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TYPES OF MOTOR AND MENTAL TRAINING AND THEIR IMPACT ON IMPROVING SKIERS' SKILLS – A REVIEW ARTICLE

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ABSTRACT

This review article consolidates current evidence on the role of motor and mental training in enhancing skiing performance across alpine, cross-country, and ski jumping disciplines. Analysis of 21 original research studies revealed that simulation-based and imitative motor training significantly improve interlimb coordination, postural control, and technical precision—especially during ski turns and take-off phases. In ski jumping, biomechanical refinement and repetition-based imitation enhance energy transfer and movement stability.

Mental and perceptual training components—including psychological resilience, low anxiety, and predictive cognitive strategies—are associated with improved skill acquisition, faster reaction times, and more consistent performance under competitive stress. Balance training, particularly when sport-specific, was shown to predict technical proficiency and reduce fall-related injuries by improving neuromuscular control.

Injury prevention strategies focused on understanding key trauma mechanisms such as ACL-related slip-catch and improper landings, with emphasis placed on correcting technique and adapting equipment to skill level. Furthermore, strength and endurance training support fatigue resistance and biomechanical control, with special relevance to upper-body output in cross-country skiing and load management in alpine disciplines.

Youth-specific training strategies should be guided by biological maturity rather than chronological age to support safe and effective athletic development. Collectively, the findings support a multidisciplinary, individualized, and periodized approach to skier development. This synthesis provides evidence-based guidance for training program design and identifies areas for future longitudinal research.

KEYWORDS
Skiing Performance, Motor Training, Mental Training, Balance Training, Injury Prevention; Biomechanical Optimization

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Introduction.

The enhancement of athletic performance through structured training interventions has been a central theme of sports science for decades. Both motor and mental training methods have demonstrated significant value in improving functional capacities, neuromuscular efficiency, and psychological readiness across a broad range of disciplines. Numerous studies have confirmed that targeted motor training can optimize coordination, balance, strength, and endurance, while psychological interventions may reduce anxiety, improve focus, and accelerate skill acquisition. Despite this growing body of evidence, ongoing research continues to explore how various training modalities interact with the specific demands of different sports, and how such interventions may be optimized for particular athletic populations.

Skiing, encompassing alpine, cross-country, and ski jumping disciplines, represents a unique domain within elite sport due to its complex combination of technical precision, physical demand, cognitive reactivity, and environmental variability. Athletes must perform under rapidly changing surface conditions, manage high-speed directional changes, and maintain biomechanical efficiency in both stable and unstable postures. These requirements place extraordinary stress on the musculoskeletal and neuromotor systems, while simultaneously demanding sustained psychological resilience and perceptual awareness. Consequently, skiing serves as an ideal model to examine the integrative role of both physical and cognitive training interventions in complex, high-risk athletic environments.

Although multiple components of skiing performance have been previously studied in isolation—including strength development, proprioceptive training, mental preparation, and injury prevention strategies—there is limited comprehensive synthesis of how these modalities collectively impact skier development. Additionally, with advances in technology and sport-specific assessment tools, newer studies offer more refined insight into the biomechanics, neurocognitive mechanisms, and psychological attributes that underpin elite skiing performance.

The aim of this review article is to systematically consolidate recent scientific findings related to various forms of motor and mental training and to evaluate their collective influence on the improvement of skiing-specific skills. By analyzing current evidence from peer-reviewed research, this article seeks to address the central question posed in its title: how do different types of motor and mental training impact the development and performance of skiers? In doing so, it aims to provide a foundation for further evidence-based practices in the design of training programs tailored to the multifaceted demands of skiing disciplines.

Methodology

A structured literature review was conducted in May 2025 using the PubMed database. Search terms included combinations of: motor preparation AND skiing performance, mental preparation AND skiing performacne. The search was limited to peer-reviewed studies published in English and involving human participants.

Inclusion criteria focused on studies that objectively assessed the impact of training interventions—motor, psychological, biomechanical, or physiological—on skiing performance or injury risk. Duplicates were removed, and abstracts were screened for relevance. Full-text analyses were performed on eligible articles.

Studies were evaluated based on methodological quality, sample characteristics, training type, and outcome measures related to skiing-specific performance. In total, 21 original research articles were selected and thematically grouped according to training category: motor coordination, imitation, psychological preparation, balance, injury prevention, strength and endurance, and youth development.

Results:

Motor and coordination training constitutes a foundational element in the technical preparation of competitive skiers. The execution of efficient skiing movements requires synchronized interlimb coordination, stabilization of the body axis, and precise control of the center of mass during high-speed turns and transitions. Studies utilizing ski simulators confirm that repeated exposure to simulated skiing conditions leads to enhanced movement smoothness and improved local and global motor control (Nourrit et al., 2003), (Hong & Newell, 2006). Athletes engaging in simulator-based training demonstrate increased rhythm, intersegmental stability, and reduced compensatory body sway during dynamic shifts in direction, which are essential in alpine skiing environments.In ski jumping, effective coordination of the lower limbs during the take-off phase has been shown to strongly correlate with jump length and technical quality. An analysis of elite jumpers revealed precise, time-locked coordination patterns of hip, knee, and ankle extension during the push-off phase, suggesting that biomechanical refinement of this phase may significantly enhance flight trajectory and energy transfer (Chardonnens et al., 2013). Imitative training was also found to be beneficial in reinforcing these kinematic patterns (Ettema et al., 2020). Collectively, the findings suggest that both simulator-based and imitative training offer measurable neuromuscular benefits and technical improvements that directly impact skiing performance. These modalities should be considered essential components of motor preparation programs for competitive skiers.

Imitative training and biomechanical refinement are critical components in ski jumping performance, particularly in the take-off and flight phases. Findings demonstrate that well-structured imitation training improves the technical execution of jumps by reinforcing optimal motor patterns associated with lower-limb extension and control of the center of mass (Ettema et al., 2020). These rehearsed movements allow athletes to transfer learned coordination into full-speed take-offs with reduced variability and increased mechanical precision.The biomechanical analysis of the take-off phase reveals that elite athletes exhibit highly synchronized intersegmental patterns in the hip, knee, and ankle joints. These coordinated extensions produce linear movement of the center of mass and stabilize the body during the critical transition from ramp to flight (Chardonnens et al., 2013). Furthermore, studies of Olympic-level athletes indicate that ski jumpers develop distinct flight styles, which are stable and individualized but not necessarily predictive of performance quality (Schmolzer & Muller, 2005). Nevertheless, consistent flight mechanics contribute to better control in the air and safer landings.Together, these findings highlight the value of combining imitation training with biomechanical diagnostics. Such integration enhances neuromuscular control and supports technical precision in ski jumping, especially during the take-off and early flight phases.

Psychological and perceptual components play a fundamental role in shaping motor learning and performance outcomes in skiing disciplines. Competitive alpine skiing, in particular, imposes significant cognitive and emotional demands on athletes, requiring efficient fear regulation, attention control, and stress resilience. Research demonstrates that sport courage, reduced anxiety, and the ability to manage fear are positively associated with improved motor learning and technical efficiency in skiing education environments (Cigrovski et al., 2018). These psychological traits support the acquisition of new skills and the maintenance of stability in high-pressure situations.At the neurocognitive level, expert skiing performance involves the use of predictive mechanisms such as egocentric chunking. This process allows athletes to organize environmental inputs into temporally structured motor routines, enabling faster and more efficient responses to dynamic external conditions (Lappi, 2022). Such anticipatory processing reduces reaction times and enhances the fluidity of movement in unpredictable skiing environments.Moreover, psychological health is increasingly recognized as a prerequisite for sustained elite performance. Athletes and coaches who acknowledge the role of mental well-being and cognitive load in training design are better equipped to manage long-term athletic development and injury risk (Bonell Monsonis et al., 2025). Collectively, these findings emphasize the necessity of integrating psychological and perceptual training into skiing programs to support both technical mastery and mental resilience.

Postural balance is a fundamental requirement in skiing disciplines, where athletes must maintain control over body position while exposed to dynamic forces, unstable surfaces, and high speeds. Research shows that both static and dynamic balance capacities are positively correlated with skiing performance, particularly among youth alpine skiers (Hrysomallis, 2011). Advanced skiers demonstrate significantly better postural stability than beginners, especially in situations involving rapid directional changes or single-leg support during turns.Sport-specific balance tests (SST), which replicate the unique demands of skiing movements, have been shown to be more accurate predictors of skier proficiency than generic balance tests. These SSTs not only correlate with competition rankings but also capture neuromuscular adaptations related to skiing technique (Rizzato et al., 2023). Their diagnostic value lies in their sensitivity to small differences in motor control, which are critical at the elite level. Moreover, proprioceptive and dynamic balance training programs have demonstrated efficacy in improving stability under sport-specific conditions. By targeting joint position sense, neuromuscular reflexes, and intersegmental control, such training reduces fall risk and enhances technical execution in skiing.Collectively, these findings highlight the importance of systematically incorporating balance training and SST diagnostics into skiing development programs, both for injury prevention and performance enhancement.

Skiing, particularly at the competitive level, exposes athletes to a high risk of traumatic injury due to high speeds, complex movement patterns, and unstable environmental conditions. Two major areas have been identified in relation to injury prevention: (1) mechanisms of injury and (2) training-based interventions for risk mitigation. Research analyzing injury severity among skiers and snowboarders found that lower self-reported skill level is associated with a higher proportion of moderate to severe injuries, especially among snowboarders (Goulet et al., 2010). This highlights the importance of skill-appropriate progression and individualized training in injury prevention. A separate video analysis of anterior cruciate ligament (ACL) injuries in World Cup alpine skiers revealed three dominant injury mechanisms: slip-catch, landing back-weighted, and dynamic snowplow (Bere et al., 2011). Each of these involves rapid force transfer and excessive valgus loading at the knee joint. Slip-catch, in particular, results from sudden edge engagement that forces the knee into internal rotation and valgus under load.The findings suggest that optimizing skiing technique—especially in edge control, landing strategy, and body alignment—along with adequate neuromuscular training and snow condition awareness, plays a key role in reducing injury risk. Tailoring equipment and technical strategies to individual skill levels and environmental variability further supports injury prevention efforts in competitive skiing.

High-level skiing performance depends heavily on the athlete's ability to generate power, sustain muscular output, and maintain technical precision under fatigue. Several studies highlight the physiological and biomechanical demands of both alpine and cross-country skiing, emphasizing the role of targeted strength and endurance training programs. In cross-country skiing, upper-body strength—especially in the latissimus dorsi, triceps, and core muscles—has been shown to significantly correlate with double poling sprint performance and peak pole force production (Mende et al., 2019). Endurance capacity, measured through VO_2max and oxygen cost, fluctuates seasonally in elite skiers and is closely tied to performance variability. Off-season endurance training focused on improving aerobic efficiency, oxygen deficit tolerance, and lactate threshold has demonstrated substantial benefits (Losnegard et al., 2013), (Hebert-Losier et al., 2017). Moreover, Norwegian training models emphasize periodization, balancing high volumes of low-intensity aerobic work with blocks of high-intensity intervals to optimize physiological adaptation (Tonnessen et al., 2024). Biomechanical analyses also point to the importance of lower-limb strength and eccentric control in alpine skiing, particularly for managing external loads during turns and absorbing impact forces (Hebert-Losier et al., 2014). Olympic preparation programs have integrated concurrent training strategies combining strength and aerobic work, improving neuromuscular coordination and fatigue resistance (Gilgien et al., 2018), (Berryman et al., 2019). Altogether, strength and endurance training—when properly periodized and sport-specific—supports performance sustainability, injury prevention, and competitive success in all skiing disciplines.

The optimization of training strategies for young skiers requires careful consideration of biological maturation, motor abilities, and anthropometric variables. In cross-country skiing, studies show that performance in youth categories is strongly influenced by strength, endurance, coordination, and sex-specific physiological development (Stoggl et al., 2015). Tests assessing upper- and lower-body strength, as well as aerobic and anaerobic endurance, have been found to predict race performance with significant accuracy.Biological maturity, rather than chronological age, appears to be a more accurate predictor of skiing ability in adolescent athletes. In particular, boys demonstrate stronger associations between

performance and physical parameters, likely due to earlier and more pronounced gains in lean muscle mass and cardiovascular efficiency (Hebert-Losier et al., 2017). These findings suggest that individualized training based on maturational stage may be more effective than group-based models organized by calendar age. Furthermore, technique and maximal skiing speed have been shown to be key determinants of performance in youth skiers. Optimizing biomechanical efficiency at an early stage may provide lasting benefits throughout athletic development (Stoggl et al., 2023). In sum, training programs for young skiers should integrate strength, endurance, and coordination elements tailored to biological age and individual profiles, supporting safe and progressive development of elite performance potential.

Discussion

This review demonstrates that skiing performance across alpine, cross-country, and ski jumping disciplines is driven by an integrated framework of motor, cognitive, biomechanical, and physiological training components. Motor and coordination training using ski simulators and imitative exercises leads to improved intersegmental control and postural precision. These interventions enhance movement smoothness and efficiency, particularly during high-speed turns in alpine skiing and explosive take-off in ski jumping. Repetition in a controlled environment allows for neuromuscular adaptations that improve energy transfer, rhythm, and technique stability.

In ski jumping, imitative training directly supports the development of coordinated push-off mechanics. Precise replication of joint extension sequences reinforces motor learning and translates to consistent execution under full load. Biomechanical studies have also highlighted that individual flight styles, while not predictive of performance, are internally stable and contribute to safe, controlled aerial phases. The ability to self-organize movement patterns suited to an athlete's morphology and air resistance conditions is crucial to minimizing technical errors and injury risk.

Psychological and perceptual factors significantly affect skill acquisition and decision-making efficiency. Athletes with high stress resilience and lower anxiety levels learn more effectively and perform more reliably under pressure. Cognitive mechanisms such as egocentric chunking improve the anticipation and structuring of environmental stimuli, allowing for faster motor responses and reduced error rates during dynamic skiing tasks.

Balance training plays a dual role in performance and injury prevention. Sport-specific balance assessments correlate more strongly with skiing proficiency than general tests, reflecting the functional relevance of proprioceptive and dynamic control. Targeted balance exercises enhance postural stability, reduce fall-related injuries, and improve control on uneven terrain.

Understanding injury mechanisms such as slip-catch, landing back-weighted, and dynamic snowplow has enabled more effective preventive strategies. These include refining landing techniques, improving edge control, and adjusting equipment to skill level and snow conditions, thereby reducing mechanical stress on vulnerable joints.

Finally, strength and endurance conditioning support technique, power output, and fatigue resistance. Upper-body strength contributes to effective double poling in cross-country skiing, while periodized training models enhance aerobic efficiency. Among youth athletes, biological maturity—not age—predicts performance, highlighting the importance of individualized, developmentally appropriate training interventions.

Conclusions

This review article has synthesized current evidence on the effectiveness of various motor and mental training strategies in enhancing skiing performance across multiple disciplines, including alpine skiing, cross-country skiing, and ski jumping. The findings strongly support the integration of simulation-based and imitative motor training, which demonstrably improves interlimb coordination, postural control, and technical precision. Particularly in ski jumping, biomechanical refinement of take-off mechanics and individualized flight control benefit significantly from structured repetition and targeted imitation training.

Equally essential are psychological and perceptual training components. Psychological attributes such as low anxiety and high sport courage, along with neurocognitive mechanisms like egocentric chunking, are associated with more efficient motor learning, quicker reaction times, and superior performance under competitive stress. These aspects are particularly relevant in alpine skiing, where rapid decision-making in unpredictable environments is crucial.

Balance training has been shown to be a critical factor not only in performance optimization but also in injury prevention. Sport-specific balance testing outperforms general assessments in predicting skiing skill and provides sensitive indicators of neuromuscular control. Integrating proprioceptive and dynamic balance exercises supports the prevention of falls and technical instability.

Injury prevention strategies must also consider technical errors and biomechanical overload, especially in high-risk situations such as ACL injuries. Improved edge control, landing techniques, and skill-appropriate equipment selection can reduce injury incidence and severity, especially in less experienced athletes.

Furthermore, strength and endurance conditioning serve as physiological foundations for maintaining high performance and minimizing fatigue-related errors. The role of upper-body strength in cross-country skiing and the importance of periodized endurance training were consistently highlighted across studies.

Finally, youth training must be individualized, taking into account biological maturity rather than chronological age. Tailoring training intensity and content to developmental stages ensures optimal physical and technical progress while minimizing injury risk.

Taken together, these findings advocate for a multidisciplinary, individualized, and periodized approach to skier development. Future research should focus on long-term outcomes of integrated training programs and their implications for athlete health, safety, and competitive longevity.

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Author's contribution:

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REFERENCES

1. Bere, T., Florenes, T. W., Krosshaug, T., Nordsletten, L., & Bahr, R. (2011). Events leading to anterior cruciate ligament injury in World Cup Alpine Skiing: a systematic video analysis of 20 cases. *Br J Sports Med*, *45*(16), 1294-1302. https://doi.org/10.1136/bjsports-2011-090517
2. *Berryman, N., Mujika, I., & Bosquet, L. (2019). Concurrent Training for Sports* Performance: The 2 Sides of the Medal. *Int J Sports Physiol Perform*, *14*(3), 279-285. https://doi.org/10.1123/ijspp.2018-0103
3. Bonell Monsonis, O., Balsiger, P., Verhagen, E., Gouttebarge, V., Sporri, J., & Bolling, C. (2025). "Health is Just the Basic Requirement for Optimal Performance and Winning": Stakeholders' Perceptions on Testing and Training in Competitive Alpine Skiing, Snowboarding and Freestyle Skiing. *Sports Med*, *55*(1), 221-239. https://doi.org/10.1007/s40279-024-02106-0
4. Chardonnens, J., Favre, J., Cuendet, F., Gremion, G., & Aminian, K. (2013). Characterization of lower-limbs inter-segment coordination during the take-off extension in ski jumping. *Hum Mov Sci*, *32*(4), 741-752. https://doi.org/10.1016/j.humov.2013.01.010
5. Cigrovski, V., Radman, I., Konter, E., Ocic, M., & Ruzic, L. (2018). Sport Courage, Worry and Fear in Relation to Success of Alpine Ski Learning. *Sports (Basel)*, *6*(3). https://doi.org/10.3390/sports6030096
6. Ettema, G., Braaten, S., Danielsen, J., & Fjeld, B. E. (2020). Imitation jumps in ski jumping: Technical execution and relationship to performance level. *J Sports Sci*, *38*(18), 2155-2160. https://doi.org/10.1080/02640414.2020.1776913
7. Gilgien, M., Reid, R., Raschner, C., Supej, M., & Holmberg, H. C. (2018). The Training of Olympic Alpine Ski Racers. *Front Physiol*, *9*, 1772. https://doi.org/10.3389/fphys.2018.01772
8. Goulet, C., Hagel, B. E., Hamel, D., & Legare, G. (2010). Self-reported skill level and injury severity in skiers and snowboarders. *J Sci Med Sport*, *13*(1), 39-41. https://doi.org/10.1016/j.jsams.2008.10.002
9. Hebert-Losier, K., Supej, M., & Holmberg, H. C. (2014). Biomechanical factors influencing the performance of elite Alpine ski racers. *Sports Med*, *44*(4), 519-533. https://doi.org/10.1007/s40279-013-0132-z
10. Hebert-Losier, K., Zinner, C., Platt, S., Stoggl, T., & Holmberg, H. C. (2017). Factors that Influence the Performance of Elite Sprint Cross-Country Skiers. *Sports Med*, *47*(2), 319-342. https://doi.org/10.1007/s40279-016-0573-2
11. Hong, S. L., & Newell, K. M. (2006). Practice effects on local and global dynamics of the ski-simulator task. *Exp Brain Res*, *169*(3), 350-360. https://doi.org/10.1007/s00221-005-0145-4
12. Hrysomallis, C. (2011). Balance ability and athletic performance. *Sports Med*, *41*(3), 221-232. https://doi.org/10.2165/11538560-000000000-00000
13. Lappi, O. (2022). Egocentric Chunking in the Predictive Brain: A Cognitive Basis of Expert Performance in High-Speed Sports. *Front Hum Neurosci*, *16*, 822887. https://doi.org/10.3389/fnhum.2022.822887
14. Losnegard, T., Myklebust, H., Spencer, M., & Hallen, J. (2013). Seasonal variations in VO2max, O2-cost, O2-deficit, and performance in elite cross-country skiers. *J Strength Cond Res*, *27*(7), 1780-1790. https://doi.org/10.1519/JSC.0b013e31827368f6

15. Mende, E., Schwirtz, A., & Paternoster, F. K. (2019). The Relationship between General Upper-Body Strength and Pole Force Measurements, and Their Predictive Power Regarding Double Poling Sprint Performance. *J Sports Sci Med*, *18*(4), 798-804. https://www.ncbi.nlm.nih.gov/pubmed/31827365
16. Nourrit, D., Delignieres, D., Caillou, N., Deschamps, T., & Lauriot, B. (2003). On discontinuities in motor learning: a longitudinal study of complex skill acquisition on a ski-simulator. *J Mot Behav*, *35*(2), 151-170. https://doi.org/10.1080/00222890309602130
17. Rizzato, A., Verdel, N., Paoli, A., Supej, M., & Marcolin, G. (2023). Sport-specific balance tests account for youth alpine skiers' ranking. *Front Physiol*, *14*, 1205347. https://doi.org/10.3389/fphys.2023.1205347
18. Schmolzer, B., & Muller, W. (2005). Individual flight styles in ski jumping: results obtained during Olympic Games competitions. *J Biomech*, *38*(5), 1055-1065. https://doi.org/10.1016/j.jbiomech.2004.05.038
19. Stoggl, R., Muller, E., & Stoggl, T. (2015). Motor abilities and anthropometrics in youth cross-country skiing. *Scand J Med Sci Sports*, *25*(1), e70-81. https://doi.org/10.1111/sms.12254
20. Stoggl, R., Muller, E., & Stoggl, T. (2023). Technique and maximal skiing speed for youth cross-country skiing performance. *Front Sports Act Living*, *5*, 1133777. https://doi.org/10.3389/fspor.2023.1133777
21. Tonnessen, E., Sandbakk, O., Sandbakk, S. B., Seiler, S., & Haugen, T. (2024). Training Session Models in Endurance Sports: A Norwegian Perspective on Best Practice Recommendations. *Sports Med*, *54*(11), 2935-2953. https://doi.org/10.1007/s40279-024-02067-4