trials could adapt (Łuba-Arnista et al., 2025; Niźnikowski et al., 2022).

Interpreted as a whole, the evidence supports a cognitive-affective account of table tennis performance in which confidence occupies a central, mediating role. Deliberate mental training appears to operate by lowering competitive anxiety and stabilising attention, thereby freeing the perceptual-motor system to express the technical skill that expert players already possess. This reading is consistent with the well-documented cognitive superiority of experienced players and locates confidence and emotional regulation as the self-regulatory layer through which that cognitive capacity is realised under pressure (Chen et al., 2024; Huang et al., 2024; Shi et al., 2024).

Theoretically, the findings extend self-regulation and confidence frameworks into a sport-specific context by showing that resilience and self-reflection reduce anxiety, that intrinsic motivation and rewards protect cognitive control under stress, and that self-efficacy is responsive to structured participation (Liu, 2025; Wang, 2023; Xu et al., 2025; Zhang et al., 2024). They suggest that confidence in table tennis is best understood not as a stable trait but as a trainable state embedded within a network of related psychological resources. Practically, the review offers coaches a defensible starting point: brief, structured mental-skills protocols, especially visuo-motor behaviour rehearsal and mindfulness, are the most evidentially supported means of building confidence and composure, and motivationally informed instruction can sustain engagement from the earliest stages of development (Luo & Li, 2024; Sharma & Prasad, 2023; Tebourski et al., 2022).

Situated against prior syntheses in racket sports, which have concentrated on mental fatigue and attentional focus rather than on confidence or mental training, this review addresses a genuine gap by consolidating the enabling, rather than the impairing, side of the psychological ledger (Ding et al., 2024; Starzak et al., 2024). Some tensions nonetheless remain in the literature. The primacy of intrinsic over extrinsic motivation is broadly supported yet complicated by evidence that both reward types can benefit cognition under different conditions, and the relative contribution of confidence versus cognitive speed to stroke accuracy is not fully resolved across studies (Haryanto et al., 2024a, 2024b; Xu et al., 2025). Such contradictions likely reflect differences in population, measurement, and task demand rather than fundamental disagreement.

Several research gaps follow. First, confidence is rarely the primary target of intervention, being more often measured as a correlate than manipulated as an outcome. Second, standardised, sport-specific measures of table tennis confidence are lacking, which impedes comparison across studies. Third, the developmental and para-athlete populations, though promisingly represented, are underpowered for firm conclusions. The review also has limitations. Its reliance on a single database and on English-language, open-access journal articles may have excluded relevant evidence; the small number of controlled trials constrains causal inference; and the heterogeneity of outcomes precluded meta-analysis. A future research agenda should therefore prioritise adequately powered randomised trials that target confidence directly, the development and validation of sport-specific confidence instruments, and longitudinal designs that trace how mental training shapes confidence across the developmental pathway. In answer to the research questions, the evidence indicates that the mental training applied to table tennis athletes comprises structured mental-skills programmes (notably visuo-motor behaviour rehearsal and mindfulness), motivational pedagogies, and technology-assisted monitoring (RQ1); and that these approaches, together with the confidence, self-efficacy, motivation, and resilience they engage, reduce competitive anxiety and enhance both technical accuracy and broader psychological performance (RQ2).

Conclusions

This systematic review of eighteen studies published between 2022 and 2025 shows that mental training in table tennis is delivered chiefly through structured mental-skills programmes, particularly visuo-motor behaviour rehearsal and mindfulness, alongside motivational pedagogies and emerging technology-assisted methods, thereby answering the first research question. In answer to the second, these approaches, and the confidence, self-efficacy, motivation, and resilience they cultivate, consistently reduce competitive anxiety and improve technical accuracy and psychological performance. The review's core contribution is to consolidate, for the first time, the enabling psychological evidence in this sport and to position confidence as

a trainable, mediating resource. For coaches, brief structured protocols offer a practical route to building composure and self-belief. These conclusions are tempered by a scarcity of randomised trials and heterogeneous confidence measures, and the field would be materially advanced by adequately powered trials that target confidence directly and by validated, sport-specific measurement.

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