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Motor Development in Adults: A Review of Locomotor and Non-Locomotor Sports

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ABSTRACT

This study aimed to examine motor development patterns in adults based on the type of sport practiced by comparing locomotor-dominant and non-locomotor-dominant sports. A qualitative descriptive literature review was conducted without fieldwork, observations, interviews, or physical measurements. Relevant scientific articles published mainly between 2020 and 2025 were identified, selected, reviewed, and compared thematically according to motor competence, locomotor and non-locomotor movement patterns, coordination, balance, agility, strength, flexibility, physical activity, and factors affecting motor development. The findings indicate that locomotor-dominant sports provide repeated experience in body displacement, changes of direction, dynamic balance, agility, and spatial coordination, whereas non-locomotor-dominant activities place greater emphasis on postural control, balance, flexibility, coordination, stability, and movement precision. Locomotor and non-locomotor components are not completely separate because most sports require a combination of movement patterns. Motor development in adulthood is also associated with exercise frequency, duration, intensity, age, physical condition, previous sport experience, and consistency of participation. In conclusion, the development and maintenance of motor skills in adulthood should be considered in relation to the characteristics of the sport and individual needs. Adult exercise programs should be planned progressively and adapted to movement goals, physical condition, training experience, and the dominant demands of the chosen sport.

Keywords: motor development, adulthood, locomotor movement, non-locomotor movement, sports

INTRODUCTION

Motor development is a crucial foundation for an individual's ability to actively participate in physical activities and sports. In the context of motor development, motor competence is understood as an individual's ability related to the mastery of motor skills, which includes locomotor, stability, and manipulative components. The literature confirms that motor skills develop during early learning periods and can continue to improve through practice and training until they reach more advanced levels. Thus, changes in motor skill patterns are influenced not only by biological factors but also by the opportunities and types of physical activity experiences an individual engages in (Saraiva Flôres et al., 2024).

In sports, differences in movement demands across different sports have the potential to shape distinct patterns of motor development. Studies and reviews highlighting motor competence indicate that individuals with a higher perception of motor competence tend to be more active, whereas developing this perception in individuals with low motor competence is considered crucial for encouraging participation in physical activity and sports. Additionally, repeated training experiences allow children and adolescents to become more familiar with motor tasks, leading to faster task execution and improved multitasking abilities. Although these findings are largely focused on children and adolescents, the principle that training

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experience and exposure to specific motor demands can shape motor skills remains relevant to explore in adulthood (Barnett et al., 2022).

Based on this, research on motor development patterns in adulthood needs to take into account the type of sport practiced, particularly the differences between sports that primarily involve locomotor movements and non-locomotor sports. In locomotor-based sports, individuals generally face movement demands oriented toward displacement or patterned movement (e.g., walking, running, jumping, and changes in position), whereas in non-locomotor sports, the emphasis is usually greater on stability, body control, and/or specific manipulations without a dominant demand for displacement. The literature discussing the components of motor competence (locomotor, stability, and manipulative) supports the importance of distinguishing these movement demands in the analysis of motor patterns.

However, there is still a need for studies that specifically compare motor patterns in adults based on the sports they participate in, particularly through an approach relevant to real-world activities in a competitive context. Most available evidence on motor skills focuses on children and adolescents, and sport-specific movement demands are rarely used as the basis for interpreting motor development in adults. Therefore, this study aims to examine motor development patterns in adults based on the type of sport they participate in through a comparative analysis of locomotor- and non-locomotor-based sports. The results of this study are expected to provide a more focused understanding of how the characteristics of sports movement demands contribute to motor skill patterns in adulthood, as well as serve as a basis for developing training programs and evaluating motor skills that are better suited to the needs of specific sports (Anju Sihombing et al., 2025).

METHOD

This study used a qualitative descriptive literature-review approach to examine motor development patterns in adulthood in relation to locomotor- and non-locomotor-dominant sports. No fieldwork, interviews, observations, or direct physical measurements were conducted. Literature searches were conducted using Google Scholar, PubMed, Scopus, ScienceDirect, SpringerLink, and relevant journal-publisher websites. The search was limited primarily to publications from 2020 to 2025, while older foundational sources were retained only when needed to explain key concepts. Search terms were combined in English and Indonesian, including “adult motor development,” “motor competence,” “motor ability,” “locomotor movement,” “non-locomotor movement,” “sports participation,” “balance,” “coordination,” “agility,” “flexibility,” “strength,” “physical activity,” “perkembangan motorik dewasa,” and “kemampuan motorik.”

Studies were considered eligible when they were peer-reviewed journal articles published mainly between 2020 and 2025; addressed motor skills, motor competence, balance, coordination, mobility, strength, flexibility, physical activity, or sport-specific movement demands; and provided findings relevant to adults or useful contextual evidence about movement development and practice. Review articles, meta-analyses, and empirical studies were considered when their focus was relevant to the research questions. Articles were excluded when they were duplicates, lacked sufficient bibliographic information, were not available in full text when the findings could not be verified, or discussed topics unrelated to motor ability and sports movement. The selection procedure consisted of identifying records from the databases and publisher websites, removing duplicates, screening titles and abstracts, assessing the relevance of full texts, and selecting studies for thematic analysis. The final synthesis included 12 core articles, which are summarized in Table 1. Because the search was

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iterative and a complete search log was not retained, the number of records at each screening stage is not reported.

Information was extracted from each selected article using a structured note-taking process. The extracted fields included author and year, study purpose, design or review type, population or sports context where reported, relevant motor components, main findings, and limitations. The information was then grouped into thematic categories: motor development in adulthood; locomotor and non-locomotor movement demands; motor patterns across sports; comparisons of coordination, balance, agility, strength, and flexibility; factors associated with motor ability; and implications for adult sports participation. A narrative synthesis was used to compare similarities and differences across findings rather than to calculate a pooled statistical effect. Methodological quality was considered qualitatively by examining clarity of objectives, transparency of the study design and procedures, appropriateness of the sample or evidence base, relevance of outcome measures, and acknowledgement of limitations. Systematic reviews and meta-analyses with transparent methods were given greater weight for broad conclusions, while cross-sectional and descriptive studies were used to illustrate sport-specific patterns and were not interpreted as proving causation. No standardized numerical risk-of-bias score was calculated, so the conclusions are presented as a narrative interpretation of the available evidence.

RESULTS AND DISCUSSION

Table 1 presents the 12 core articles used in the narrative synthesis. The evidence base includes systematic reviews, meta-analyses, intervention research, and descriptive or cross-sectional studies.

Table 1. Characteristics of the Core Articles Included in the Narrative Synthesis

Author(s), year	Study type / context	Main focus	Relevance to this review
(Adams et al., 2023)	Systematic review and meta-analysis	Physical-activity interventions in middle-aged adults	Strength, balance, and falls
(Barnett et al., 2022)	Systematic review of longitudinal evidence	Motor competence and health	Lifespan context; not adult-only evidence
(Faíl et al., 2022)	Systematic review and meta-analysis	Aquatic exercise in adults	Exercise context and physical-function outcomes
(Fallo et al., 2024)	Empirical study	Biomotor components and motor-skill domains in futsal	Multiple motor demands in a locomotor-dominant team sport
(Febrianty, 2020)	Descriptive motor-skill profile	Motor skills among sports-science students	Context on motor ability in a physically active student population
(Gao et al., 2021)	Review article	Motor-skill competence, physical activity, and health	Conceptual support for links between competence and activity
(Guler et al., 2021)	Training intervention study	Functional strength training in middle-aged adults	Functional movement and balance
(Ma et al., 2021)	Systematic review	Interventions to improve gross motor competence	Supporting evidence on practice; population is not adult-specific

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Author(s), year	Study type / context	Main focus	Relevance to this review
(Mustafa & Sugiharto, 2020)	Conceptual/review article	Motor skills and lifelong movement learning	Lifespan movement-learning perspective
(Alizadeh et al., 2023)	Systematic review	Mobility training in sporting populations	Mobility, strength, speed, jumping, balance, sport-specific outcomes
(Suzuki et al., 2024)	Cross-sectional study; 213 participants	Balance characteristics across several sports	Direct comparison of sport-specific balance profiles
(Zulrafli & Kamarudin, 2021)	Descriptive analysis	Motor ability among physical-education students	Context on motor ability in a sport-related population

Because several sources examine younger populations or sports-science students rather than adults exclusively, they are used as contextual evidence and are not treated as direct proof of adult-specific developmental effects. The strongest adult-relevant evidence comes from studies of middle-aged adults, adult aquatic exercise, mobility training in sporting populations, and balance characteristics across sports.

Motor Development in Adulthood

Motor skills are basic movement abilities that reflect a person's capacity to perform physical tasks in daily life and sport. In adulthood, these abilities are not necessarily fixed; they can be maintained or improved through regular physical activity and practice that challenges movement control. Reviews of adult physical-activity interventions indicate that structured exercise can support strength and balance, while motor-competence research highlights the importance of movement experience across the lifespan (Adams et al., 2023; Barnett et al., 2022). Therefore, motor development in adults is best understood as an ongoing process shaped by physical condition, experience, and opportunities to participate in varied movement tasks.

Motor ability in adults is closely related to motor skill performance, motor control, and physical fitness. Coordinated movement requires the nervous and musculoskeletal systems to work together so that posture, force, and timing can be adjusted to the demands of a task. Evidence from functional strength training in middle-aged adults indicates that targeted training can improve functional movement and balance, supporting the role of exercise in maintaining movement quality (Guler et al., 2021). However, the extent of improvement may differ according to the participant's starting condition, training history, and the specific movement skills practiced.

Changes in motor skills during adulthood are influenced by physical condition, exercise habits, and the demands of the activities performed. Regular training provides repeated opportunities to practice movement patterns, adjust body position, and maintain strength and balance. A systematic review and meta-analysis of physical-activity interventions in middle-aged adults found that exercise can support strength and balance outcomes, although effects vary by intervention and outcome (Adams et al., 2023). This suggests that motor ability can be maintained through appropriate activity, but the type and structure of training should match the individual's needs.

Motor development and motor skills in adults are influenced by several interacting factors, including age, physical fitness, previous sport experience, and consistency of exercise. These factors affect how effectively a person can control movement and adapt to the technical demands of a sport. Research on aquatic exercise in adults indicates that water-based activity

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can provide a useful training context for physical function while presenting loading characteristics that differ from land-based exercise (Faíl et al., 2022). Accordingly, no single exercise type should be assumed to develop every motor component equally; varied activities may be needed to address different movement goals.

Locomotor and Non-Locomotor Movements in Sports Activities

Human movement in sports can be described through locomotor and non-locomotor movement patterns, although most real sports combine both. Locomotor movements involve changing the body's location, while non-locomotor movements emphasize body control without substantial displacement, such as bending, twisting, stretching, and maintaining posture. This distinction is useful for describing the dominant demands of a sport, but it should not be treated as a strict separation between sports categories. Studies comparing balance characteristics across athletes in different sports show that balance performance varies with sport context, supporting the view that repeated sport-specific demands may shape different movement strengths (Suzuki et al., 2024).

Locomotor movement is characterized by displacement from one place to another through actions such as walking, running, jumping, hopping, and changing direction. These actions require the coordination of multiple body segments and the ability to regulate speed, direction, and force while the body is moving. In sport, mobility and movement range may also influence performance outcomes such as speed, jumping, change of direction, balance, and sport-specific skill execution (Skopal et al., 2024). Therefore, locomotor-dominant sports can provide repeated practice in dynamic balance and spatial coordination, although the exact adaptations depend on the sport and training program.

Non-locomotor movement emphasizes controlling body position without a major change in overall location, including bending, rotating, stretching, swinging, and stabilizing the trunk or limbs. Such actions place demands on postural control, flexibility, joint mobility, and the ability to coordinate body segments precisely. Evidence from functional strength training in middle-aged adults indicates that programs combining mobility, stability, and multidirectional movements can improve functional movement and balance (Guler et al., 2021). In addition, mobility-training research reports potential benefits for flexibility-related and sport-performance outcomes, although study quality and training protocols vary (Skopal et al., 2024).

Locomotor and non-locomotor movements generally occur together during sports performance. A soccer player, for example, runs to a new position and then stabilizes the body to pass, turn, or strike the ball, while a gymnast may move across the floor and then perform controlled rotations or balances. These combined demands mean that an athlete needs both movement through space and control of body position. (Suzuki et al., 2024) [1]found differences in balance characteristics among athletes from different sports, illustrating that sport-specific practice may emphasize distinct balance demands without eliminating the need for other motor components.

Some sports rely strongly on locomotor movements, although they also require stabilization and precise control. Running and jumping events in athletics depend on repeated displacement, acceleration, take-off, landing, and changes in direction, while soccer and futsal combine running with rapid adjustments to the ball and opponents. Research identifying biomotor components in futsal highlights the relevance of multiple physical and motor domains rather than a single isolated skill (Fallo et al., 2024). In addition, studies of sport-related skill

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acquisition emphasize that the learning and performance of sport skills depend on the type of task and the practice conditions provided (Choo et al., 2024).

Other sports place greater emphasis on balance, mobility, and precise control of the body, although locomotion may still be present. Gymnastics involves rotations, stretching, controlled landings, and static or dynamic balance, while strength training often requires stable positioning and coordinated force production. In a study of athletes from different sports, gymnastics showed strong performance on both two-leg and one-leg balance measures, while other sports showed different balance profiles (Suzuki et al., 2024). These findings support the argument that the movement demands of each sport influence which aspects of balance and control are most frequently practiced, rather than proving that one sport develops all motor abilities better than another.

Patterns of Motor Development in Adults Based on Sports Disciplines

Patterns of motor skill development in adults may differ according to the type of sport practiced and the movement demands repeated during training. Locomotor-dominant sports commonly involve running, jumping, acceleration, deceleration, and changes of direction, which repeatedly challenge dynamic balance, agility, and spatial coordination. Evidence from mobility-training reviews indicates that training methods can affect sport-performance variables such as strength, speed, change of direction, jumping, balance, and sport-specific skills (Skopal et al., 2024). Nevertheless, these outcomes should be interpreted in relation to the training protocol and athlete group rather than generalized to all locomotor sports.

Sports that emphasize non-locomotor movements place a greater demand on body control, stability, flexibility, and precision in a relatively fixed or controlled position. Examples include gymnastics elements, stretching-based activities, and strength exercises that require stable posture while force is produced. Functional strength training research with middle-aged adults found improvements in functional movement and balance following a structured program, suggesting that training which includes stability and multidirectional tasks can support these abilities (Guler et al., 2021). However, the classification of a sport as non-locomotor-dominant is relative, because most activities still require some displacement and dynamic movement.

Coordination, balance, agility, strength, and flexibility are interrelated components of motor performance in adults. Coordination supports the timing and sequencing of body segments, balance helps maintain or regain stability, agility supports rapid changes in direction, strength enables force production, and flexibility contributes to the available range of motion. Research on athletes across sports shows that balance characteristics vary by sport and may also be related to physical attributes and muscle strength (Suzuki et al., 2024). Similarly, reviews of mobility training suggest that improving movement range may influence several performance outcomes, although the effects depend on the methods used (Skopal et al., 2024).

The frequency and duration of participation in physical activity influence the amount of movement practice an adult receives. Repeated participation may provide more opportunities to refine coordination, balance, and sport-specific movement patterns, although frequency alone does not guarantee improvement if the activity does not match the intended skill. Reviews of exercise interventions in middle-aged adults report benefits for physical outcomes such as strength and balance, while also indicating variation across interventions (Adams et al., 2023). Thus, training consistency should be considered together with the quality, intensity, and specificity of the exercise program.

Motor development in adults can follow different patterns depending on the characteristics of the sport and the motor demands practiced most often. Locomotor-dominant

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activities tend to provide repeated experience in displacement, acceleration, changes of direction, and dynamic balance, whereas non-locomotor-dominant activities emphasize stability, postural control, mobility, and precision. Evidence from athletes across several sports indicates that balance profiles are not identical across sport types, supporting the importance of considering sport-specific demands (Suzuki et al., 2024). These differences should be understood as tendencies rather than absolute categories, because most sports combine locomotor and non-locomotor actions.

Comparison of Motor Development Between Locomotor and Non-Locomotor Sports

Motor development in adults can be compared by examining the dominant movement characteristics required by different sports. Locomotor sports involve moving the body from one location to another, such as running, jumping, and changing direction, while non-locomotor-dominant activities place greater emphasis on control of posture and movement without major displacement. These categories provide a useful framework for comparing the kinds of practice athletes receive, but they do not imply that one category is inherently superior. Evidence from studies of balance and mobility training suggests that different movement contexts may emphasize different outcomes, including balance, mobility, strength, and sport-specific performance (Suzuki et al., 2024).

In locomotor sports, coordination is needed to control the body while moving through space and adapting to changing external conditions. Athletes must coordinate the arms, legs, trunk, and visual information when changing direction, adjusting speed, or responding to opponents and equipment. These actions also require dynamic balance because the body's center of mass must be controlled during acceleration, deceleration, and landing. Research on futsal biomotor components similarly indicates that performance depends on several interacting physical and motor capacities rather than on locomotor skill alone (Fallo et al., 2024).

Non-locomotor-dominant exercise places greater emphasis on controlling the body while maintaining a stable base or performing movements with limited displacement. Coordination supports accurate sequencing, while balance and flexibility allow the body to achieve and maintain required positions. Functional strength training that includes multidirectional movement and stability tasks has been associated with improvements in functional movement and balance in middle-aged adults (Guler et al., 2021). Mobility training can also support range of motion and several sport-performance outcomes, but the evidence varies by protocol and the quality of individual studies (Skopal et al., 2024).

Strength contributes to both locomotor and non-locomotor sports, but its role depends on the movement demands of the activity. In locomotor sports, strength supports propulsion, jumping, acceleration, deceleration, and changes of direction, whereas in non-locomotor-dominant activities it can help maintain stable positions and control force during precise movements. A systematic review of physical-activity interventions in middle-aged adults found that structured activity can support strength and balance, while emphasizing that outcomes depend on the intervention characteristics (Adams et al., 2023). Therefore, strength should be developed in a way that matches the sport's technical requirements and the participant's physical condition.

Flexibility and mobility are important in both movement categories, although their practical roles may differ. In locomotor sports, sufficient range of motion can support efficient stride patterns, jumping, and changes of direction, while in non-locomotor-dominant activities it can help athletes achieve controlled positions and complete movements with precision. (Skopal et al., 2024) reviewed mobility training in sporting populations and found that a range

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of methods may benefit or help maintain several performance outcomes, including jumping, balance, and sport-specific skills. These findings support including mobility work when appropriate, but flexibility should be developed alongside strength and control rather than treated as an isolated goal.

The main difference between locomotor- and non-locomotor-dominant sports lies in the movement demands that are emphasized during practice. Locomotor activities provide frequent experience in displacement, direction changes, and dynamic control, whereas non-locomotor activities tend to place more emphasis on postural stability, flexibility, and precision. However, sports cannot be divided into completely separate categories because locomotor tasks also require stabilization and non-locomotor tasks often involve movement across space. Findings on balance differences between athletes and on the effects of mobility training support a sport-specific interpretation rather than a universal ranking of movement categories (Skopal et al., 2024; Suzuki et al., 2024).

Factors Affecting Motor Development in Adults

The development of motor skills in adults is influenced by various factors related to exercise and individual conditions. In adulthood, previously acquired motor skills must be maintained through appropriate physical activity and exercise. A lack of physical activity and the absence of targeted exercise can prevent motor skills from developing optimally. Therefore, regular exercise tailored to an individual's condition is a key strategy for maintaining and improving motor skills in adults (Adams et al., 2023; Gao et al., 2021).

The type of sport practiced is one factor that can influence the development of motor skills. Each type of sport has different movement characteristics and physical demands, so the motor skills developed may also vary. Game-based exercises, aquatic activities, gymnastics, plyometric exercises, and various other forms of sports can provide a diverse range of movement experiences. Aquatic exercises, for example, can engage various muscle groups and serve as an alternative for individuals with limitations in performing land-based activities. Meanwhile, plyometric exercises place greater demands on the ability to generate power quickly, thereby supporting the development of power and reaction speed. Therefore, the choice of sport should be tailored to the training goals and individual abilities (Fallo et al., 2024).

The frequency of exercise also plays a role in the development of motor skills. Regular exercise provides the body with the opportunity to gain repeated movement experience, thereby helping to maintain coordination, movement control, and motor skills. Conversely, irregular physical activity can reduce an individual's ability to maintain movement patterns they have already mastered. Therefore, consistency in exercise is a crucial component in establishing movement habits and supporting the motor adaptation process in adults.

In addition to frequency, the duration of exercise is also important. Adequate exercise duration allows the body to adapt to the physical activity. Through exercise performed for an appropriate amount of time, individuals have the opportunity to gradually develop coordination, body control, and movement quality. However, exercise duration must be tailored to the individual's condition and goals so that the exercise can be performed effectively without placing an excessive burden on the body. Adaptive and context-specific exercise programs are essential because each individual's needs may differ (Adams et al., 2023).

Exercise intensity is another factor that can influence motor development. The right intensity can provide sufficient stimulation for the body to improve physical and motor abilities. Exercises of a certain intensity, such as plyometrics, can stimulate power and reaction speed. On the other hand, aquatic activities can serve as an alternative form of exercise that

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allows individuals to engage in physical activity with a different load on the body compared to land-based activities. Therefore, exercise intensity should be tailored to each individual's initial ability, exercise goals, and physical condition (Faíl et al., 2022).

Age is also a factor that must be considered in the development of motor skills in adults. Although basic motor skills have already developed in earlier stages, exercise needs may vary at each age stage. Changes in physical condition that occur with age can affect a person's ability to perform physical activities. Therefore, exercise programs for adults must take into account the individual's age and physical characteristics to ensure that the activities provided remain appropriate for their abilities and needs.

Physical condition also influences a person's ability to participate in exercise and develop their motor skills. Factors such as initial fitness level, mobility limitations, strength, and injury history must be considered when determining the type and form of exercise. Individuals with different physical conditions naturally require different exercise approaches. These adjustments are intended to ensure that exercise can be performed safely while providing appropriate stimulation for the development of motor skills.

Experience in sports can also influence a person's motor skills. Individuals with experience in specific sports generally possess movement skills that can serve as a foundation for learning or developing new skills. Conversely, individuals with limited experience may require basic training and a more gradual adaptation process. Therefore, sports experience should be taken into account when determining the level of difficulty and type of exercise provided to adults (Rivaldi; Septiadi, Firman; Nurudin, 2023).

Another equally important factor is consistency in exercising. The development of motor skills requires an ongoing process because movement skills need to be maintained and developed through experience and repeated practice. Consistency in physical activity can help maintain movement ability, fitness, and motor skills in adults. Conversely, a prolonged cessation of physical activity can reduce movement experience and affect established physical abilities. Therefore, consistent exercise is a key factor in maintaining motor skills throughout adulthood.

Implications for Sports Activities in Adulthood

Sports activities during adulthood play a vital role in maintaining and enhancing previously established motor skills. For adults, sports activities are not solely aimed at improving fitness or achieving competitive success; they also serve to maintain optimal movement function. Therefore, the selection of sports activities must take into account the motor needs, physical condition, and individual characteristics of the participants.

The choice of exercise should be tailored to the specific motor skill components one wishes to develop. Each form of exercise entails different movement demands, thereby providing distinct stimuli. Game-based exercises, for instance, can be used to train agility and coordination while offering activity variety that boosts participant engagement. Aquatic exercises serve as an option for individuals requiring activities with different weight-bearing characteristics, specifically those placing relatively less stress on the joints, whereas plyometric exercises can be employed to stimulate power and movement reaction speed. Consequently, sports activities for adults should not be based solely on personal preference but should also align with the motor skill needs one aims to maintain or develop (Anju Sihombing et al., 2025).

Sports activities also play a role in maintaining motor skills during adulthood. The development of movement skills does not cease after childhood; rather, it requires ongoing activity and practice to preserve the abilities that have already been established. Regular physical activity provides continuous movement experience, thereby helping to maintain

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coordination, balance, strength, flexibility, and the body's capacity to perform various activities. Consequently, sports for adults can be viewed not merely as a means to enhance performance, but also as an integral part of maintaining motor function and supporting quality of life.

Training for adults must be conducted regularly and tailored to individual characteristics. Each person possesses a unique baseline level of ability, physical condition, exercise history, and set of motor needs. Consequently, training programs should be designed to be adaptive and contextual, ensuring that the activities align with the participants' capabilities. This approach is particularly important for individuals with limited mobility or those just beginning an exercise regimen. Furthermore, since a lack of physical activity over time can impair movement capabilities, training should be carried out in a gradual and sustained manner to help restore and maintain motor skills (Ma et al., 2021).

The findings from the literature review can also be applied to designing exercise programs for adults by incorporating various forms of planned activity. Game-based exercises can be combined with other physical workouts to provide a diverse range of movement experiences, while plyometric exercises can be utilized as needed to develop power and reaction speed. Aquatic exercises offer an alternative for participants requiring activities with different loading characteristics. Furthermore, culture-based activities such as traditional dance can be employed as forms of physical activity that engage coordination and balance while adding variety to exercise routines (Anju Sihombing et al., 2025).

Thus, the implications of motor development for sports activities in adulthood indicate that training programs must be designed in a planned, systematic manner tailored to individual needs. Selecting the type of sport, intensity, frequency, and form of exercise requires consideration of initial capabilities and the specific motor goals to be achieved. A flexible and adaptive approach allows sports activities to be better aligned with participants' characteristics, thereby supporting the sustained maintenance and development of motor skills throughout adulthood.

CONCLUSION

The literature reviewed in this study suggests that motor skills in adulthood can be maintained and developed through regular, purposeful, and individually appropriate sports participation. Locomotor-dominant activities provide repeated practice in body displacement, acceleration, changes of direction, and dynamic balance, whereas non-locomotor-dominant activities emphasize postural control, stability, mobility, flexibility, and movement precision. However, these categories are not mutually exclusive because most sports combine movement through space with stabilization and control. Evidence from studies of athletes across different sports and from reviews of mobility training supports interpreting motor development in relation to sport-specific movement demands rather than ranking one category as universally better (Suzuki et al., 2024).

Motor development in adulthood is also associated with exercise frequency, duration, intensity, age, physical condition, previous sport experience, and consistency of participation. Structured exercise can support selected outcomes such as strength, balance, mobility, and functional movement, although the benefits depend on the program, population, and outcomes assessed (Adams et al., 2023; Faíl et al., 2022; Guler et al., 2021). Consequently, adult training should be planned progressively and adapted to individual capabilities and goals, combining locomotor tasks with activities that develop postural control, coordination, strength, balance, and flexibility. Because the present study is based on a narrative literature review and the available studies differ in design and population, the findings should be interpreted as a

synthesis of current evidence rather than direct proof of causal differences between locomotor and non-locomotor sports. Further empirical research with adult participants and comparable measures is needed to test these patterns directly.

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